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**ENERGY TRANSITION: HOW LEGITIMACY CHANGES IN THE DISCOURSE OF UTILITIES.  
TEXTOMETRIC ANALYSIS OF 15 YEARS OF CSR REPORTS**

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# ENERGY TRANSITION: HOW LEGITIMACY CHANGES IN THE DISCOURSE OF UTILITIES

## TEXTOMETRIC ANALYSIS OF 15 YEARS OF CSR REPORTS

### ABSTRACT

The energy transition forces energy companies to rethink their strategies. Traditionally, electricity companies have derived their legitimacy from public service and granting society access to electricity. This was shaped with large production units, centralised networks and stable regulatory framework. However, this legitimacy is no longer taken for granted. Energy transition offers decentralised technologies, peer to peer transaction and self-consumption possibilities which altogether could lead to electricity markets without electricity companies. To remain legitimate, electricity companies are adapting to energy transition, and evolution in their discourse is part of it.

This strategy research project looks at how legitimacy changes in the discourse of utilities under the stress from energy transition. By studying CSR reports over the last 15 years and across 12 companies, mostly European and American, statistical discourse analysis shows evolution in the vocabulary and variation across companies. Evolution in the discourse testifies change in mix of energy sources into more renewable, as could be expected when studying strategy of utilities. Emergence of concepts such as energy transition, clean power or carbon footprint, shows how vocabulary changes and integrates new threats and opportunities. This move is heterogeneous, as each company progresses on its own path. But there is an increasing convergence after the Paris Agreement. While utilities relied yesterday on a cognitive legitimacy strongly tied to their traditional role, today it has changed into different types. Some companies now root their legitimacy purely on business transactions. Others insist on moral aspects, including respect of legislation and ethics. But all companies studied develop new discourse to affirm their legitimacy and their commitment to energy transition.

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*To O.L. and M.C.L.*

“Comparing us to dwarfs perched on the shoulders of giants; if we see more and farther than our predecessors, it is not because we have keener vision or greater height, but because we are lifted up and borne aloft on their gigantic stature”

Jean de Salisbury citing Bernard de Chartres (*Metalogicon*, 1195)

With this metaphor of dwarfs and giants used so many times since Bernard de Chartres, I want to thank, from my tiny dwarf point of view, some of the giants I tried to pursue during these research years.

Among the many academic giants my deepest thanks go to Patrice Geoffron, since our first encounter and up to the latest sweat drop. I thank Isabelle Bouty and Lionel Garreau for leading the Executive Doctorate programme in Business Administration. Together they orchestrated the marching giants striding the corridors of Paris Dauphine, but also introduced me to academic research and so many key authors I had never heard of.

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Revisiting the initial sentence, my impression is to enjoy this present equilibrium of being perched on giants' shoulders cited here, neither standing firm nor lazily lying. To stay in this position the only way is to keep moving forward.

## INTRODUCTION

“Then you should say what you mean,”  
the March Hare went on. “I do,” Alice hastily replied;  
“at least--at least I mean what I say--that's the same thing, you know.”  
“Not the same thing a bit!” said the Hatter.  
“You might just as well say that “I see what I eat” is the same thing as “I eat what I see!””

**Lewis Carroll**

If carbon is associated to life, present in all living being, carbon dioxide has turned negatively into a major cause of global warming. This translated into objectives to reduce carbon, capture and store carbon, limit carbon footprint at country or company level, sometimes even for individuals.

So, when BP, SHELL and TOTAL announced in February, April and May 2020 their objective to become carbon-neutral by 2050, do they really mean a shift out of hydrocarbon when using such simple words (greenwashing vs commitment)? Or do they say in a nutshell what strategy they mean to pursue (straightforward vs elusive communication)?

Targeting to become carbon-neutral does not seem to be a way to increase profit in the short term, but a necessary strategic move to remain legitimate on the energy scene by taking action against global warming. But ways to reach this neutrality can be numerous: discontinuing carbon emitting activities, developing other activities, compensating carbon emitted... An original solution to become carbon-neutral in human resource could be planting trees when people join the company to compensate human body carbon dioxide emission, making sure that trees grow accordingly, up to potentially chopping them off when employees retire. This deliberately oriented example illustrates what a "cynical" approach to carbon neutrality might look like ...

Such announcements towards low-carbon are not changing strategies of energy companies overnight. But they mark either a tipping point or at least a horizon to follow.

The energy sector searches new strategies to adapt to lower carbon economy, and this takes also to coin new concepts. The power of words in a world of power production is embodied in formula as “carbon-neutral in 2050” which are both a commitment to act and a way to communicate about it.

If strategies are translated into words, meaning is revealed in how they are associated together. Studying movement in power plants for example, has nothing to do with « the power of

movement in plants” (Darwin, 1881). It shows at a glance that a word is not a discourse, and a discourse is not an implemented strategy.

This research follows different paths, roads and meadows in strategies, energy transitions and meaning on words, towards understanding of how legitimacy changes in the discourse of utilities. If the outcome appears linear, it was achieved in several iterations of research (Van de Ven, 2007). And for each iteration the question of where to start from had to be revisited (Dumez, 2016).

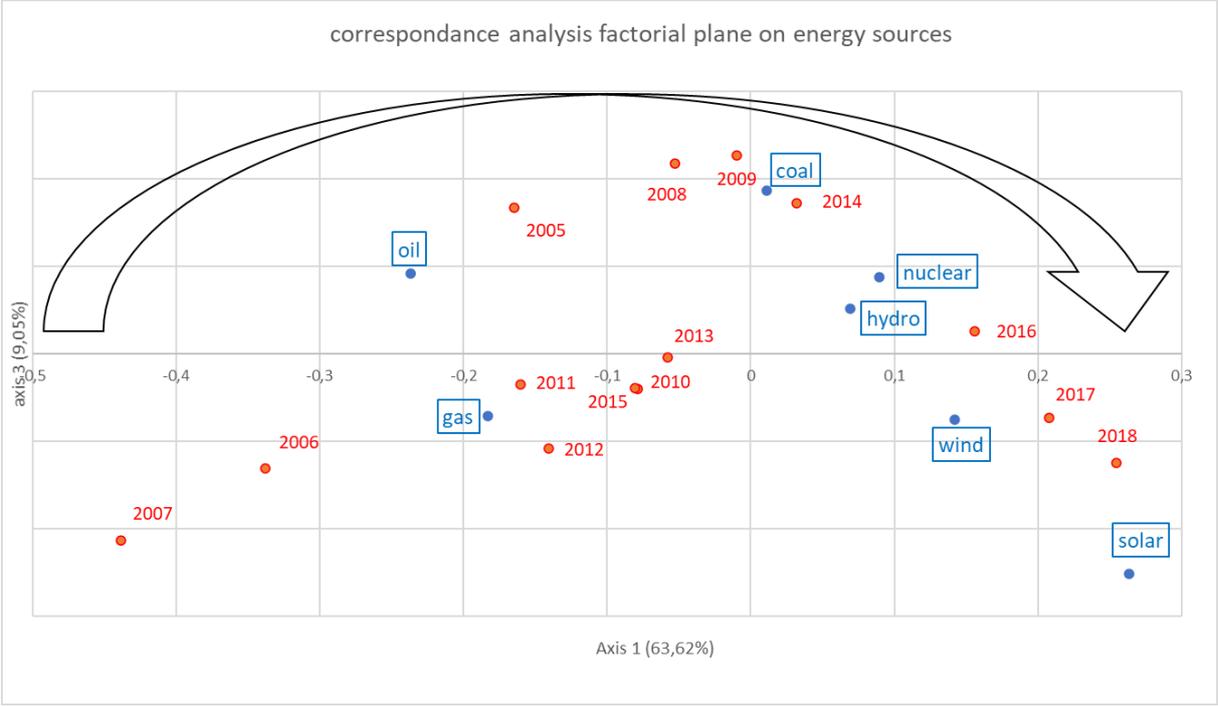
The first part of this research starts in energy transition studies. In the energy sector, energy transition is getting more and more momentum and eats legitimacy off electricity companies. We look at companies taken from an institutional point of view; in the energy sector and more specifically utilities companies in the production and distribution of electricity. What are the risks in losing legitimacy for a utility? It can be decrease in business, lower acceptability of power plants in the landscape, and customers opting for newcomers in the electricity market leaving assets and fixed costs to the incumbent. The subject here is to look at legitimacy claimed by utilities in their corporate communication. With all changes incurred from energy transition, how legitimacy changes in the discourse of utilities?

A second part is dedicated to theory with an association between legitimacy and energy. Studies on legitimacy explore how organisations gain, maintain or repair it (Suchman, 1995). In a symmetrical way, building large electricity production units, then maintaining their level of service, and last facing arrival of independent producers and self-consumption of electricity are examples of these three phases. Exploring the intersection of three research streams, legitimacy, energy and discourse analysis creates a model for how energy companies communicate as they become confronted to loss in legitimacy. A hypothesis at this stage would be that all companies align their discourse into energy transition, or on a different direction that each one pursues differently, pragmatic moral or cognitive legitimacy.

The third part covers methodology and choice of statistical text analysis as research design. The choice of discourse analysis method allows a longitudinal dimension as well as differences between companies selected. Corporate Social Responsibility reports are taken as primary data into statistical text analysis software. A total corpus of 9.5 million words made of 129 CSR reports is studied with statistical analysis tool TXM and with content analysis. For each of the 12 utilities in the sample it can represent up to 15 years evolution.

Statistical text analysis and content analysis are developed in part four, they show a series of dimension in the discourse, including evolution over the period and variation across all companies studied. If clear patterns emerge, and pressure of carbon reduction, sustainability

emerge, then takes on in CSR reporting, there is not one single move for all companies. Some companies are moving faster. Some stay on a steady path, while others take new directions. The types of legitimacy observed in discourses demonstrate how much utilities are converging or diverging. An illustration on Figure 1 takes all CSR reports year by year and plot them against energy sources. The lexical trajectory is passing through oil, gas, coal into wind, nuclear, hydro, wind and into solar. It is not physically replacing one by the other, but proximity of the discourse speeding up into renewable energy.



**Figure 1 lexical proximity of years and energy sources**  
**(produced with software TXM, correspondence analysis, on energy sources lemmas)**

## PART 1 WHY ENERGY TRANSITION IS A GAME CHANGER FOR ENERGY COMPANIES?

This research is about energy transition and its impacts on energy companies. In the past, several energy transitions happened, from woodfuel to the various energies we know today. But challenges from climate change, global warming, and keeping the world within +2°C have unprecedented dimensions.

Energy transitions are analysed from three angles. The first one concentrates on an explanatory framework showing why the energy landscape is difficult to predict and lessons from past changes. The second one presents challenges for different stakeholders. The third one deals with path dependency and whether a peak in carbon emissions could be in sight.

From the big energy scene, this research is progressing as follows: first, energy transition what is it all about? Then presentation an explanatory frame, the Multi-Level Perspective. Third point will be how stakeholders are embarked on transition. Fourth one is describing paths, path dependency, and ways forward in energy. In a fifth step we choose level of analysis for this research to finally build the research question.

**This first part starts in the landscape of energy transition and management.** As international reports on greenhouse gases are released one after another, companies are increasingly confronted with energy transition questions. The chiselling of our research question follows Van de Ven (2007) citing “ good research questions are ones that pose dilemmas, subvert obvious or canonical truth, force incongruity upon our attention”, Bruner, (1996) p127.

In this problem formulation step highlighted in Figure 2 below, we will move from the big issue on energy scene to formulation of our research question.

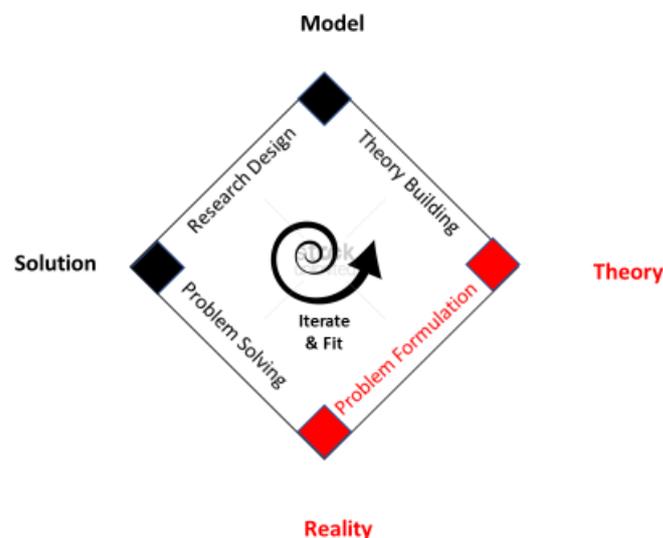


Figure 2 Situating problem formulation, adapted from Van de Ven (2007)

This research steps includes to define the big issue at stake, then information needed to ground the problem in reality. This will be the basis for elaborating a good research question at the end of this part.

Energy companies face increasing opposition and mistrust, while new solutions emerge for customer to bypass them. It raises the question how they should change to remain legitimate for their customers, shareholders, employees... To narrow down the scope of research, we take the Kyoto Protocol as tentative starting point. For the scope of companies, we select electrical companies, considered as institutions. We do not go one level down at how managers decide and implement energy changes; nor on a higher level how energy sector adapts differently than automotive sector, or chemical producers for example. Change is studied by looking at how the strategy is declared over time.

### **1.1. ARE UTILITIES (STILL) LEGITIMATE BY ESSENCE?**

Energy and legitimacy have one common point, they meet in companies called utilities. Is distribution of electricity any different than water or gas? What makes the legitimacy of this service? And could we do without paying electricity bills to a national company and imagine another model?

At first glance, **production and distribution of electricity can be named utility company**. And public utilities, through several definitions, contain key elements linked with legitimacy. We show that electricity shares some elements of utilities, and not others. And along the production and value creation process, it is also debatable.

We can at least name three definition from dictionaries:

A business organization (such as an electric company) performing a public service and subject to special governmental regulation, in Merriam Webster,

A service that is used by the public, such as an electricity or gas supply or a train service: a supply of gas, electricity, water, or telephone service to homes and businesses, or a business that supplies such services, in Cambridge dictionary

Services provided by the government or state, such as the supply of electricity and gas, or the train network, in Collins

Under the "same public utilities" entry, there are differences in what is a utility, and in what scope it covers. In the goods or services covered, three main common features are dense

network up to each household, large costs to deploy the service, obligation to serve everyone who asks for it. In the various definitions above, it is not indifferently applicable. It is very much the case for water, for access to electricity. It is also the case for those asking for access to gas and telephone. But it does not necessarily apply to train service. These variations trigger the question of what scope of supply can cover a public utility. An example with telephone is the switch from fixed network where everyone relied on access to the central utility, to a largely open cell phone not requesting same investments.

The scope of public utilities can be product and or service. The largest definition includes produce the good, transport it and distribute to every household, invoice the quantity, ensure the quality delivered, then look after assets for maintenance, repair, and modernization. In the definitions above, first dictionary Merriam Webster only focuses on regulatory frame; this is operated by the rules, whatever boundaries of product or services specified in government regulation. For the second dictionary, Cambridge, it is a service, but also includes some product supply. And for Collins dictionary it is a service, but examples cited look more like products.

It shows that the main focus of utilities is one of the services, on the delivery to final end user of water, electricity, gas, etc. What we retain here is that the manufacturing (collecting water springs up to reservoir of drinkable water) is not necessary part of utility nor the transportation. This has been a justification in electricity to separate production from distribution.

Electricity networks have three characteristics which make them indispensable: the **cost of developing networks is so high that users agree to go with one single supplier**; then electricity distributor has an obligation to serve anyone who asks for it, so that it is the only point of contact. Last, definition and calculation of price is a complex mechanism where individuals consumer do not necessary bear the cost of their connexion to the grid.

We take these three characteristics one by one, supposing, for the moment, that electricity includes supply of energy source, transformation into electricity, transportation to consumers and distribution.

Network is the essence of electricity system; the fact that we need generation, transportation and distribution suggests that they always come together to make a legitimate entity. Networks have developed centralizing electricity generation, in the form of power plants, or hydraulic dams, or renewable fields; and with coordination of transportation and distribution with high voltage, and low voltage lines. From a consumer point of view, electricity supply can be viewed as a common. Citizens and companies feel part of the system, whether as to co-owners, co-users, or co-responsible.

From the producer's point of view, electricity tends to be a subtle supply demand management, with yearly, monthly, daily, hourly fluctuations of demand, and a mix of energy sources to adapt with seconds to variations.

This is questioned by renewable energies. Producing electricity on roofs or close to consumption places does not require complex networks, and this is even more the case when storage of electricity becomes feasible.

**The obligation of service is the next cornerstone of legitimacy.** As everybody needs access to electricity service, it gets a notion of general interest. If we take a parallel between gasoline and electricity, instead of having a hypothetical network a service station for each village, with everyone pulling over for refuelling, supply of electricity appears as pushing into each consumer point. Only by switching off is the delivery suspended. Further aspect of obligation of service is obligation to connect the grid to every point of consumption asking for it, even remote, isolated, difficult to access. This often goes hand in hand with including in authorization process of building new houses some conditions on electricity supply.

This also is questioned by renewable energies. A few wind turbines can cover needs on an island, a few solar panels the needs of a few houses on top of a mountain. Coupled with some electricity storage in batteries it could replace obligation to connect to a national grid.

**Price mechanism is the third element that builds legitimacy** of electricity distribution. If selling prices were quoted on a local basis, those located close to a hydropower dam or a power plant would pay a low price, when remote customer would pay significant transportation and distribution fee.

Definition of price of product and or services is often a complex process, taking into account quantity from small households to large industrial sites, distance from generation site and delivery point. But also taking into account all other cost of electricity, and costs of transportation. This makes the price appear different than a buyer and seller relationship, and more like a legitimate value of the service discussed and agreed between states or cities, public opinion and direct parties in the transaction.

But here also legitimacy is questioned by renewable energies and energy transition. Self-consumption of individuals or small communities can be done without buying from the grid. What could be the price of residual power, maybe 10%- 30%, on top of what is self-produced and self-consumed? And determining how to price episodic use of the network opens many questions: is it a price at marginal cost, at average cost of building and maintaining installations? Or is it a higher price of access to infrastructure, or reservation of capacity at all?

**Why not making utilities fully dispensable?** Legitimacy was obvious for electricity companies, because no one could design, build and operate an efficient electricity network. With energy transition, no one is becoming any one can do it. Design can be a few solar panels and connexion for an individual household. Build could be an industrial company using its skills to develop biomass or maybe burning waste into heat. Operate could be a community using peer to peer technologies to balance supply and demand. Data collection for the quantities and parameters, blockchain for invoicing, there is no longer need for a utility to step in. We could consider that this scheme makes electricity company redundant.

## **1.2. ENERGY TRANSITIONS, WHAT IS IT ALL ABOUT?**

This research focuses on the meaning of words, and how the meaning is constructed. Before studying strategy wanderings of energy companies, the first step discusses what is an energy transition, or energy transition(s). The second point will be to draw some comparison from history and insights from literature. But the comparison falls short as the third section show how the landscape is reshaped with global warming.

### **1.2.1. From energy of words to words of energy, Energiewende and energy transition**

**What is energy transition?** By reading this expression everywhere, it tends to mean a world we departed from, CO<sub>2</sub> intensive, polluting into a new energy world, environmentally friendly. It is not as straightforward as that. A simple starting point is to use definitions from energy agencies: first, a long-term structural change in energy system (“World Energy Council. 2014. Global Energy Transitions”). The second one is more specific on energy sources: the energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. (International Renewable Agency, IRENA). More than looking at an initial stage and a final stage in energy, energy transition is better described by the path, the process of changing, and by the steps taken. That is the meaning of ‘Energiewende’, the term coined at the very start of discussion on energy transition (Krause, 1982). Interestingly, in the emergence of this concept, the very title “Energiewende, ohne Gas und Uran”, was focusing on the roadmap for Germany in 1980, exit from oil, gas and nuclear, but it did not mention coal, nor any renewable sources. There was no focus on CO<sub>2</sub>, but on country independency. The definition of this energy transition is linked to what can be found

nationally, coal and lignite, as opposed to importation with risk on price, oil and gas. And it is also linked to acceptability with massive opposition to nuclear in the 80s in Germany.

Looking at it from today's perspective, energy transition is mostly focused on CO<sub>2</sub> footprint, renewable energy, energy efficiency and how companies adapt. In academic journals, energy transition is used in physics, chemistry, economy, policy..., (a non-extended list includes energy policy, energy economics, journal of physical chemistry, journal of cleaner production). At the crossroads of these domains, we can define it as "the switch from an economic system dependent on one or a series of energy sources and technologies to another" (Fouquet & Pearson, 2012), or in a more condensed definition "change in the state of an energy system". (Grubler, 2012).

In this research we will keep this open-ended process that include actions to switch, change... But we will leave open what kind of end points it could lead to. It could be a zero-carbon emission context, or a limitation below 2°C warming, or many other possibilities.

**Words matters, for example "clean" vs "affordable clean".** In 2018, US administration issued a new act "Affordable Clean Energy" issued by Environment Protection Agency replacing the "Clean Power Plan" from previous administration issued in August 2015. Both Trump administration and before Obama administration developed plans for climate change, greenhouse gas emissions and global warming. But adding "affordable" changes the focus and the direction; Clean Power Plan was enhancing new energies, with a focus on solar power, wind onshore energy, a strong push to develop offshore wind east coast and west coast, with fixed foundation or future floating foundations. It was around innovation and different energies summarized as "clean".

On the opposite, by using "affordable" the new administrations stresses: it is going to be painless for American because it will be cheap. It is something easy to achieve because it is not unaffordable. It changes from previous regulations that were too expensive and just not affordable. Another way to read it is to think of what is "affordable clean" as opposed to solutions more complex to put in place: maybe further reduction of coal power plants emission, NO<sub>x</sub>, SO<sub>x</sub> is more affordable than developing floating offshore wind. That shows that "affordable clean" is also setting priorities on the short term rather than looking farther ahead.

The content of the act is stressing priorities on improving current production means. First, by improving the heat rate of coal power plants, with better coal burning bringing a higher conversion into energy. Second, by enhancing CO<sub>2</sub> reduction of existing assets and by developing carbon capture into the ground for example. Whereas in 2008 clean power plan was focussing on developing new fuels: wind both onshore and offshore on the east coast and the

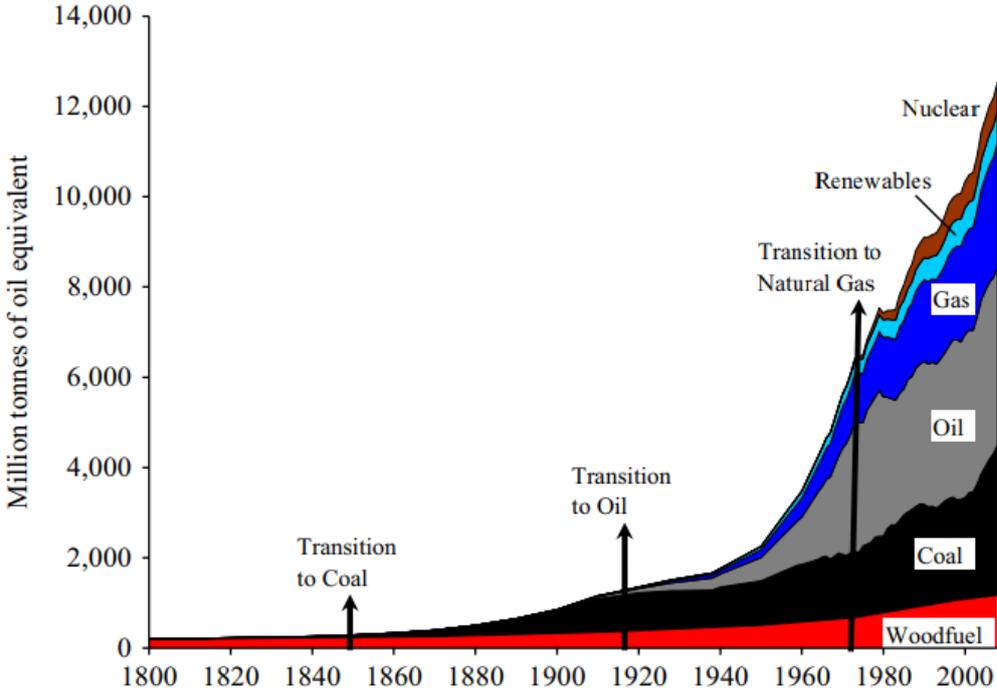
west coast, large development of solar power parks... And development of emission trading markets in order to set a price of carbon as a signal in favour of emission reduction.

This short analysis of communication on energy transition shows paths of change: either adapting to energy constraints, which means remain affordable, insist on economics. Or adopting energy transition as new fuel for ideas and business opportunities, insist on innovation, new services, new markets.

**1.2.2. Has any comparable transition happened before?**

This section presents elementary bricks of energy transitions and explain how it represents a change of model in energy.

**Addition vs substitution, and how it contributed to growth.** Energy use has been rising for a very long time. Adding energy production and consumption has a long thread in history. According to Fouquet (Fouquet, 2010) it can be traced back to middle age. Since then, there has only been additional energy found or transformed: coal, oil, gas, hydraulic, nuclear, up to present one, but surely not the last. Figure 3 below shows when and at what pace each new energy source was used.



**Figure 3 Global energy consumption and transitions, 1800–2010 (Fouquet & Pearson, 2012) citing Fouquet (2009)**

It is striking to see how each new energy comes with its use and production without replacing previous ones: as simple example car running on gasoline did not replace lighting houses. There are of course counterexamples where some fuels become less used in absolute or relative values. Wood fuel is the clearer, with disappearing of burning wood fuel directly for heating and private use. But even here, innovation in production and in use permits to foster wood pellet as new form of wood fuel, and local solutions to use by products of forest exploitation. These new niches, with local access to forest, or temporary excess of wood material question again the possibilities in the socio-technical regime of energy.

In a context of energy addition, energy companies built their legitimacy on skills to manage bigger and bigger projects. Challenges were monitoring of capital expenditure, time and quality control. Parallel to construction of more production capacities is the structuring of distribution network. Key to legitimacy lied in speed of construction, then availability and reliability in exploitation. As markets were more or less dedicated by country, actors could not choose between several suppliers and price was a result of calculation, more than negotiation.

**Changes in energy system have been more in addition than substitution.** The second mechanism by which energy landscape changes is substitution of one energy but a ‘better’ one.(Smil, 2018) Why is it that in Figure 3 above there is so much addition and so little substitution? In fact, nobody wants to do it: it is painful, then it is costly, and finally brings no value. For an electricity producer it is the same set of issues. When an asset is running smoothly, at low cost, and generating reasonable revenues, why change? Because it is a key component of energy transition.

First, substitution of one energy (here we assume coal) by another one is hurting (here we assume wind energy for our demonstration). What to do with current assets which run fine? Between closing and dismantling, putting idle for temporary case, selling to a potential competitor on the same market, many factors intervene. New energy means new sites, new technologies to master, new constraints on building, operating, and integration in the electric network. And the change itself is a question; it requires different mindset of employees, possibly customers, shareholders...question of acceptability of this change is important both internal to the company and to external parties.

As for second issue of substitution, it is costly. Whether we look at types of costs piling up from closing assets, and open new ones; or if we look in comparative values by MW, or compare energies one to one. And pricing of these costs can be uncertain. Dismantling coal power plant in our example can be limited production losses. Or it can be decommissioning and scrapping materials. But maybe some soil remediation is also required. That together with how long it

will take create uncertainty on the energy substituted. As for the new energy, contingency during construction phase can be added to risk of new technology. Even with good commercial clauses, operation of the new energy might be under estimated.

Third, substitution in favour of a new energy is valueless. When the project consists in time and money to generate the same electrons, it generates no apparent value. This is an issue for value creation of companies for the earnings; but it is also an issue for convincing internal and external parties. Hence substitution is a hard project to sell.

How could substitution become economically attractive? To overcome difficulties just mentioned, there can be incentives for substitution or constraints forcing to do it, or both incentives and constraints. We give here one example of each. Incentive can be that national state offers a fixed tariff, or feed in tariff, which guarantees in the long run a premium vs other energy sources.

Constraint can be regulation to ban coal power plants within a number of years. Here operators have no choice but to plan the conversion. It is either shut down, dismantles and takes losses, or also operators would build new energy capacity to recover some revenues. And association of incentive and constraint could be a regulatory package that both fosters renewable energy and restricts use of fossil fuel power plants. Another example is be the creation of a carbon market where operators, not only electricity production, gets some carbon certificates (like the European Union Emissions Trading System or ETS since 2005). If they emit more than their certificate over one year, mechanism is a constraint with the obligation to purchase carbon permit from others, we are in the constraint and penalty part of the system. But if they emit less than their total certificate, this excess can be sold on the market, this is the incentive side of the mechanism.

**Challenges of addition or substitution depend on geography.** Addition and substitution are entangled, but they appear differently in different countries. In most developed countries the main trend is energy substitution rather than addition. This is quite a different perspective in fast growing countries such as China or South Africa. Increase in fuel consumption has been dominating changes from 1700 to recent years (Pearson & Foxon, 2012; van de Ven & Fouquet, 2017). Progressively we move to substitution by new energy and energy efficiency.

Geography plays a large role. In Europe or North America, the tipping point of total consumption starting to decrease might be already behind or just ahead, reshaping the world of energy. Nevertheless, in many countries there is an open debate if energy demand will remain flat, increase marginally or decrease.

Next argument in energy transition discusses speed of change, and whether there is one transition, or in the contrary several transitions.

**A much higher speed of change than any time before can be expected.** Speed of transition and importance of prices are key elements to describe energy transitions (Fouquet, 2016). The speed of transformation and dissemination is not easy to measure, and it will be kept for the end of this section. On the contrary comparing diffusion of one technology with another one is easier.

In the past, development of energy transitions like diffusion of coal then oil have been very progressive. Transition from wood fuel to coal is estimated at 130 years, and coal to oil at 80 years (Grubler, 2012). Here it is important to define how this transition is measured, since the rate of replacement and addition of use varies, and previous usage still marginally remains. For next transitions we could anticipate that installed base slows down the transition. And the tendency to follow previous developments creates path dependency. It seems that it is not the case. Solar energy started around 1958 with satellite Vanguard. This makes 60 years since then, but it is difficult to measure as we are somewhere in the middle of its deployment. Wind energy dates more than 30 years if we exclude wind mills across Europe until 19<sup>th</sup> century. But as Arnulf Grubler puts it “rates of change are slow, but not always” (Grubler, 2012).

**Speed of change and speed of price changes.** Speed of change is favoured by a sharp cost curve. Learning curve of new technologies is usually a sharp decrease, but in the case of renewable energy the fast ride along the learning curve is steady. Figure 4 shows economies of scale in the case of photovoltaic cells production.

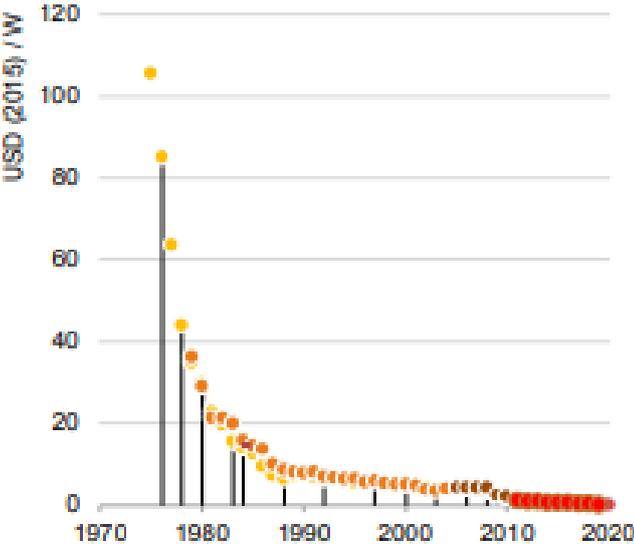


Figure 4 Evolution of PV solar module cost (IEA, 2020a) p81

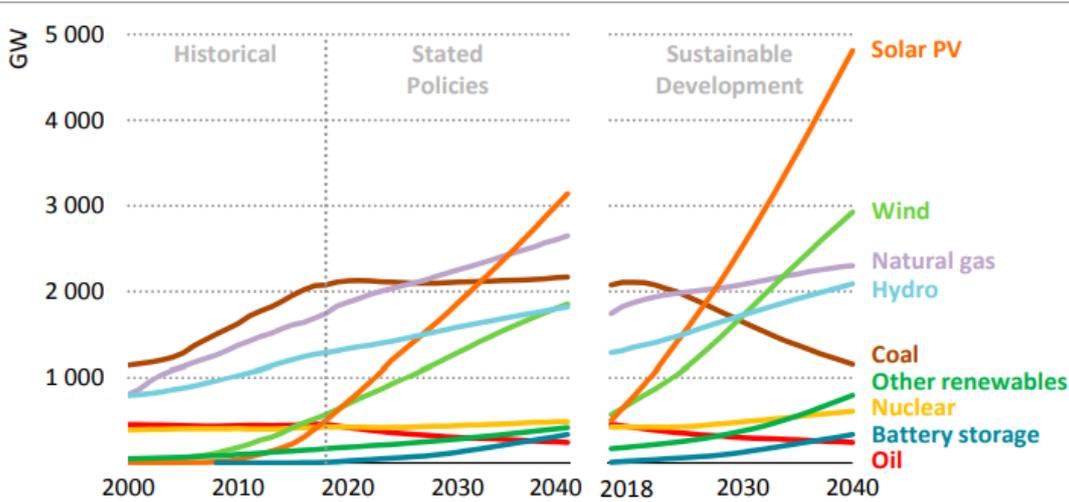
**Each vertical bar is a doubling of capacity installed, each colour a different data source**

Together with low cost curve, the time to complete renewable project is comparatively short to other energies. A typical wind farm takes 1 year of installation, compared to 2 years for a gas power plant, 5 years for a coal power plant or 10 years for a nuclear power plant. With low cost technology and easy to deploy, it triggers a fast transition. But at different speeds, depending on energies, wind, solar, tidal, geothermal, or biomass... there will be many different learning curves with open end success.

On the other side, pace of transformation is linked to the speed of adaptation by companies or by electricity networks. To a large extent, cost curve is going down rapidly because there is a steady adoption and many projects start on the assumption that cost will keep going down. This cycle is fuelled to large part by secured energy tariffs, where electricity is sold at a premium compared to markets. When selling price of electricity go down towards market price, it changes the speed of new projects and new energy adoption.

In his cautionary tales, (Grubler, 2012), express concerns on an energy transition that would be “too fast, too big and too early”. Some years later we could say that transition to renewable energy is slow in some countries, marginal in others, significant only in few places. It is not that big when investment in renewable are compared to investment in fossil energy year by year. As for too early, some voices would rather name the transition too late or just in time.

Figure 5 shows past and future installation trends for renewable energy, especially solar (in orange) and wind (in green) among other energies. The exponential pattern followed is clear for the past curve; and two scenarios of IEA, called here “stated policy” or low case, and “sustainable development” or high case, show how the how fast, big, early in Arnulf Grubler’s expression remains a valid question.



**Figure 5 World global power generation capacity, since 2000, with forecast up to 2040, World Energy Outlook (IEA, 2019) p266**

**Is history teaching us anything?**

It is not the first time that there is a change in energy source. There have been several energy transitions in the past that can provide a frame for current transition from exhaustible resource to renewable. Taking examples from the literature on history of past energy transitions, a first significant one has been from wood fuel to coal and steam, with estimated beginning in 1850 up to 1910 with the start of transition to oil (Fouquet & Pearson, 2012). This transition was a sharp increase in energy usage. In this case we see a) a progressive change in technology of burning fuels b) a complete shift in resource used c) change in usage opening large growth. We can compare with our current challenges of a) abrupt change in technologies b) competition between exhaustible resources and renewable resources like wind and sun c) declining use in some countries with a focus on energy efficiency and increasing use in other fast developing countries.

The second example is the transition from coal to oil, which can be estimated from 1910 to 1970. Some authors even date a tentative end of transition to oil, and define a next transition into natural gas since the 70s (Fouquet 2011). This transition was both an increase of energy use and a replacement depending on different usages. Usages can be differentiated into replacement only, addition only, and mix of replacement and addition. As an example, in replacement only we have household heating; in fully new sectors we have automobile or air transportation, and last a mix of replacement and addition could be electricity production out of coal boiler, or gas turbine, both creating steam transformed into electricity. These changes happened not only with technology diffusion but with marketing creating new products (starting with oil lamp, up to petrochemical and plastics). Compared with the previous example we see a) complete shift of technologies with refineries and engines b) shift in resource with logistics questions where to find oil and how to transport it c) mixed change in usage with some replacement and some addition.

**Progressive change is gaining momentum and reaching a point of urgency.** Energy transition has been very progressively taken into account, at least in public opinion and in many companies. Press analysis on Kyoto Protocol in USA and Italy (Bassi, 2010) illustrates a contrast between USA with “problem presented as remote and faraway.”, that is compared to Italy, country home of the author, “general words indicating natural calamity, nomination of concrete problems”. There is not at that time a sense of urgency to act, more a confuse threat to be dealt at country level. Between the Kyoto Protocol 1997 and the Paris Agreement at COP21 2015, there has been considerable change.

Here is an example from the American utility Duke Energy, which will be studied in the company selection of this research. Back in 2006 the company was overcautious about carbon footprint. “Duke Energy is committed to developing more efficient electric generation with fewer emissions, including the greenhouse gases that contribute to global warming.” (Duke Energy CSR 2006 report p 1). Even the link from carbon to global warming is not appearing as central. The path taken up to 2018 for Duke Energy is putting low-carbon at the centre of priorities “We’re looking at ways to accelerate the move to cleaner energy because we know it’s right for our customers, our communities and society at large. The lower-carbon future we all want requires a delicate balancing act with no one-size-fits-all solution, as it must be safe, reliable and affordable for all customers regardless of where they live”. (Duke Energy CSR 2018 report p2).

In this short example, it is clear how energy transition changed into a stringent priority. It used to be a question of adaptation, to evolving legislation, and economics. This company has been studied in literature for the importance of coal in the electricity production mix, especially in rhetoric for defending their production mix (Patala et al., 2019). These authors cite Duke Energy in 2010 “some would like to turn away from coal completely. That’s not realistic given that it powers most of Indiana’s – and half of our nation’s – energy needs. Indiana has more than 110 years of recoverable coal reserves. We simply cannot turn our back on this abundant, relatively low-cost fuel resource”. This plea for coal can be compared with lower-carbon future advertised in 2018.

### **1.2.3. Radical changes blowing up the energy scene**

After discussing the quantity, whether addition or substitution, and the price elements; before presenting innovation and change in technologies, which will be presented in section 1.2 explanatory frame, some other features on the energy scene have undergone major changes: trend into energy centralisation is now challenged by decentralised production ; energy regulation that ensured long term vision are challenged by burgeoning offers and needs.

**Decentralization is challenging the central market design.** Centralising electricity networks was a safe and comfortable way to aggregate demand, plan supply and prepare an emergency response when needed. Why is it no longer the case? Because many small wind or solar production sites come into the national grid. This changes geography and quantity of electricity injected in the grid. The result is an unpredictable network, and geography of the landscape

influenced not only inland, but also with offshore potential (fixed bottom offshore wind farm, progressively floating offshore wind, and tests on floating solar power).

The long and stable process of centralising electricity networks had many advantages. It focused on large production units, with carefully thought location. This allows a network directly into main consumption areas, and high voltage line to balance supply and demand between areas. Next level is interconnecting with neighbouring countries, opening possibilities of export and import, but also increasing security in case of shutdown of some power plants. Some of benefits included economic optimum of the network, no redundancy of network, best allocation of investments. One of the underlying assumptions is a coordinated planning of future demand to continue this allocation.

There is a powerful shift from central planning to decentralized production. Small windfarms and solar farms (5 MW to 50 W) scattered in often remote geographical areas produce electricity in competition with large power plants (400 MW to 1500 MW), disrupting national grids and market organization (Hirsh & Jones, 2014). This challenges how managers in utility companies face these changes, and decide to adapt, to change, to transform. Within these decisions, our current research question address more specifically decision to change the production mix, in closing some production capacities and opening others (for example closing a coal power plant and opening offshore wind park), and more broadly transformations of company, like different services offered.

This move from central to decentralised network is making the future landscape foggy. Same uncertainty on the consumption is coming from self-consumption. When many households run autonomous from the grid, but for a few weeks of higher need in winter, how can centralised network still accommodate these fluctuations. In the short run, risk appear minimal as infrastructure can cover all situation and self-consumption remains marginal. In the mid-term, there could be some uncertainty if intermittent is located far from consumption, higher self-consumption and some of the network not maintained to save on costs. In the long run, autonomy of cities in energy is a further uncertain parameter. Decentralisation process is not a choice of network architecture, but a road to many options that will make more redundancy and risk of runout in the electrical grid. It will call for many local coordination. This is an unprecedented situation compared to the previous increasing centralisation.

**This time it is no longer a game update but rather a game change.** There are always been new energy sources and technologies coming up, so that emergence of wind power or boom of photovoltaic panels is nothing unheard of before. But this time the rules of the energy game are

not updated with more technologies and more usage but the game itself is changing. A mature and cheap energy resource like coal becomes disliked, damageable, for some even called “evil”. What happens to existing coal mines, coal power production, and experts in the sector? Abundant resource like oil in Saudi Arabia could turn unwanted and unnecessary if sufficient electric transportation is developed. These two examples show on one hand that it could lead in the long term to value less resource and on the other hand that in the short term less use of a resource in some regions makes additional credit for its use in others. When is the point between this short term and that long term? And for the owners, operators, users of these resource how to manage them?

**Global warming impacts companies’ existence, then profits.** Global warming impacts industrial companies at least twice: first on their licence to operate, as very first conditions to stay in business; and second one as a risk on profitability level. With increasing environmental concerns, national governments issue stricter regulations, often staggered in several steps. Diesel particles are a good example. Either automotive industry, or energy producer in our examples can stay below the regulatory limits, then they can operate, otherwise not. We suppose here that companies abide by the rule and that control system is strong enough to prevent, sooner or later, any infringement of legislation, like Dieselgate, first for Volkswagen, then for several car makers, in EU disclosed in 2015. As regulation gets stricter, the challenge to stay in business increases with questions for many assets. What is it worth upgrade a refinery into lower sulphur emission, a coal power plant into thinner particle emissions, as opposed to discontinue operations? For units where adapting costs become higher than value of their business, utility value can become fully stranded, up to the point of paying a fee to sell them.(Ansar et al., 2013) Supposing our industrial company keeps its licence to operate, then global warming can have concrete impacts on profitability, both upwards as downwards. Upward is less obvious, it could take the form of companies developing electrical car saving on fuel, or building insulation saving on heating and cooling needs. Here global warming is creating an incentive for innovation adoption, for new product introduction. It can be at an interesting economic calculation, but also at a premium price for any perceived reason. Downward factors are, for some, linked to all costs incurred to stay in business; but other negative impact can be numerous. In the field of competition between firms, it may not matter only to stick to emission limits of regulation, but to reach them first. In the oil refining industry, this could translate into achieving, earlier than competition, milestones like lower sulphur gasoline or percentage of biodiesel blended.

**Global warming pushes companies into two extreme cases, collapse or transform.** On this path of transformation there are two extreme cases for energy companies, one is collapse and stop activity, the other extreme being to transform completely; all possibilities between them make the present research design and result section, which we study with the perspective of corporate discourse analysis.

A recent example of collapse is US coal miner Murray Energy filing for bankruptcy in Oct 2019. This company producing 20% of coal in the USA. Here the company decides to focus on its existing assets and optimise them. It could be compared to the spin off that German company E.ON made at one point between conventional activities, coal, nuclear, under the name UNIPER and the renewable part in a new E.ON structure. The former was a structure dedicated to assets meant to be dismantled at one point, under German legislation. These are activities with a forecasted stopping date; managed adequately, it can be a cautious way to handover industrial sites to new activities.

These transformations are largely in the making, and many large energy companies tap in their profitable businesses to develop new activities. Three noticeable examples show permeability between oil sector and electricity production. In June 2011 TOTAL entering solar power production for USD 1.3 billion; in December 2016 SHELL entering offshore wind production with Egmond aan Zee wind; and June 2020 Total entering also offshore wind for an estimated investment of 1.9 B USD, in Seagreen 1 offshore wind 1140 MW off Scotland. Together with the amount of money spent on last of these three examples comes the verbatim on strategy on the: “This move represents a major change of scale for Total’s offshore wind activity in line with our strategy of profitable growth in renewables and low carbon electricity” (TOTAL press release June 2020).

To conclude this section on how sustainable the path could become, there is a very broad range of economic transformations, which Fouquet and Pearson (Fouquet & Pearson, 2012) painted as “revolutions are moments when new possibilities and opportunities emerge”.

### **1.3. EXPLANATORY FRAME: MULTI LEVEL PERSPECTIVE**

After the previous description of changes at stake in energy, there is a need to bring some explanation. Considering energy transitions as an example of a social and technical system, how do these changes pop up, sometimes blossom, mature or sometimes fail? That is the centre of Multi Level Perspective covered here.

A fruitful frame to understand how energy regimes shifts from one set of technology to another one is the Multi-Level Perspective formalised by (Geels, 2002). Although it has been rethought and improved, there are three main elements: niches (it could be emerging technologies on hydrogen in 2020, compared to onshore wind turbines in the 1990s), landscape (means of energy production and consumption), and socio-technical regime (all changes in technique, use, and their development)

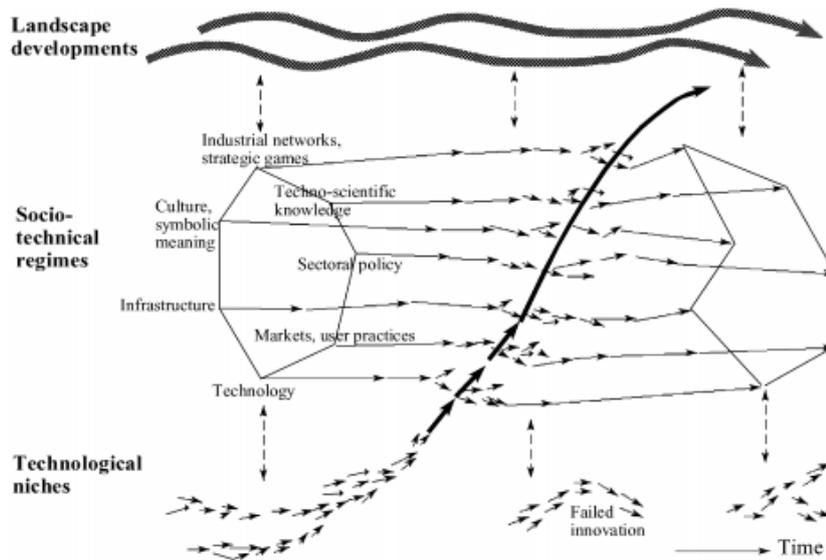
### **1.3.1. A model of technological transitions**

**Changes in energy studied under Multi-Level Perspective frame.** Why and how energy sources change? Some answers are obvious, like one day oil reserve will die out, or solar power will remain available and cheap in foreseeable time. Others are not, like what is the best solution to compensate intermittent renewable energy from wind or sun.

A large stream of research studied what fuels transitions, in diffusion of innovation and its adoption. And part of that focuses on energy evolving from wood fuel to coal, from coal to oil, and to gas, nuclear. Another part explains development, and resistance to diffusion for energies like wind, solar, geothermal...this literature explores many innovations in the energy that push out existing means of production and consumption and establish new ones. How did the landscape of windmills, water mills and horsepower evolve into what we know today?

**Three main components to explain to energy transition.** Multi-level perspective deals with innovation and transitions. This perspective helps to understand why some innovation will disseminate, and why some will not. In fact, it is more how it disseminate, from a tiny niche into wide possibilities. Its description of diffusion of innovation have been applied to energy transition.(Geels, 2014; Geels et al., 2017).

Frank W. Geels takes the example of shift from sailing ships to steamships. From our today's point of view, it is obvious that steamships were faster and better for any use than sailing ship. But in a world of sailing ships there was no room them. It is similar for large wind turbine that populate our countryside. Back in the 80s there was no interest and no space for a series of small fans scattered on a windy field. As described in Figure 6 below this perspective is built on three elements; below the technological niches, then socio technical regimes and at the top of the figure landscape developments.



**Figure 6 « A dynamic Multi-Level Perspective on technological transition » (Geels, 2002)**

There has been numerous developments of the frame, taking into account additional factors; such as power relations, and how incumbent energy companies tend to limit changes (Geels, 2014). Figure 6 can be read in several directions. The main reading point of view described in detail below is to look at new ideas and inventions, as some technological niches, then moving up through development of use and product, social and technical aspects; and reaching a widespread level. A second reading is horizontal along time line; on the left new ideas happen. Then many events happen favourable, called development, or unfavourable, called failed innovation. Finally, to the right history becomes a tale of victorious innovations without further mention. A third reading is only on the landscape at the top. This landscape is metaphorical description of products and innovation as we see them. More specifically, (Geels, 2002) p 1260, “The metaphor ‘landscape’ is chosen because of the literal connotation of relative ‘hardness’ and the material context of society, e.g. the material and spatial arrangements of cities, factories, highways, and electricity infrastructures.” On this landscape appears with time some hills with new product and services becoming part of the landscape. This would be close to history of Braudel and Ecole des Annales, where apparition of an event is more the reflect of a long process than a sudden change. As illustration, we could say that 1886 first telephone by Graham Bell is not an isolated day in the history of telecommunications.

**Starting from technological niche.** First concept used is how new technologies appear, like niche or novelty. At one point in time, in a context of stable technologies, new niches emerge. Geels does not define the concept but borrows it from previous research. Ultimately this concept

can be traced back to biology about animal and “their ecologic or environmental niche, (..) niche, as ultimate unit, is occupied by just one species or subspecies” (Grinnell, 1924) p 4. In this definition, the protection from the outside is considered as a requisite for future evolution. As main characteristics, niches are closed, but also protected, and they benefit from different selection criteria than usual. First, the insulation from the market could be non-profit structure, or a captive customer. Geels describes as “these niches are protected or insulated from ‘normal’ market selection in the regime (Geels, 2002) p1260. Second, the notion of protection comes with some visibility on order intake, or financial support up to a certain level. Protection could also mean exclusivity, or any form of contracts that minimize risks taken. And last, different selection criteria refer to any mechanism beyond price, quality, delay...for instance it could be commitment to take and use whatever product is achieved.

Concept of niche has been fruitfully used in many fields, in ecological studies animal’s ecological position in the world, where animals are described in relationship with a protected environment; but at an opposite spectrum in strategy where exploiting a niche market refers to a high profitable but narrow market. Spatial dimension has also been developed as development on a local territory implementation site (Geels et al., 2017). Switching from definition to some examples, includes niches as wind turbines in Denmark in 1977, or application of solar panel from first satellites in the 50s into more basic panel to be installed. These cutting-edge technologies find their ways in small subsidized markets, or solutions pushed by policy incentives, or for users prepared to pay very high prices. This change is as much society as technology driven, (Latour, 1990) we see examples of developing onshore wind production, which a development associating acceptance by populations and technological improvement (Zelem, 2012). Some new ideas fail, and disappear from the landscape, either temporarily or for good. A past example would be the prototype Themis concentrated solar power built in south of France, and briefly operated between 1983 and 1986. Current example could be developing floating solar panels installed on lakes as trials for potential developments. In this perspective, the next socio technical regime could be reaching a new production mix with a large part of renewable production complemented by some current power plants.

**Moving into socio-technical regime.** These niches change as they confront evolution of techniques, and evolution of uses. This is described for the first steamships in a world of sailing ships, as improvement of the combustion and better ships, and use for passengers on reliable travelling time. With this example (Geels, 2002) explains the second element of Multi-Level perspective, in which technologies evolve in social and technical environment. Geels defines it in two steps. First a technical layer then a social orientation. For a given innovation,

“technological regime is the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, problems; all of them embedded in institutions and infrastructures” (Kemp et al., 1998).

Then Geels adds the social environment, including customers, suppliers, lenders, authorities and so on. Socio-technical regime is modifying the technological as “the semi-coherent set of rules carried by different social groups.” (Geels, 2002) p1260. Here the stakeholders are very numerous, and much wider than a supplier, employer and customer perimeter. Rather, a range of multi-actor interact on the social and technical aspects.

**Multi-Level Perspective continues with landscape development.** If we were to describe what the energy landscape looks like, it could be made of hills, trees and grass featuring energy sources, energy transformation into electricity, fuelling engine; and the latter additional or alternative usage made of energy. ‘Landscape’ has been carefully chosen at crossroads of pre-existing material, path taken up to now, and perspective of what could further change. Geels defines that ‘landscape consists of a set of deep structural trends. The metaphor ‘landscape’ is chosen because of the literal connotation of relative ‘hardness’ and the material context of society, e.g. the material and spatial arrangements of cities, factories, highways, and electricity infrastructures” – and: “Landscapes do change, but more slowly than regimes.” (Geels, 2002) p1260.

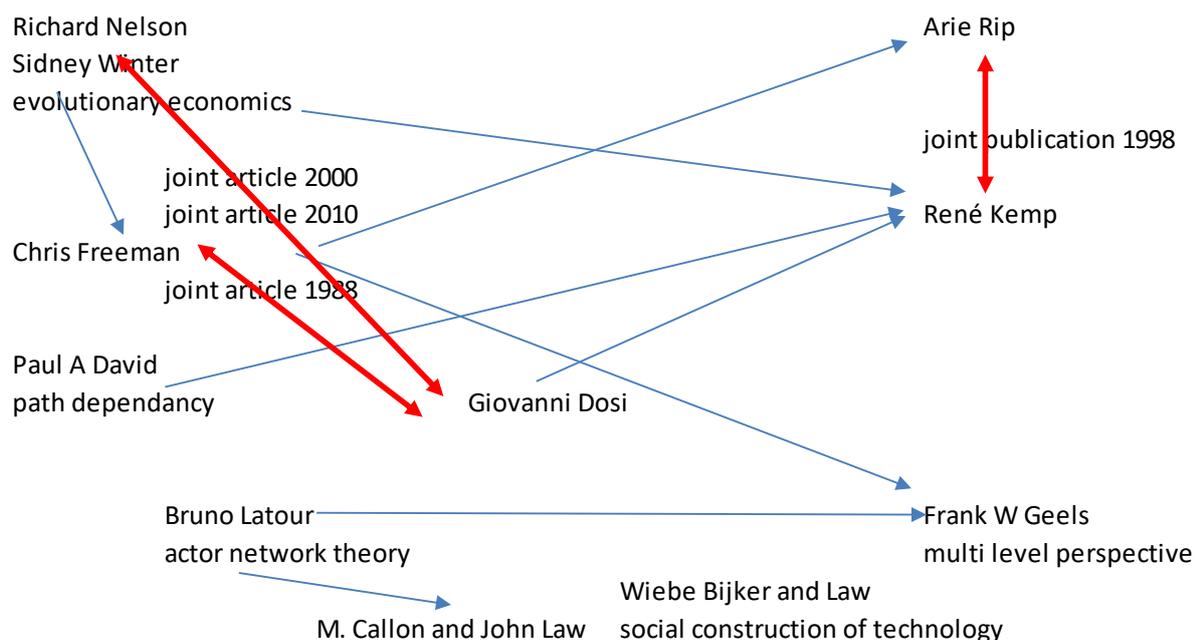
In the energy landscape, these hard elements can be easily seen, like large coal, gas, nuclear power plant structuring the countryside. But these infrastructures have not always been there, and will probably neither. Networks of high voltage and distribution network also populate geographical as well an innovation landscape. At the same time some changes appear, new technologies and try outs. The first wind turbine may look similar to the last windmill from the previous century, and then it spreads out. Diffusion is accelerated by new innovation, and slowed down by how and where to make it acceptable. This metaphor is particularly suitable for energy innovation blossoming into many directions.

This analytical frame has been used extensively to explain changes in energy, from coal mine (Turnheim & Geels, 2013) to impact of climate change on car manufacturers . (Penna & Geels, 2015). But wider application have been made, like changes in agriculture and food (Ollivier & Plumecocq, 2015). It remains a fruitful and active stream of research, with development on power structure and roles of institutions (Fuenfschilling et al., 2017).

### **1.3.2. Explanation frame built on evolutionary economics**

**Multi-Level Perspective grounded on evolutionary economics.** We open a side discussion to justify how theoretical frame is grounded into previous literature. On one side, we show that Multi-Level Perspective has been elaborated on a long stream of research that we trace from evolutionary economics (Nelson & Winter, 1982). On the other side, we prove that this is a well-used frame to study energy transitions which happened in the past and up to present.

We start with 3 propositions that directly inspired Multi-Level Perspective. The first one states: “the proposition growth can take care of itself is reckless” (Dosi & Grazzi, 2009). That is a strong link between economic growth and environment, in a context of discussing limits to growth. And it opens a wide debate on how environment is limiting or orienting growth. The second one states “The higher the price for fossils, the better for humankind in the long run (Dosi & Grazzi, 2009). This orientates energy choices based on total value, including externalities or other non-financial elements. It contains a positive message that if oil and fossil resource remain at a sufficiently unaffordable level, it will trigger creativity for alternate solutions. Finally the third one states “Even sky rocketing prices might not be sufficient to induce a sustainable pattern” (Dosi & Grazzi, 2009). That last one questions what sustainable pattern needs. It could be a shift in behaviour, an economy of use more than an economy of acquisition. These propositions open up to sustainable patterns and how achievable they can be. This methodology to analyse innovation development is grounded on theory of evolutionary economics with its development since 1977 shown in Figure 7 theory mapping below. This large theory focuses on innovation, history, economics, that starts with the question of finding a useful theory of innovation (Nelson & Winter, 1993)



legend : red lines are joint articles with dates; blue lines are citation from an author by another

**Figure 7 Theory mapping how multi-level perspective is grounded and elaborated**

These concepts ground energy transition studies on theories on diffusion of innovation (Kemp, 1994) (Dosi, 1982). They describe it with key components rather than a determined path. How does innovation happen and how does it differ from other concepts like technology, invention, breakthrough, progress or in a fashionable way disruption? These concepts are deeply rooted in economics and sociology (Nelson & Winter, 1993) (Latour, 1990). First, technological breakthrough comes progressively, and second, this regime of transition is open ended. Those two propositions create a circle of trial and errors which generates ideas of tomorrow and others that will be dead ends.

A particularly convincing case has been built on technologies for typewriters (David, 1985). This is an example where the bad technology took over the better one. Two competing techniques for typewriting were QWERTY keyboard and Dvorak Simplified Keyboard, or DSK. It turned out that the worse of the two keyboards, 30% longer and requiring to move more fingers to type the same text, has overcome the Dvorak special with no apparent advantage.

### 1.3.3. Further developments into power relationship and institutions

**Further development, with power and resistance.** Since the version of 2012 presented hereabove, research on Multi-Level Perspective has blossomed into many directions. One of them covered the role of power and resistance. What makes new energy technologies

successful, is to have overcome resistance for change (Geels, 2014). These resistance for change can be source of halting adoption, like nuclear power plants hit by the strong anti-nuclear movement in Germany in the 70-80s. But they can also be source of speeding up diffusion once power relationships help (Granovetter & McGuire, 1998).

There is a strong link in taking a point of view of resistance to change, and looking at energy changes from an institutional perspective (Fuenfschilling et al., 2017). This can lead to considering companies as institutions adverse to change, or keen to it depending on many factors and this is the design taken in this research. This is also why this research refers back to state of explanatory frame of 2002, rather than latest state of the art (Köhler et al., 2019).

**A limit of Multi-level perspective is to be an explanation tool, not a predictive solution.**

This frame we presented is explaining how innovation disseminate. It describes what makes innovation, applied in energy innovation, succeed in offer and in adoption. But it is by no mean a predictive model. It does not help to understand in a deterministic way if floating offshore wind, for example, will be successful. This makes the model even more interesting for us here, because it shows that legitimacy of an innovation is never a given. For electricity companies adopting new products or new solutions, it may increase their legitimacy and gain attraction, but it could turn out harmful for unpredicted reasons. This is illustrated in California between 2016 and 2019. For one announcement of Pacific Gas and Electric to close its nuclear power plant and build renewable, which increases commitment of the company for cleaner energy; only few years later, wildfire with accusation of poor maintenance destroys it.

This section has presented how energy transitions appear one after the other, and the relationship between technical innovations and ways that make them accepted.

#### **1.4. HOW STAKEHOLDERS TAKE PART TO TRANSITION**

This section covers some elements on how stakeholders around energy companies change their attitude and action with energy transition. It is not an exhaustive list of stakeholders, rather a selection for the purpose of showing how strategy and legitimacy of utilities is changing.

##### **1.4.1. When shareholder's meeting change into concern of global warming impact**

In this review of some stakeholders changing their expectation to include energy transition, the first chosen is shareholders. For energy companies in general and utilities in particular,

shareholders meeting were focused on return and performance, together with risk management among elements.

A good example of risk management taking climate change on board was the May 2017 Exxonmobil shareholders meeting. Disregarding the company's opposition, Exxon Mobil shareholders asked the oil giant to provide more information about the impact that climate-change policies could have on its business. The measure was approved Wednesday by investors holding 62 percent of Exxon shares. A similar proposal earned 38 percent approval a year ago." This example is not a binding plan, but shows the trend and speed of change. In 2019 several oil companies have committed to become carbon neutral. It is not the case for Exxonmobil, but, Equinor, Norway, BP (announced Feb 2020) Shell (-50% for 2050), Total (announced in May 2020).

If this pressure on energy companies is becoming so strong, it also applies to electricity companies to exit activities (first of them lignite and hard coal), and develop new ones (including wind or solar). A second example is the RWE shareholder meeting in 2019 with NGO asking for a swift step out of coal. These two examples show how shareholders' attention shifted from risk and return management to how companies will adapt to global warming; on one side it is more acute risk management to avoid value less assets, and on the other one it is search for new profitable investments along energy transition.

#### **1.4.2. From regulation to risk and uncertainty**

This section is not presenting regulation of electricity markets, it would be way too ambitious. It is showing how regulation used to be a clear frame for electricity companies, and has become source of risk and uncertainty. This destabilised utilities while at the same time offering opportunities to reinvent electricity markets.

Ensuring an equal access to energy in **quantity, price, and reliability has been a constant concern** for most countries and studied by key authors in the literature (Fouquet, 2013; Helm, 2012). It allowed to build dense distribution network, to build larger and more efficient power plant when the forecast of demand could be reasonably foreseen (like nuclear power plant increasing size from 900 MW in 1970s to 1500 MW in 2002 in France).

A key question was to design fair price for each user in a context where the network was mostly national, or on a regional scale. It includes issues like peak load pricing when electricity demand is maximal and additional production requested within minutes; Williamson (1966) cites at least

four solutions in the literature, from “Marcel Boiteux, Hendrick Houthakker, Peter Steiner, Jack Hirshleifer”.

Reaching independence of supply was a great motivation for development of electricity vs oil shock in the 1970s, with coal and lignite power development in Germany on the back of local resource, and nuclear construction program in France.

Helm (2005) assess a first period of change “during the 1980s and 1990s energy policy concentrated on privatisation, liberalisation, and competition (...)”. This can be considered as a progressive change from fixed landscape, into moving environment.

**Then electricity markets became a moving landscape.** Taking liberalisation as a first cause, this created possibility for utilities to develop in other countries, hence competition, taking over of companies... in Europe, interconnexions between national networks allows a physical exchange of electricity; together with trading platforms it creates a more fluid market for electricity.

A second period of changes is dated 2000 onwards by Helm (2005) “the focus moved from asset sweating towards investment, and has been accompanied by a paradigm shift in the objectives of energy policy, towards security of supply and climate change.”

Old objectives of security of supply and prices have not disappeared, but subdued into new concerns of energy transition. Helm sees also ageing of assets and problems on networks as trigger to new cycle of investment. In this view, renewable energy technologies would come to maturity about at the right time of investment decision on coal, gas, nuclear power plants.

There is a combination of global warming and change in market rules, which are summarised as “if deregulation of energy markets started earlier than increasing concern on global warming, the latter has considerably contributed to restructuring rules in energy “ (van de Ven & Fouquet, 2017).

The most important for the present research is the wide strategy options for electricity companies. Energy transition creates constraints and opportunities in decentralized production, change uses from oil products to electricity, increasing flexibility or intermittent production.

These changes also means new opportunities, expansion of energy companies into other countries, and merging of companies as if energy was becoming one sector like others (Geoffron & Méritet, 2006).

What if regulation not only paves the existing landscape of energy, but sometimes precedes (creation of CO<sub>2</sub> markets in Europe) and sometime lags behind? This guide becomes a factor of instability, with signals difficult to read, sometimes in favour of volumes, or prices, or both.

We conclude that companies are influenced by changes in regulation, as much as they influence themselves these changes.

A reasonable guide of how renewable energy disseminates in the production mix consists in energy laws issued nationally, or at European level. At the international level agreements under UN are sometimes indicative and sometimes binding. The Paris Agreement, signed at CoP21 in 2015 constraints nations to provide contributions to curb CO<sub>2</sub> emissions below 2°C. It was the first binding agreement after the commitments and promises of previous CoP organised by UN.

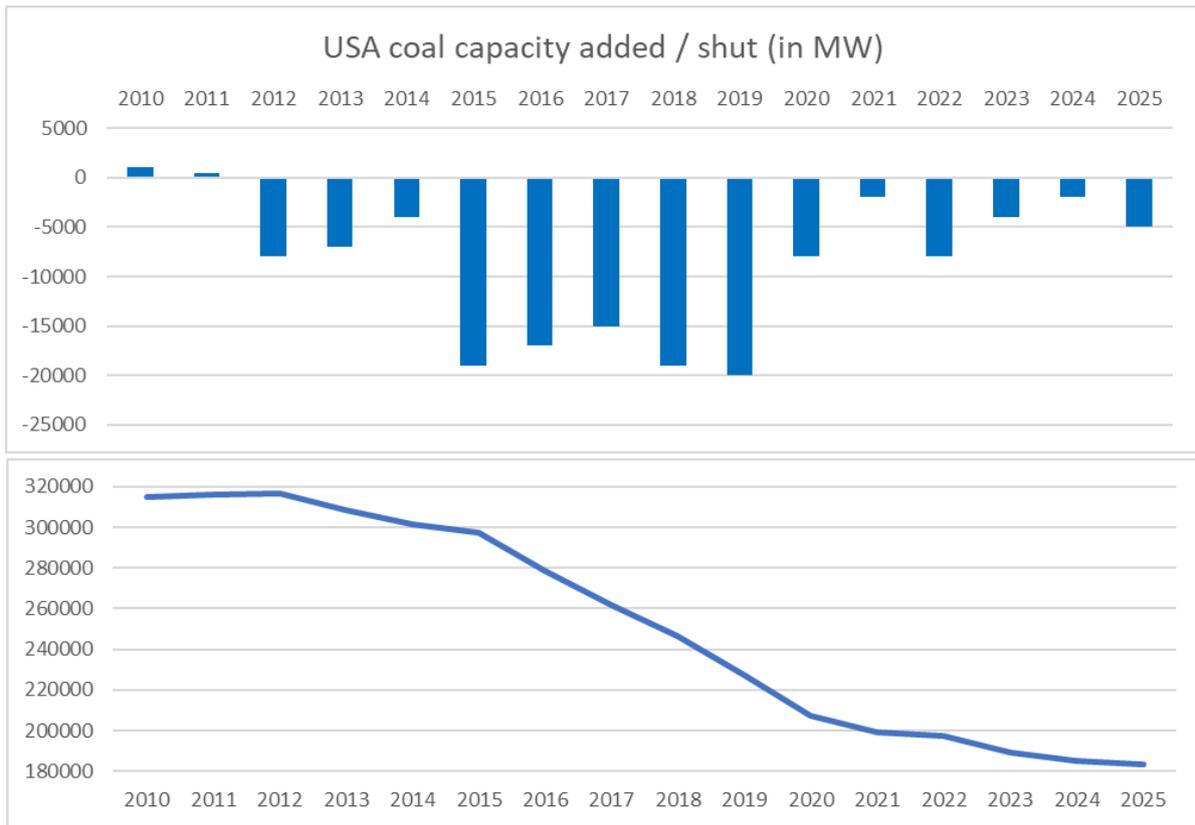
Translated into regional level, impact at European Union level, changes can be traced back from 2007, with the introduction of a binding 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020 (with three key targets: 20% cut in greenhouse gas emissions from 1990 levels, 20% of EU energy from renewable and 20% improvement in energy efficiency). This sets the scene for speed of energy transition, but not for the trajectory in which fuels, what level of consumption, what structure of networks.

But instability of legislation blurs the signal of how electricity companies should transform.

It is illustrated in Germany with the Renewable Energy Act 2017 (“Erneubare Energien Gesetz” 2017), which is the 6<sup>th</sup> legislation on energy since 2000. These changes create challenges for energy company to remain compliant to legislation, and to find new opportunities and businesses.

On the USA side, first commitment was taken with Clean Power Plan Act proposed in 2014 by Environmental Protection Agency, then countered by an Affordable Clean Power Act in 2018. This is an example of radical change in direction. Despite the contradictory signals for closure of coal power plant at the beginning, and now in favour of extension of coal power plant, electricity companies are comparing gas power plant, solar, wind to extension of coal.

Together with overall supply and demand, **coal use is continuously down** as shown in Figure 8.



**Figure 8 Evolution of USA coal power plants in MW (adapted from Reuters 2019)**

In this example, legislation influences decision of energy companies as much as behaviour on market impacts updates of legislation. Electricity companies try to anticipate changes in rules of the game: if coal power plant see their duration of operation restricted, they prepare for shutdown or conversion. When legislation sends a positive signal for coal power development, economics and spot markets push many actors into another direction.

The last aspect on the regulatory environment is the **evolution of risk and uncertainty**. Risk assessment and risk coverage is very intricated with energy: safety, pollution, security, emissions, are the very basics before running any assets. But uncertainty appears in decisions to be taken. What if a very high impact accident could happen with a very tiny probability? Nuclear power plant meltdown is a classic example of such decision under uncertainty.

Decision under uncertainty has been modelised for investing in 2000 in French EPR Flamanville (Epaulard & Gallon, 2000): this covered how to decide a large long term investment in nuclear vs wait and build in 2 years a gas power plant when becomes needed.

Symetrical to decision to invest are decision to close assets. With the same real options modelisation, research looked a decision to shut down or abandon of any energy assets (Fleten et al., 2017; Nazari et al., 2015). It could be tested specifically on coal power, in a decision to

pursue coal power operation despite CO<sub>2</sub> impact, compared to gas power plant running on shale gas, or renewable energy. It could also be simulated on mature technologies vs emerging ones, like hypothesis on floating offshore wind progress compared to other alternatives.

This much wider uncertainty of energy market, and of climate change policy (Blyth et al., 2017) is less suitable to management of large established assets, and more towards portfolio approach of different technologies, size, countries... it creates new challenges for utilities: often with limited cash, how to decide investments in many different directions? And how to link operations of current assets and preparation of new ones?

Finally, the question becomes how to integrate “risk, uncertainty and economics for a warming world”? (Nordhaus, 2013). Externalities from climate change have to come into economics. But how to do it? There is a wide range of options, uncertainties of all sorts. In this moving environment, electricity companies are having a hard time to develop new development models. Energy transition is a game changer for electricity company, or a new paradigm, at a more fundamental level. “The central question in the new energy paradigm is how to design a new energy policy with security of supply and climate change at the core” p16 (D. Helm, 2005).

#### **1.4.3. Financial institutions changing their investments, to a certain point**

**How to continue to finance coal projects in 2020?** If the role of financial institution was to finance projects worth it, technically and economically, this is no longer sufficient. Here are two examples of financial institutions taking steps towards energy transition:

« BNP Paribas announced stopping definitely finance of coal sector project as of 2030 for European Union, and as of 2040 for the rest of the world (press, November 2019)”  
“The European Investment Bank (EIB) has unveiled its new climate strategy and energy lending policy and decided to stop financing unabated fossil fuel projects (including gas) from the end of 2021, i.e. one year after the initial proposed date, (press, November 2019)”

These decisions are easy to track in future investments. They can have negative financial impact in the short term, and possibly positive financial impact in the long run if coal power plant become valueless. Hence there could be a purely financial and risk management explanation. Maybe it on the contrary a communication strategy, where other project would give more attention to be financed by greener banks.

In this context, it becomes nearly impossible for energy companies to ignore pressure to change the power production mix. Whenever they need to call for financing, energy companies have to prepare answers, and to demonstrate how they implement solutions.

**CSR participates to companies' evaluation by finance community.** Independently and before global warming started to be widely discussed, corporate Social Reporting, CSR, has become part of reporting obligations for companies. But scope of CSR has moved with the years, and the environmental part incorporates sustainability, global warming, fight against climate change. Communicating every year on environmental and social issues is equivalent to sending a signal to stakeholders, which then makes mandatory for the company to put in place some kind of actions. It can be argued that CSR reporting would be merely a greenwashing exercise, or a formal communication, or a catalogue of wish list, but maybe also a testimony of actions performed... While many tensions and paradoxes underly CSR report construction (Høvring et al., 2018), they nevertheless cause some changes in action. This research takes the point of view that regular (and mandatory) communication on CSR objectives binds company to say what they do on climate change, and to do what they say.

To illustrate this shift in perspective taken by electricity groups, examples of title chosen for CSR report are a good observation point, with two examples (Appendix 2):

A first example is VATTENFALL (Sweden); the 2006 report, embedded inside annual results, is called “creating value for the future”; same report, as a standalone CSR in 2018 is “fossil free within one generation”. When future remains, the content of the project is now firmly into climate change.

The second example is taken here with E.ON (Germany); the 2004 report is called “energy efficiency engagement”; in 2018 it has changed to “Can we make energy more sustainable? The challenge is.on” [with a parallel and neologism “E.ON to is .on”]. Here the focus on operations has moved to sustainability; the affirmative form is replaced by an open question. E.ON is advocating a much wider view on energy.

The content of reports will be studied at length in this research, but just comparing titles of reports shows convincing differences of point of view.

#### **1.4.4. Financial impact of stranding assets**

This next change starts in accounting rules of asset evaluation, and ends in financial impact of energy companies virtually bankrupt. The evolution is between asset management, applied to

electricity power plant, with investment and optimisation, repairs and upgrade; and then assets become worse than value less.

As an illustration, CEO of Total in an interview in June 2020, said “we will eventually exit oil activities, while there will still be oil in the ground left”; stranding mechanism means what is the value of this oil remaining? Is it only a zero value, or does it carry dismantling, depolluting many previous installations?

Derived from the concept of stranded costs, or all unrecoverable expenses in a project, comes the concept of stranded assets (Caldecott & McDaniels, 2014). Choice of this verb insists on the two main definition in the dictionary:

Webster meaning 1 “to run, drive, or cause to drift onto a strand”. Here stranded assets become paralysed beyond sensible repair.

Webster meaning 2: “to leave in a strange or an unfavourable place especially without funds or means to depart”. And here it is the market condition and finance aspect which is emphasised.

**What happens when assets get stranded?** Taking the point of view of a coal power plant operator, lifetime of operation is decreasing with increasing regulation for CO<sub>2</sub> emissions; provision for decommissioning and indemnify all parties tend to increase. This causes net asset value of coal power plants to decrease, up to a zero-net value. Assets become stranded. What is the legitimacy for this operator to continue operations in these conditions?

If net asset value gets below zero, with less visibility on remaining years of operation and higher anticipation of cost to discontinue, then coal plant assets turn in fact to liabilities. Described this way they become a burden that operator would try to get rid of earliest. The way assets lose values is “unanticipated or premature write-downs, devaluations or conversion to liabilities” (Caldecott & McDaniels, 2014) with makes them progressively stranded.

**Is stranding an asset a one-way process?** An asset that becomes progressively a liability is rather counterintuitive. One power plant, generating power and positive cash flow, sees its value go down to zero. And operation of this assets becomes meaningless. That covers not only the question of economical or not, like a difference from fuel costs and total cost to selling price of electricity. That covers neither the question of bankruptcy, or misconduct of any kind above asset value. But stranded here corresponds to an asset that can no longer be operated. Is this process irreversible?

First, different actors have a different view of what is stranded or not. And second if stranding is caused by a specific context, a change in context could bring back assets into different use.

Two examples illustrate the question stranding of assets, both coal power plant operated by the same ENGIE company in South Australia: Hazelwood 1600 MW brown-coal plant and 1000

MW Loy Yang B coal-fired plant; one was closed, and the second was sold both in 2017. This shows both from the operators and from potential buyers of the power plant, or authorities supervising the dismantling how views can be different on the same asset.

If we try to imagine what could be reversible stranded asset, we could take closed coal mine. With installation dismantled and outside of operation they represent a good stranded asset with only potential soil remediation or covering up the site with fresh ground. But supposing capture of CO<sub>2</sub> becomes feasible at large scale, economical and accepted, these mines would raise interest of many player looking for cheap storage capacity of CO<sub>2</sub>.

To summarize this section, when each power plant can be a profitable asset at the start, some of these desirable assets become a hot potato. Everybody wants to get rid of the stranded asset before it burns into hot potato; but maybe some clever operators will find a way to cool them down and make edible.

#### **1.4.5. Newcomers and incumbents, many new competitors want to sell electricity**

This section covers how utility model confronted to energy transition is no longer possible, and how utilities are forced to reinvent themselves.

**Newcomers in electricity eat up legitimacy and leave costs to incumbent.** In a landscape of large-scale power plant covering up the demand, some new small energy producers have appeared (Fouquet, 2010; Kungl, 2015). They are backed up by wind turbine and solar panel, and develop with new technologies. This is similar of Multi-Level perspective with how niche innovations force their way through. (Richter, 2013).

Incumbents' legitimacy is challenged by newcomers. Change in regulation created incentive for renewable energy with some favourable prices has brought more electricity, and changed the merit order of power production. It is no longer obvious that one or several utilities are the main suppliers for end users or industrial needs. And as renewable energy prices go down with learning curve and scale effects, newcomers bring cheap, flexible, to some extent storable electricity. In order to keep their position, it forces incumbents to invest into renewable, close some existing production capacity, find additional needs for electricity, but also a wide range of empirical strategies (Smink et al., 2015).

As user of utilities, individual or industrials tend to be **first and foremost user of electricity, before being customer**. This can explain why changes in electricity sector do not start with new demand from customer. Until deregulation of market and development of renewables,

changes for user are mostly a switch of their installation: change individual heating from heating oil to electricity, installation of gas boiler or electricity installation...

With deregulation of markets, users become progressively customers. Choice of supplier is made possible between the historical supplier, or incumbent and other players. But how to rely on an unknown company not legitimately established on the market? Opening the market is not necessarily leading to large competition. For example, in France EdF still holds 82% of individual customers in 2018 when open concurrence started in 2007.

In the leading advantages for incumbent, it is always convenient for users to choose the status quo: the brand can be considered strong and trustworthy, costs are supposed to be reasonable and supervised by official authorities. But many external pressures can bring the influence of incumbents down (Kungl & Geels, 2018). Strong commercial strategy of newcomers, niche strategy by geographical area or by technology are likely to eat up some market share. Next to incremental changes, destabilisation of the sector by negative public opinion, sudden change in legislation can create “perfect storm” scenario (Kungl & Geels, 2018).

**Then customers turn to self-consumption.** Electricity users have become customers most of the time. They can also become energy producers. It can be solar panel on the roof of the house, wind turbines in a field, joint photovoltaic production between neighbours. At different scales, individuals, association of citizens, energy cooperatives, cities become energy producer. Some energy is directly used by producers, while some surplus is either lost, stored, or sold to the electricity grid.

It may appear to be only very marginal volumes, less than 0.1% of number of households in France in 2018 but it could reach 5% or more of total volume in 2035 (Geoffron & Hadj, 2018) For example, large users like supermarkets, or buildings in cities can have a much larger impact for local distribution networks. And for small users or numerous households, peer to peer technologies like blockchain can provide the level of trust for aggregating payment made by net buying and received by net selling users (Geoffron & Voisin, 2019).

Expansion of self-consumption represents two challenges for utilities. The first one is the decrease in volume, with marginal surplus of electricity, and second is the challenge towards a new model, with energy services to supply (integration to the grid, stability of networks, maintenance of equipment...). It also pushes to the grid operator some debates on how to operate a distribution network down to users with occasional use, and impacts of cost allocation. An economical negative point of view on self-consumption is summarised as (Rebenaque, 2020) “The drop in revenue due to self-consumption leads to a deficit for the grid operators, which must be covered by an increase in the grid tariff. This situation leads to cross-subsidies

from standard consumers to self-consumers.” But it could be read in an opposite way, where local electrical networks save investment of large centralised power plants.

It is striking to see that customers are not first to destabilise electricity markets, but rather producers. This is true in Europe with onshore wind or offshore wind bringing a lot of power in a balanced market. This is true in Africa where solar farm isolated, or in microgrid put in question the pending need for large infrastructure. On the demand side there are progressively transfers between energy sources (electrical vehicle vs gasoline, hydrogen from electricity vs from methane...)

**The frontier between economic sectors around electricity gets progressively blurred.** In a centralised electricity regime, utilities are protected on both sides of supply and demand; they are protected in production mode due to capital intensity and knowledge to build and operate large gas, coal, nuclear power plants; and they are protected in distribution and sales due to the fine grain of network into each household, company, building.

But entry barriers have melted down and several other industrial sectors are entering the electricity sector. **On the production side, some independent players** started small solar farms, wind farms...backed by fixed electricity tariff, and negotiating good technical coverage from equipment manufacturing, they could scale up volumes and production sites.

Then, oil and gas started to lure into electricity. This was the case with Total buying a majority shareholding in Sunpower in 2011, a solar energy operator in America. It expanded especially with offshore wind attracting large interest from oil and gas companies (eg: partnership between SHELL and EDP for east coast USA in Dec 2018). There are many common skills with oil production which create synergies in project development and in operations: knowledge of seabed conditions, ability to operate in complex sea conditions, offshore platform, welding... and during operations management of surveying teams, remote and onsite maintenance.

This move comes in addition to all industries who could use heat to make turbine generate electricity. If this is a long experience practice, it raises new interest. For example, German agency BnetzA issued in oct 2017 a specific tender for 100 MW auction for cogeneration plants, heat and power plants.

Beyond the production side with new actors, important changes happened on the consumption.

**Transportation is the most striking impact on the demand side:** cars, trucks, tramways, trains, and to some extent ships (prototypes with solar power) or planes in a foreseeable future. Electrical vehicle is wiping out the distance between manufacturers and energy networks; car manufacturer can integrate or not rechargeable battery, network of charging station can be a common playground, and electrical services a direct competition between utilities and car

manufacturers. The whole value chain of electricity is challenged: optimizing time for charging, stabilizing grid network, value of the flexibility to load or discharge. To a certain extent it is a return to electrical mobility in a time where tramways and electrical public transportation were much more abundant than gasoline or diesel fuelled vehicles (Volti, 1996).

This review of stakeholders cannot skip how NGO contribute to the debate on energy sources and on how to manage CO<sub>2</sub> emissions, to cite the closest topics here. Two illustrations here are taken from “Perspectives Energie 2050” (Dancette, 2018). Among successive views of 50 experts, professors, NGO and industrial voices, these statements complement the review of stakeholders done here:

from NGO global chance, Benjamin Dessus: “transition is not a technological question, but an individual and collective responsibility. It calls for sharing, cooperate, energy saving (Dancette, 2018) p28.

from NGO Energy for humanity, Kirsty Gogan: “a world cleaner, quiet, prosperous and connected. But even if progress is possible, it is not certain” (Dancette, 2018) p45.

These two voices add a social dimension, with sharing access to energy and conditions for everyone; and a dimension on living together peacefully, which links to acceptability of new energy schemes and sharing their benefits.

Stakeholders examined here covered shareholders, lenders and investors, regulators, customers, competitors... they were chosen for their impacts on reshuffling electricity companies, and questioning the very legitimacy of utilities. We acknowledge that some important stakeholders of utilities were not covered. For example, employees, including differences within organisation between managers and other employees, between function in the organisation. This a choice of taking an institutional perspective of companies looked from the outside. Among other stakeholders, neighbouring community, NGOs, local associations were also left out. Their role in acceptability of current means of production (coal, nuclear), and acceptability of future project is crucial.

So far, a first research question from the electricity user would be: **For private or business users, in a world of many self-consumption possibilities, are utilities still legitimate?**

### **1.5. PATHS, PATH DEPENDENCY, WAYS FORWARD**

Transformation of energy systems starts somewhere, and this point is the path each country or company has come up to: power plants, distribution network, energy mix... this path

dependency, tends to frame next changes as progressive, but not always. This is all the challenge of global warming and how to stay / come back under a +2°C warming.

### **1.5.1. Path and path dependency, leading to a peak**

With the frame of Multi-Level Perspective and the details of parameters challenging energy companies, we come now to the question where this leads us to. Is there one trajectory for every energy companies? Reversely is there as many evolutions as individual company cases? This section focuses on incremental changes, on marginal adaptation. Each company is dependent (or even sometimes prisoner) of its past trajectory, so that change is path dependant. We conclude that the challenge of energy transition is not mostly a discontinuity, but rather a tipping point.

As seen in section 1.2 on explanatory frame, the Multi-Level Perspective suggests a curve starting at apparition of niches and moving to broad diffusion and new socio-technical regime. This curve shows a path, and incremental change rather than a sudden continuity. Here we introduce concepts of path dependency, peak, tipping point and their application in energy.

**Path dependency is particularly relevant for analysis of energy changes.** This concept was largely developed in the context of technical innovation (David, 1985). In energy it can be seen in evolution of percent factor achieved for turbines, or temperature in coal boiler. Gas turbine development increased since its invention from a few percent to 90% of gas captured in the turbine in the 1990s (Smil, 2007). This shows some continuity in development, but also that improvement will change direction at one point. When a technology starts to be widespread, there is a strong incremental trend towards optimisation. This concept of dependency of where we come from to estimate what lies ahead, tells us that wind turbines will only get bigger and more efficient, that efficiency of solar panel will always improve... But reality is always more complex than that.

**The concept of peak oil helps to understand exhaustion of resource.** There was a beautiful and simple idea in forecasting energy worldwide, that we would find more and more oil and gas, up to a point where resource already found and used would always be higher than what is still to find. This point was called peak oil (Hubbert, 1949, 1956) it really created an accounting system between resource used and resource yet to use. But when did this peak oil happened? Date was pushed many times, strong research has been done, with high uncertainty on this peak oil. It is still debated as World Energy Outlook discussion shows: “(...) but without an additional policy push, it is too soon to see a rapid decline of oil” (IEA, 2020b). The reason we

use this notion here is that it would be very convenient to imagine a peak carbon, where emissions will only go down.

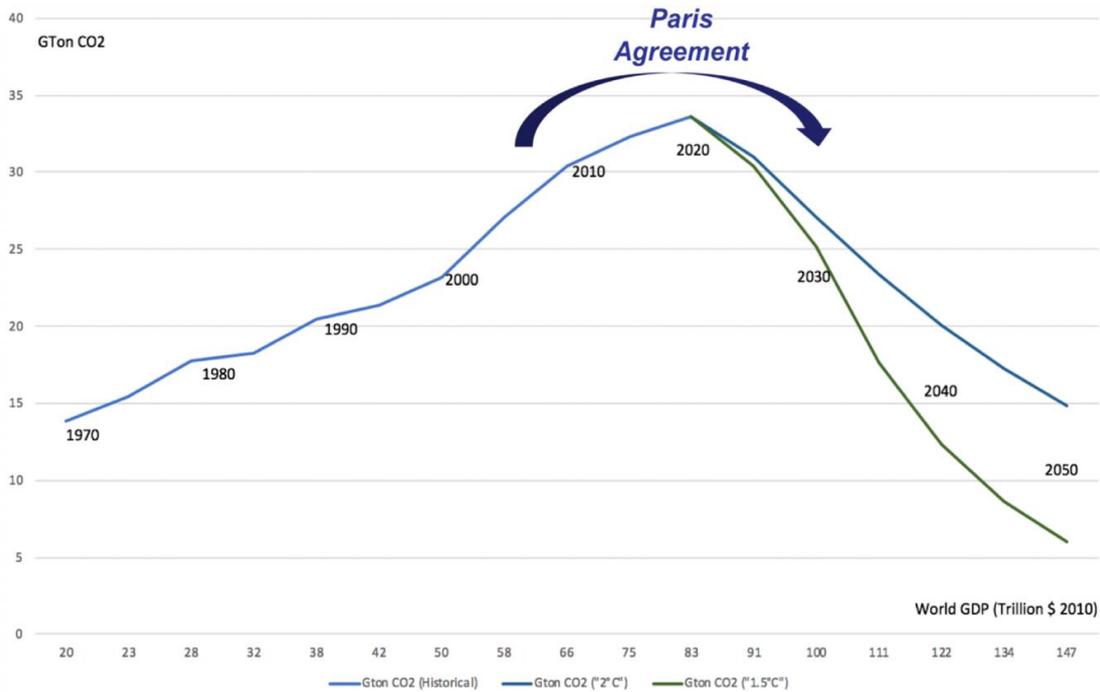
Another dimension of path dependency in energy is that it fits very well the available energy as exploitation of resource and how to further use it (McGlade & Ekins, 2014). Either it is exhaustible resource, gas, coal to be extracted from the ground or bottom of the ocean, and we face questions on how to extract more, faster, move it to consumption places. Then comes the question how to move from one extraction point to the next one like drilling additional oil fields. Or on the contrary, it is renewable resource, wind, sun, maybe to some extent geothermal. And there, path dependency is on a project scale, with size of project, location in lower wind, less sun exposure. The first spots that are developed are those easy to use and to access, and as technology matures it is more complex sites, and more remote. We have notions of wind potential, sun potential which are close to resource available for exhaustible energy.

**In the transition path there can be some tipping points.** Staying on the path of energy transition does not mean there are no turn in direction. Looking at the very change of direction, turning towards a different direction, “Energiewende” in the literal German expression, it could be described as a tipping point. Many efforts are deployed until the point is reached, and it is only after the facts that the tipping point can be appreciated (Murray & King, 2012).

### **1.5.2. Growth and CO<sub>2</sub> emissions: historical trends and future uncertainty**

**Drawing CO<sub>2</sub> emissions and growth.** There are many graphs describing evolution of CO<sub>2</sub> with time, all depicting how the world moved from a low carbon emission period before industrial revolution, to a creeping level of CO<sub>2</sub> emission (Geels, 2014) or by main fuel types (Fouquet & Pearson, 2012).

Projected curve in Figure 9 gives a much more interesting relationship between growth and CO<sub>2</sub> emission.



**Figure 9 The Paris Agreement as a disruption of historical link between GDP and carbon emission (Geoffron, 2019) based on data from UNFCCC, IEA and World bank**

This is not a curve restricted to economic research but has a direct implication for electrical companies. A company on the left part of the graph would have its activity in direct proportions to CO<sub>2</sub> emission, with coal power plants and gas power plant. Then moving towards the middle of the graph, we could imagine companies with an energy mix addressing more demand and using more renewables. This results in a company growth with less carbon intensity. At one point of the graph, electrical company growth necessitates less and less carbon. It could correspond to dismantling some assets, or selling the most CO<sub>2</sub> intensive. To the far right of the curve, there could be companies mostly devoted to energy services, and renewable electricity production. We note however that in these examples it leaves most of soil depollution, use of all dismantled power plants unanswered.

Figure 9 reveals many things on how growth is fuelled by carbon use. We range them hereafter from the most intuitive to the least. First, **trend of CO<sub>2</sub> emission is linked to GDP**. Where we are accustomed to see worldwide GDP up, it could have been less correlated with CO<sub>2</sub> emissions. Especially during recession period, there could have been decrease in CO<sub>2</sub> emission as well. As this is not the case, it probably means that past development was always with CO<sub>2</sub> content increase. How could we then invent a different pattern with decreasing CO<sub>2</sub> emission while increasing GDP? This reflects the change in paradigm in front of us.

This raises as a second point the question of **how this curve would look like at a country level instead of worldwide**. Are there only increase of carbon emission with GDP or is not the case for some countries? Are the rapidly developing countries the ones with the steadier increase in CO emissions?

As a third remark, **the curve is not linear**. That the period 1980-1990 proves less carbon intensive than 1970-1980 could be well explained by oil price shocks. But it is more surprising to read a sharper carbon content for 2000 -2010. A last increase in the theoretical curve is a 2010 to ... sometime, and this is precisely the route towards a peak carbon that we study in the next section.

### **1.5.3. Whether it is the end of historical trend of carbon content of growth**

Timing and shape of the curve is uncertain; geography will make emissions grow further for some countries and down for others; but efforts in large cities can overcome whole territories. 2020 is an unprecedented year, with massive impact of Covid-19 on energy consumption and CO<sub>2</sub> emissions. Is it the turning point in energy transition, or a crisis soon overcome by huge investments?

**Are we heading towards a peak in carbon emissions soon? Yes, every country has committed.** The Paris Agreement and commitments made by most countries on reduction of their emission could be considered the doom of carbon emission. In a parallel to peak oil, there could be a peak carbon as a point in time after which carbon emissions only go downward. With all heated debates on existence and timing, it is less value laden to use the concept of peak in carbon emissions.

This can be measured, at electricity production level, by the amount of investments on renewables projects as opposed to fossil project. Similarly, amount of public incentive for renewable can be tracked, whether in price mechanism, cover of part the development costs for example. The list of countries who committed to become carbon neutral is growing. More ambitious and more remote than the efforts for staying at 1.5°C warming, it would correspond to an effort at 0°C when carbon neutral. In Sept 2019 UN secretary issued a statement on carbon neutral commitments, with 66 countries, regions, cities. This list is only growing longer, like in September 2020 when China committed to carbon neutral by 2060 and in October South Korea committed to become carbon neutral by 2050. Along states, companies or investors commit also, intertwining of governmental action, and private companies.

**Are we heading towards a peak in carbon emissions? No, a peak carbon would come too late, too slow to meet global warming limits.** On the opposite, international reports forecast curbing of CO<sub>2</sub> emission to be postponed year after year. This is verified for example in the number of new coal projects coming on stream. As less coal is used in Europe and North America, large volumes of coal are available at cheaper prices. This is an additional incentive in some places to build new coal power plant, but a negative step towards lower CO<sub>2</sub> emissions. Next argument is on the speed and timing to contain carbon emissions. It is here the opposite view to (Grubler, 2012) “warning against moving -too fast, too big and too early- is one of the many cautionary tales which historical energy transition research can provide”. What if we started too slow the diffusion of renewable, with too small scattered projects, and too late for industrial sectors to compete with fossil technologies? Others argue that legislation and incentive toward renewable are not adequate. It should be focussed on physical infrastructure and not only on the design of Emission Trading Scheme in Europe (Dieter Helm, 2014).

**It all depends... of level of efforts.** The result of efforts by companies and countries could well be that in the end, it all depends. It depends on scale and geography. Some cities have committed for ambitious reduction plans that do not necessary concern all countries they are in (like New York committing but not implying USA as a whole). When a company like ENGIE reduces emission by closing a large coal power plant in Australia, Hazelwood, this is both a national impact as well as a company impact. This can be applied to many companies in search of clean power supply for their installations and advertising their efforts. These do not appear as a specific effort of each country.

It also depends on willingness to change. On one side there are softer or stronger commitment by each country. But among resistance we can have the existing network. As Fouquet (2016) points, it “a crucial factor that can delay a transition is the reaction of the incumbent and declining industries”

If we now continue the line of past path into a sustainable scenario, it leads, for electricity, to minimizing carbon footprint. But minimizing is an ongoing process not a definitive state. There is carbon emission from fuel used to produce electricity (coal, gas, oil) which is the most evident. Next to fuels are the carbon emission to build and run the production site (concrete, steel for the construction, but also shipping and installing repair material). And carbon footprint when assets are discontinued; is it just turning off, or dismantling, or removing up to foundations, or soil remediation? Sustainable is also difficult in renewable equipment were old turbine are not easily turned into new turbine for equipment, even less old solar panels for reuse.

The outcome of this section is to highlight how energy systems change. The time dimension, both linked to the years, and linked to the momentum when concepts and techniques emerge will be used in the research design. Then that it is an open-ended transformation. At country level, economic sector, or company level there will be a wide range of engagements.

Relevance of following past paths to explore next ones can be summarised in: “how to figure out the world of tomorrow? Complexity of transition leads to explore deep in the past, and far into the future, for emerging new models of low carbon societies” (Geoffron in Dancette, 2018) p1.

## **1.6. CHANGES IN STRATEGY BETWEEN THE KYOTO PROTOCOL AND THE PARIS AGREEMENT**

The level of analysis considered in this research work is electricity companies, and more specifically their strategies. The point of view is to consider them as institutions, and to decipher how their strategy is impacted by energy transition. Sample of companies studied is made of large electricity companies (from Europe, America, South Africa).

### **1.6.1. Level of observation**

Our choice is to take electricity companies as object of our study. It could have been a broader object, using country level, or regional level EU or USA. Even taking a worldwide point of view with reports from UN, and conferences of parties gathered every year in COP21 Paris, COP 22 Marrakech, COP 23 Bonn COP 24 Katowice (December 2018) onwards. Adversely it could have been a more detailed level with how various individuals or groups in corporation build answers to energy transition. Is it more a confrontation process, or emerging consensus between functions and operations of the company? Is it more a vision and direction of change, or an iteration of moves taken?

By choosing the level of electricity companies, we put the emphasis on relationships, and on economic driven decisions. First, on relationship when comparing companies to other companies. Even with size or culture difference, many obligations and communication are done for all companies which meet certain criteria. That is much more consistent than spotting similarities or differences between France and Germany with very different energy product mix for example.

This is linked to obligation to publish annual reports, corporate social responsibility reports, regular press release that are in a firmer process than obligations for governments.

Secondly, emphasis on relationship is detailed in stakeholders studied. Companies are in the middle of most stakeholders, influenced by states and local regulation, customers, suppliers and many others. Therefore, companies offer a better frame to study reaction to influences than looking at a national level. The level of analysis of employees and managers within a company may have as many relationships, but fall outside our research question.

Choice of energy companies is driven by two further assumptions. On one hand that regulation is not fully translated into reality, leaving time and room to adapt; on the other hand, that economics, price, costs, as well as activity to buy, sell, build, operate have a dominant role in adaptation to change. If regulation and its change to take energy transition onboard were directly, automatically, and quickly implemented, companies would have only one way to stay legitimate, to adapt to new regulation. In reality it does not happen like this.

### **1.6.2. Delimiting the scope of research**

**Process and technologies move with Multi-Level Perspective.** When electricity companies were solely in charge of producing and selling energy in a reliable and cost optimized way, things were already complex to organise. Real time network optimisation or fair price to be paid by individual or companies, isolated or amidst cities were large challenges which keep moving to some extent with time.

Change in technologies and solutions in energy have made it much more sophisticated. Floating solar power is a potential to expand at sea what works ashore; floating offshore wind is an extension of fixed offshore wind with renewed technical difficulties but potential to reach further water depth.

This is looking again at Multi-Level Perspective (Geels, 2002) here with some technologies which will fail and disappear, and other moving into a wider adoption. For illustration here, maybe hydrogen for train or planes will turn out more applicable than hydrogen for industrial purpose, but the reverse could be true.

We observe here an increasing uncertainty. For electricity companies whether to produce differently, to produce less becomes a hard choice. Potential for any solution is difficult to assess including economics and sociological factor, for example for development of offshore wind power (Flynn, 2016).

**New stakeholders enter the field and call for action.** In the recent years, new demands arose from companies' stakeholders, and some new form of stakeholders, calling for radical change into energy transition.

Some annual meetings of shareholders now include completely different demands. For example, Exxonmobil assembly passed a resolution, quoted below, requesting management to evaluate how climate would impact the company. If this may appear as a cautious move for one of the oil major corporations, it is a radical turn; the previous line of conduct was that people willing to invest in renewable select companies doing so, and people willing to invest in oil select Exxonmobil. This separation no longer holds.

“Disregarding the company's opposition, Exxon Mobil shareholders asked the oil giant to provide more information about the impact that climate-change policies could have on its business. The measure was approved Wednesday by investors holding 62 percent of Exxon shares. A similar proposal earned 38 percent approval a year ago (in 2016)”. Quote from the annual meeting of shareholders (retrieved ABC News, May 31<sup>st</sup> 2017).

Acceptability from communities has completely changed in most European countries (Zelem, 2012) Electricity companies used to build large power plants with relative public support, or at least sufficient from the state to flood a valley and install a dam (we can name few examples in France of large hydraulic infrastructure: Lac de Tignes 1952, lac de Roselend 1962, lac de Sainte Croix 1974). It has turned into fierce opposition from anti-wind energy, landscape defenders, plants and wildlife protection. Therefore, the question of how to make these new investments acceptable, and compensation measures for the environment have taken a high importance.

NGO contestation is not a new phenomenon. Activists chaining themselves at oil platform (1995) or other spectacular actions have long been part of industry, energy, oil, gas, coal, nuclear... Today, there are new forms of this contestation often more specific against large corporations (like legal dispute against onshore or offshore permits), or including break of material, and more generally negative public debate (Kungl & Geels, 2018).

What is emerging is the commitment from large part of populations to fight climate change, and calling companies to change. Worldwide youth, students engage against climate change, as they strike, sign petitions, demonstrate, write... While we intently do not name here emblematic figures, or specific organisations, all these voices urge energy companies to take actions. Companies are forced to react, either for their future customers, and business partners; or for their future talents to attract, employees, managers; or simply to keep a responsible licence to operate.

As a result, electricity companies see their legitimacy on the market eaten up. Whether they close CO<sub>2</sub> plants too slowly, or rush to build new renewable capacity with limited care for consequences in the neighbourhood, they are increasingly criticised and good candidate for public discontent.

**This research focuses on how strategies are affected by energy transitions** for electricity companies. It could be strategies as declared, or strategies as implemented. A difficulty of strategy declared is that it can be self-justification and disconnected from reality; and difficulty from strategy implemented is to decipher in facts and figures what is chance, adaptation, or strategy. In order to observe change of strategy over 10 years or more, it drives the research design into strategy as discourse. A good observation point of strategy as discourse is corporate communication. With a longitudinal design changes in the discourse can be studied to show adaptation to energy transition. Corporate communication, like CSR reporting, shows how rhetoric is used by electricity companies, and how their organization changes (Chia, 2000; Suddaby & Greenwood, 2005).

|           | DUKE Energy (USA)  |      | VATTENFALL (Sweden)                                |
|-----------|--|------|--|
| 2006/2007 | our path forward   | 2006 | creating value for the future                      |
| 2007/2008 | Building bridges to a low-carbon future                              | 2007 | power for renewables                               |
| 2008/2009 | Redefining our boundaries  | 2008 | what we want > what we do > what we have achieved  |
| 2009/2010 | What is simple about providing Affordable, reliable and clean energy | 2009 | (not available)                                    |
| 2010/2011 | Delivering today. Investing for our future                           | 2010 | (not available)                                    |
| 2011/2012 | well positioned  | 2011 | towards sustainable energy                         |
| 2012      | (not available)  | 2012 | a new energy landscape                             |
| 2013      | Lighting the way   | 2013 | continued positioning for tomorrow's energy market |
| 2014      | Connected  | 2014 | towards a more sustainable energy portfolio        |
| 2015      | generation/next  | 2015 | energy you want                                    |
| 2016      | bringing the future to light   | 2016 | power climate smarter living                       |
| 2017      | building a smarter energy future                                     | 2017 | fossil free within one generation                  |
| 2018      | transforming the future  | 2018 | fossil free within one generation                  |

**Table 1 Compared titles of CSR reporting between DUKE energy and VATTENFALL**  
 (Note: 'not available' means the report does not carry a specific title)

Table 1 shows title of yearly reports for two very distinct companies, USA Duke energy very traditional American electricity producer, and Swedish VATTENFALL among pioneers

towards sustainable energy. What a simple look at their discourse shows is that ‘renewable’ and ‘sustainable’ show up very early for VATTENFALL, starting already 2007; when DUKE energy mentions ‘Affordable, reliable and clean energy’ in 2011 but only in 2017 firmer into energy transition. Order of words affordable and reliable first, insist on the classical request to utilities price and availability much before the ‘clean’ part of it.

This short reading of report titles comforts that they correspond to our research object of energy transition translated into strategy. It could be argued that one sentence is quite short to be used as an insight, but as report issued only once a year, it can be assumed that words were chosen carefully, with a purpose of legitimating action of the company (Van Leeuwen, 2007).

### **1.6.3. Selection of period from the Kyoto Protocol to the Paris Agreement**

**Starting around the Kyoto Protocol 1997.** Our focus is to study change in energy systems, which necessitates a long period. In a classical history definition, we could take a starting point, maybe law enforcement on environmental matter, and an end point where results can be measured. Unfortunately, this is not so clear for in reality. How energy companies take into account energy transition in their business. A good point in time would be the signature of the Kyoto Protocol back in 1997. This has been largely studied in research (Bassi, 2010). There is no such thing as a day one of energy transition close to signature of the protocol, but it is a tipping point in consciousness around energy transition.

**Ending at the time of the Paris Agreement 2015.** On the end timing of our research, a natural milestone would be enforcement of the Paris Agreement in 2015. If Kyoto is an eye opener and large agreement, the Paris Agreement is a commitment to act for states. Between these two dates for states, we can derive how it challenges strategy for energy companies. But there is some time between commitment taken from states and how it translates for electricity companies. Some companies operate in many countries and have to comply with different national commitments. And some private companies are less dependent on national decisions. This shifts the scope of this research beyond year 2015. By extending up to most recent information available at the time of data collection, it allows to capture better how it is translated into discourse and into facts for electricity companies.

We therefore consider that onwards corporate data contributes to energy transition and to the implementation by electricity companies into their activities. We will use data available from companies up to end 2018 data. For those companies who published report in 2019, data is included as well.

**More important than the beginning and the last year of data collection, our study relies on longitudinal analysis.** Ideally it would be long series of data, back from 1970s, when new concerns emerged on reliability of oil supply for energy, both in quantity available, and on reasonable price to pay for it.

In the longitudinal dimension we are faced with choice of event selection, in a ‘Chronos’ type of analysis, or in progressive emergence of changes. The former can be traced in change of top management, or in name change. Interestingly in electricity companies we analyse, there are many name changes to study: GDFSUEZ (France) becoming ENGIE in 2017, E.ON (Germany) and RWE (Germany) splitting with new company names, UNIPER, INNOGY, before a new series of merger happen. Are these name changes natural evolution, similar to oil and gas examples like TOTAL? (Marion, 2000) Or is it an implementation of change that translates into a new name? The latter choice, observing emerging change, can be measuring quantitative data, like energy production, or analysing how discourse on energy transition is modified, and how it turns into facts.

We focus on discourse analysis of electricity companies. There is a gap between discourse and practice, but we believe that increasing pressure from all stakeholders do not leave much margin to electricity companies for diverging between saying what they will do, and eventually doing what they said. Under this small margin, there is room for incumbents to fight back newcomers, for postponing decisions... but pressure from global warming is growing every year.

The outcome of this section is to tune problem formulation on how electricity companies frame their strategies with an increasing pressure of energy transition.

### **1.7. ELABORATING A RESEARCH QUESTION**

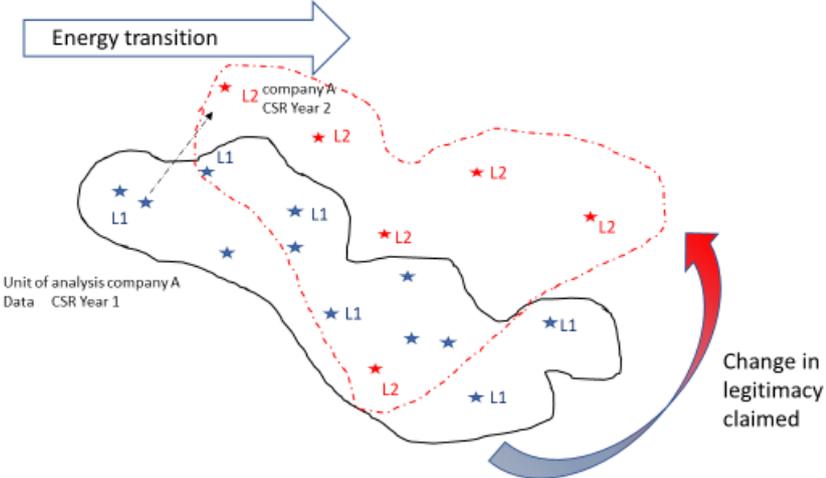
Looking at all changes happening in the past years in energy transition, we do not detect any hidden research question in the description of energy changes. Instead, the question to be researched needs to be built, as reality is socially constructed (Berger & Luckmann, 1966). Construction of energy is made of history of technologies, of how people used them.

It is a series of choices that build our research question. First, we saw that energy transitions move slowly but not always (Grubler, 2012). This leads us into process research and looking both at speed and time when changes happen (chronos); but next to chronological order looking at the right moment when energy systems change (kairos) (Smith, 1969).

The second choice comes from path dependency of energy companies. If all technologies develop into the same dimension, how come that companies make different choices? Apparently, some follow a singular path, when other companies tend to integrate energy transition in a consistent matter. For example, when a few years back energy companies were looking at battery storage of electricity, in 2020 no one wants to be left out of the new hydrogen production and its usage potential. This leads us to inquire on the variation between strategies companies take. With these two dimensions, study of change along the time and across companies, energy transition is bringing radical changes in strategy of electricity companies.

Let us imagine a world where everyone produces its electricity, with rooftop solar panels, some small wind turbines combined with a reduced consumption; surplus and deficit are traded in the neighbourhood via crypted peer to peer transaction, storage for the higher demand is done with electrical vehicles charging or loading the local network... In this close to real situation, what would large electricity companies be worth? Are they still legitimate in a decentralised network structure?

We take legitimacy as our perspective, and screen how energy transition tends to eat up legitimacy of electricity companies, and how they develop strategies to maintain it. Our frame around legitimacy will be developed in part 2 in the academic literature. Here we simply define legitimacy as “the quality or state of being legitimate, that is to say conforming to recognized principles or accepted rules and standards” (as per Merriam-Webster dictionary).



**Figure 10 Drawing of research question**

Our main question can be formulated as: **how does legitimacy change in corporate discourse in a time of energy transition?** It is shown visually on Figure 10.

It is a question of strategic change. What defines the strategies of each company at the beginning is difficult to grasp entirely, as is the final stage. If any, the final stage is probably here only the latest data available.

It is a question of corporate discourse. In an exploration of words, patterns and evolutions can be researched. Rhetoric used by companies stresses their forces, as silence on other topic can reveal weaknesses.

It is about energy transition. How global warming and climate change force electricity companies to adapt to a new context, or to adopt a completely different strategy.

And it reveals how legitimacy is impacted. Companies can, for example, consider it like a resource to attract customers and maintain their reputation. Then all efforts aim at making their legitimacy shinier.

**This research will be qualitative, but with quantitative analysis of discourse.** Inside a period from 2003 to 2018, we will use a corpus of text of about 10 million words covering at least 10 years for a sample of 12 large electricity companies.

Several types of changes can be expected. The first intuition is probably that every company shifts away from coal, carbon and all related energy and that by 2018 all have converted to renewable. Of course, things are not that simple, let alone due to legacy of existing installations. The second path of results could be that each company goes its own way. Some explain their past efforts are sufficient to prove their legitimacy, when other rush into solar power, or into offshore wind. But another third possibility could be that some companies converge into similar paths, when other diverge. Evolution of vocabulary used, with new words, emerging themes, diverging or disappearing contributes to describe these legitimacy changes.

**This research question covers a gap in literature between energy transition and strategy.**

On one side, academic research in strategy has explored neo institutional theory at length; and legitimacy studies belong to this stream of research. This field is only marginally touching climate change or energy transition issues. On the other side, research in energy transition is not using often legitimacy frame.

An example at intersection of energy transition studies and legitimacy frame is how pro and con nuclear industry in Netherland from 1945 to 1986 (Geels & Verhees, 2011). It calls for some update with current technologies and current challenges on acceptability of new energies. Our research question targets to bridge these two streams of research, by providing several dimensions to look at changes in legitimacy. We develop two main dimensions; one dimension along the time, when and how fast change happen. And one dimension on variation across different cases.

**The originality of this research is to use computer assisted tools for discourse analysis.** It allows a statistical analysis, as well as exploring the content of texts used. With this methodology it becomes possible to study a relatively long period of time, 10-15 years which would be have been very challenging if it required to organise interviews over such a long period of time, all the while maintaining diversity in cases with a selection of various companies studied.

What knowledge can be produced with this research? And what difference does it make at the end? In the field of energy transition studies, this research specifically addresses call for using neo-institutional perspective on how transition happens (Fuenfschilling et al., 2017). It shows how vocabulary of energy transition is value laden and culturally rooted in each company. Energy transition is also a transition of words.

In the field of strategy, this research shows a link between priorities taken by electricity companies into energy transition and their legitimacy claims. It is rooted in strategy, starting at discourse analysis level, then one level up to interpretation, then showing paths forming from evolution of discourse. It supposes strategy is not decided but rather emerging from action. We follow here Mintzberg: “you need a strategy? Just pick one they grow like weeds in a garden”.(Mintzberg, 2019) But our goal is to explain some of the different weeds existing, and how they have a chance to look like when they blossom.

**Dividing the research question into several directions.** How does legitimacy change in corporate discourse in a time of energy transition? Under the research question three main interrogations can be put together:

Change in time and speed. Here there are questions on tipping points, momentum of change. When can change of legitimacy be perceived? We will look for results on speed of change, on what makes change speed up or not.

Singular path or isomorphism in strategy. Next dimension of inquiry is on variation across companies. Are all companies transforming in the same way or some follow a very specific course? We study whether companies tend to move in an isomorphic way (DiMaggio & Powell, 1983) or if different paths emerge. Among other questions there will be how companies change their claim for legitimacy; is it linked to geography, to assets of the company or to other factors? What factors explain the transformation? Some specific themes and words appear in the context of climate change. One question is how these emerging themes are incorporated into legitimacy. How different is it for each company? It can be the wording around carbon or CO<sub>2</sub>, moving from a “carbon footprint, carbon emission”, to “carbon reduction, carbon free”.

In part 2, we will ground our research question in the literature, building on legitimacy, legitimacy in energy, and legitimacy in discourse analysis.

#### **1.8. CONCLUSION OF PART 1 RADICAL CHANGES QUESTIONING LEGITIMACY**

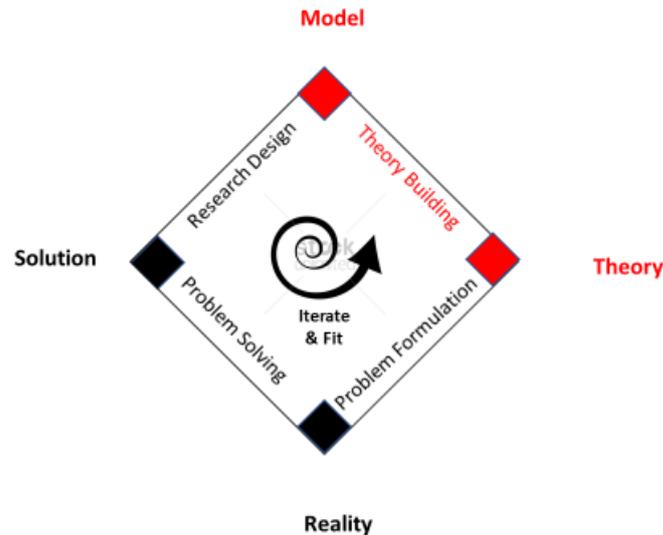
We have explained how much energy transition is a radical change for electricity companies. So radical that it challenges their legitimacy and not only an evolution in demand, resource or adaptation to the environment. It questions electricity companies' legitimacy in their very licence to operate. Without this licence, "people" might turn away. And "people" include customers, shareholders, lenders, employees, job applicants... Maintaining legitimacy is path dependent, but oriented into new directions. Electricity companies probably do not develop one single strategy, but different ones. The purpose of this research is to explore which directions they take.

## PART 2 THEORY: A LEGITIMACY VIEWPOINT ON ENERGY TRANSITION(S)

This second part introduces research on legitimacy as part of neo-institutional theory. By neo-institutional we mean a perspective which looks at companies as institutions with a sociological approach, based on established research (Meyer & Rowan, 1977). Legitimacy is an ancient concept, used for example to explain why a political regime lasts. It has found a renewed attention within neo-institutional research. A synthesis of how companies gain, maintain or repair their legitimacy was performed by Suchman (1995). But it has also opened a new stream of research on various forms of legitimacy. In energy transitions, legitimacy is a theoretical and practical question. A practical example is why most customers stay with a large electricity company, when rooftop solar and peer to peer transactions can cover demand and offer.

It is difficult to measure legitimacy, but it can be qualified. In particular, discourse analysis and types of rhetoric were used to observe how companies viewed as institutions deal with legitimacy. Some researchers has looked at the underlying mechanism in discourse (like power, culture, conflicts of legitimacy) when others looked at change in legitimacy (speed of change, variation across companies, internal and external impacts). This approach considers that there is no reality of energy transition and legitimacy given, but that its reality is socially constructed. With a constructivist point of view, strategy of actors emerges from the discourse and the way they change over years.

After the problem formulation, **this step consists in building a theoretical model**, as per “Engaged Scholarship” (Van de Ven, 2007). In this part, highlighted in red in Figure 11, theory is not a book ready from shelf; but a construction from the reality observed and the question to build a way to look at it. Our theoretical frame is grounded on legitimacy, and how it can be followed in discourse analysis. The model to test is to imagine an arrangement to look at legitimacy in the discourse of utilities when it is disturbed by energy transition.



**Figure 11 Theory building in the research process adapted from Van de Ven (2007)**

### 2.1. WHAT IS LEGITIMACY, WHERE DOES IT COME FROM

The concept of legitimacy is fruitful to analyse energy transitions. With decentralisation, deregulation, digitalisation of energy and more specifically electricity, why still buy product and services from large national utilities? Many users can do self-production with solar or wind power, and exchange in the neighbourhood with peer to peer technologies, at a competitive price, respecting grid regulations. Will this eat up legitimacy of utilities? Which events could turn utilities illegitimate?

**The origin of the word “legitimacy”** itself carries, because of its Latin origin “legitimus” a dubious meaning, that prospered in many different fields of research. Out of two main uses, the first considers in government structure what is regular structure, or legitimate power; as opposed to what is taken by force, starting by being illegitimate to strive to become legitimate. And the second concentrates on what behaviour is acceptable or not. This individual level corresponds more to a moral meaning.

A first stream of research has scrutinized how institutions manage their legitimacy. Companies are considered to be institutions which are observed from the outside. Affirming their legitimacy can take the form of manipulation of their audiences, customers, communities, or copying most successful in their sector, in an isomorphic way. (DiMaggio & Powell, 1983). This corresponds to a sector where companies behave like their competitors to remain legitimate.

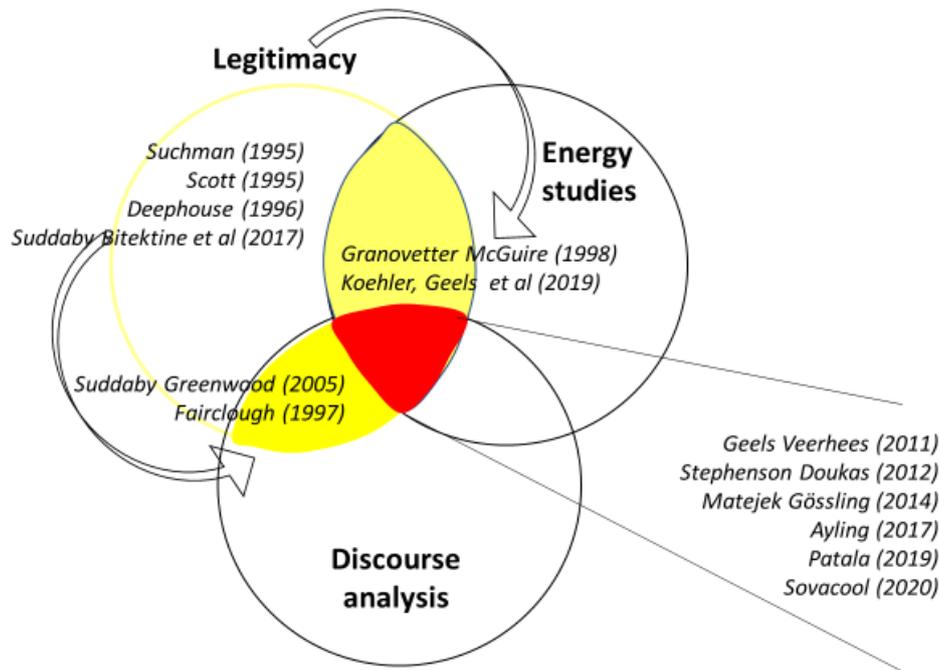
In parallel, a second stream looked into strategic legitimacy. Here managers play the main role. Explanatory role of power relationship, conflict and culture are at the centre. People shape the organisation and can generate legitimacy by manipulating, using rhetorical strategies to gain support.

A turning point between these two institutional and strategic approaches was reached by Suchman (1995) who synthesised them. In the form of a matrix, he identifies sources of legitimacy in transaction with the organisation, moral aspects or intrinsic (named “pragmatic, moral, and cognitive”). The second dimension is how it evolves over time (named “gain, maintain, or repair legitimacy”). It has opened new directions for research.

Since then further research was undertaken; it can be characterised in three directions ((Suddaby et al., 2017). First, legitimacy is analysed as a property. It represents here an asset, with a measurable value which can increase or lose value. The second stream looks at legitimacy as a process. Legitimacy is socially constructed and has the purpose to identify what contributes to its construction and how. Last, legitimacy is considered through its perception by evaluators, and then how they influence the company in return.

Legitimacy is a good fit for studying transition in energy, since all dimensions are at stake. In one direction pragmatic legitimacy is the basis for understanding where utilities supply and invoice electric power. But ethics could question where the electricity comes from; whereas cognitive legitimacy could be a target for utilities to remain natural source of energy vs opening potential choices. And in the other direction, gaining legitimacy is an ongoing target for emerging energies, wind, solar then hydrogen, tidal energy... maintaining and repairing legitimacy are key questions for large utilities facing losing customers, or increasing opposition from stakeholders for their coal assets, or nuclear power plants, or installation of new wind parks.

**Our basis will be legitimacy, and applied to energy transitions studies.** This is illustrated in Figure 12 as the intersection between legitimacy and energy studies. Furthermore, discourse analysis is the way reality is apprehended. Intersection between legitimacy and discourse analysis is also a wide field of research. In the end the area studied is the intersection of the three: legitimacy, energy studies and discourse analysis.



**Figure 12 Intersection of theory and research fields**

Section 2.2 looks at intersection between legitimacy and energy studies, when section 2.3 covers intersection between legitimacy and discourse analysis. Our research is inside the red part of Figure 12, described in section 2.4.

### 2.1.1 Legitimacy, towards a definition

The theoretical frame considered here is following works of Mark Suchman (1995). Legitimacy is not easy to define, because it is often when it is lost that it appears clearly: political regime arriving by force have to establish their legitimacy, or in management a new management team taking over a company have to demonstrate their skills. Research work done on legitimacy before synthesis by Mark Suchman, his contribution and further development since then are the backbone of this literature overview (Déjean, 2004).

**The starting point is a definition of legitimacy (Suchman, 1995).** A central definition for legitimacy is: “a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions” (Suchman, 1995) p574. This overcomes the key difficulty that legitimacy is self-explanatory term and includes elements directly linked to legitimacy (Pétrin et al., 2013), tending to limit legitimacy to any not illegitimate, or only acceptable.

There are three parts in the definition which build legitimacy, and which will be confronted below with other academic definitions. Legitimacy is about perceiving or assuming actions.

This part of the definition shows an a priori point of view. Here organisations are deemed legitimate, maybe monopoly, public company or utility. Alternatively, it comes from experience, but presented here as a perception: this is consistent with an approach of social constructed system where reality can only be perceived, and not considered as a hard fact.

The second level states that the organisation behaves as “desirable, proper or appropriate”. Each of the three questions who perceives or assess legitimacy. Appropriate actions can be considered as good decisions or good strategies, but who could measure or confirm. Proper actions are more linked to conformity to rules, legislation, but it could expand to a code of conduct. And desirable actions would rather be associated with intention to buy, attracting employees, or making company name shine.

The last part associates legitimacy to “some socially constructed system of norms, values, beliefs and definitions”. This is a sociological level, where individuals and organisation interact.

**There are alternative definitions, like Deephouse or Scott.** Among the numerous authors who explored legitimacy, two are often highlighted in complement to Mark Suchman.

The first definition comes from research made by David Deephouse on legitimacy and isomorphism. Legitimacy is viewed as: “From the perspective of a particular social actor, a legitimate organization is one whose values and actions are congruent with that social actor's values and expectations for action. The social actor accepts or endorses the organization's means and ends as valid, reasonable, and rational” (Deephouse, 1996) p1025. This definition is by no mean in contradiction but comes as a complement with the concept of alignment. It opens a debate between this alignment between values and action on one side, and expectation on the other side. Hence it can be a temporary alignment, and changes imply loss or increase of legitimacy. Another precision not included in previous definition is the point of view. The perspective is not from above or far from the scene, but from a specific actor. It also means that different actors (maybe a customer, a regulator or a newcomer in our energy context) would see different legitimacy levels.

The second definition coming in relationship to Mark Suchman' states: “legitimacy is not a commodity to be possessed or exchanged but a condition reflecting cultural alignment, normative support, or consonance with relevant rules or laws » (Scott, 1995) p45. In complement to the previous definitions, this one shows a balance between negative and positive, with the opposition between commodity and condition. Legitimacy here is an environment conferred by a series of elements, on which the organisation may or may not have an influence. On the contrary, the efforts by the organisation are not linked to what the produce

(goods for exchange) but on their suitability to their environment. And this suitability is conferred by alignment, support, and consonance.

Legitimacy has been a very fruitful stream of research already in the 60s, and if Suchman can be considered to have reached a synthesis (Déjean, 2004), different definitions had been elaborated before, and refined also since then. A comprehensive work by Marie Laure Buisson (2008) lists up to 17 definitions in chronologic order. Without digging into their differences, an extensive series of authors from 1960 to 1995 are: “*Parsons (1960), Dowling and Pfeffer (1975), Pfeffer and Salancik (1978), Ashforth and Gibbs (1990), Aldrich and Fiol (1994), Boddewyn (1995), Hybels (1995)*”. (Buisson, 2008). Then, after formalisation by Mark Suchman same author lists further development between 1996 and 2008: “*Stone et Brush (1996), David (1997), Kostova and Zaheer (1999), Zelditch (2001), Zimmerman and Zeitz (2002)*”. (Buisson, 2008). Legitimacy studies are still a very lively stream of research as illustrated below (Suddaby et al., 2017) in a dedicated paragraph.

This section has highlighted legitimacy as a concept and the research community associated. Next comes a focus on the dynamics of legitimacy. It covers with Mark Suchman how organisations deal with their legitimacy, in a cycle starting with gaining it, and then manage legitimacy onwards.

### **2.1.2 Typology of legitimacy between pragmatic, moral and cognitive**

After the definitions just exposed, comes a further level of explanation that identifies three main types of legitimacy, namely pragmatic legitimacy, moral and cognitive (Suchman, 1995):

- Pragmatic legitimacy, based on audience self-interest.
- Moral legitimacy, based on normative approval.
- Cognitive legitimacy based on taken-for-grantedness.

Pragmatic legitimacy is defined as “self-interested calculations of an organization’s most immediate audience” (Suchman, 1995) p578.

This aspect of legitimacy is a direct relationship, a transaction between the organisation and a third party. The main concept below legitimacy are exchanges. Past transactions and accumulation of information on exchange are building up a relationship deemed legitimate. It is close to mutual trust, but built on past exchanges not as a given.

If we apply it to energy sector, it could be a customer buying energy from a supplier deemed legitimate because of the most obvious reasons. When this customer tanks from the nearest petrol station; the shop and trademark have always been there, they are deemed legitimate. The

customer is confident on quantity paid, with a stamp confirming the meter has been proofed. He is convinced that the price is within range so that no further effort is needed to find another supplier. This direct relationship turns into a transaction because of pre-existing legitimacy.

The second type is called **moral legitimacy**. "Moral legitimacy rests on a judgement whether the organization's behaviour is the right thing to do" (Suchman, 1995) p579.

There is a distance between customers, partners, community as audience of the organisation, and appreciation of whether its behaviour is morally legitimate or not. First because they need not to be in transaction with the organisation to issue an opinion (for example a large NGO pressing an oil company to exit fossil fuel). And second because measuring of moral legitimacy is only perceived between organisation's statements and degree of buy in by audience. it is hence legitimacy as a perception, in a socially constructed way, not an observation.

Third and last, **cognitive legitimacy** is considered as taken for granted, is the sense that "alternatives become unthinkable, challenges become impossible, and the legitimated entity becomes unassailable by construction". (Suchman, 1995) p582. This aspect of "taken for granted" is more elaborated than the two other ones. Suchman links it to "inevitability, and permanence". Legitimacy goes much further than just being obvious. It becomes the only solution, but not perceived as a constraint rather as a fact of life. And in the time dimension, it also appears as a status quo not subject to change. If this cognitive legitimacy is perceived as evergreen, some events may force it to change.

If we apply it to energy sector, this is an interesting formulation of a utility company. In a limited range of supply, and limited geographical range, one single provider is obvious. Here liberalisation of electricity markets in Europe are one way to break the "taken for granted" part, and force to open the market to challengers. Technology are also a way to break into the taken for granted. Scattered electricity production, by solar panels, wind turbine, local geothermal access, ... force to revisit rules of quantity and price of production and how they convert into final energy prices.

Whether these three categories are the only one possible or not has been largely debated. For illustration purpose, a typology derived from Suchman uses pragmatic, legal, moral and cognitive legitimacy (Ayling, 2017). This is more or less a divide into legitimacy claimed with respect for legislation and legitimacy based on ethical values. These four categories will be used in the last part of the result section.

**2.1.3 Gain, maintain and repair legitimacy**

The three main types being set, legitimacy is not an intangible asset of an organisation. Before considering legitimacy equally as a property, a process and a perception (Suddaby et al., 2017), the basic representation is along a timeline. The first out of three phases is to gain legitimacy (Suchman, 1995). This can be acquiring customers or becoming a full member on a market. The next phase identified is maintaining this legitimacy, and creating momentum and keeping it are closely linked. This would explain ongoing organisations. At a time when things will become difficult, a loss in legitimacy occur and needs mending. This can be mistrust from customers, loss of market share, law enforcement, and in our energy context it is often large industrial accident. Here comes the third phase of repairing legitimacy.

The two dimensions can be combined into a matrix could be drafted on Suchman definition, summarised in Table 2.

|           | Gain | Maintain | Repair |
|-----------|------|----------|--------|
| Pragmatic | x    | x        | x      |
| Moral     | x    | x        | x      |
| Cognitive | x    | x        | x      |

**Table 2 Summary of legitimation strategies, simplified table (Suchman, 1995) p600**

This suggests here that one organisation could be in more than one single square at a time. If we apply this to the energy sector, there could be a company maintaining its legitimacy in nuclear activities with a cognitive approach, while developing renewable energy to gain legitimacy on a moral type of justification.

**2.1.4 New developments on legitimacy**

In the developments on legitimacy in social sciences, we detail here research on different dimensions of legitimacy (Suddaby et al., 2017). Instead of verbs or adjectives, a simple observation is the choice of nouns: legitimacy is approached as a property, a process or a perception. This difference opens three spaces where previous dimensions can also be used.

First, **legitimacy as a property**. Described like this, legitimacy appears as an asset, potentially intangible asset on the balance sheet. As an asset, it has a value. This can help in a pragmatic legitimacy to develop transaction. It is a given, which is very close to the cognitive legitimacy. But it is more something that the company has, and not that the company is.

Then **legitimacy as a process**. Here it unites the temporal dimensions of building, sustaining or defending legitimacy, into an ongoing process. To stay legitimate, organisation have to take action, and it can be both internal (produce new sources of legitimacy) and external (defend against competition, against contestation).

And last, **legitimacy as a perception**. Perhaps this is the closest from Suchman definition starting with “generalised perception”. It shows that the observer is the main evaluator of legitimacy. With its own belief and values, an old customer could estimate that the organisation makes efforts to repair its legitimacy, where a new customer sees gaining legitimacy. Figure 13 summarise the key differences of these three streams:

|                              | Property  | Process  | Perception   |
|------------------------------|---|--|--|
| What is legitimacy           | A property<br>A resource<br>An asset<br>A capacity<br>A thing   | An interactive process of social construction  | A social judgment<br>An evaluation<br>A socio-cognitive construction   |
| Where does legitimacy occur? | Between the legitimacy object (e.g., an organization) and its external environment<br>Mostly at the organization and field levels                           | Between multiple social actors, particularly those seeking or opposing change<br>Mostly at the field level, also at organization (group) levels                | Between individual and collective evaluators (groups, organizations, society)<br>Multilevel, but leaning toward the micro  |
| How does legitimacy occur?   | <i>Contingency view:</i> Through “fit” between attributes of an organization and external audiences’ expectations   | <i>Agency view:</i> Through purposive efforts of change agents and other social actors   | <i>Judgment view:</i> Through perceptions, judgments, and actions of individuals under the influence of collective-level institutionalized judgments                   |
| Representative publications  | Dowling and Pfeffer (1975), Pfeffer and Salancik (1978), Singh, Tucker, and House (1986), Suchman (1995), Ruef and Scott (1998), Zimmerman and Zeitz (2002) | Barron (1998), Rao (1994), Suddaby and Greenwood (2005), Barnett (2006), Golant and Sillince (2007), Johnson et al. (2006), Sine, David, and Mitsuhashi (2007) | Walker, Thomas, and Zelditch (1986), Elsbach (1994), Tyler (2006), Bitektine (2011), Bitektine and Haack (2015), Tost (2011), Zelditch (2001), Lamin and Zaheer (2012) |

**Figure 13 Legitimacy as a property, a process, a perception (Suddaby et al., 2017) p453**

These three dimensions are well suited to energy transitions studies. Legitimacy as an asset is the core of incumbent companies. considering it as a process lead to study now newcomers, new technologies find their way to become legitimate actors. And perception is about the convincing power of utilities to demonstrate their (true) commitment to energy transition. In a shortcut, legitimacy as a property could be the present energy production mix, with all energy sources as assets; and legitimacy as a perception represents all efforts presented by electricity companies, whether they are perceived as greenwashing or transformation of the energy system.

**2.1.5 Legitimacy and legitimation**

Before leaving the theories of legitimacy, there remains a clarification on legitimation vs legitimacy. Most authors discussed so far are discussing legitimacy, and this is the perspective taken in this research, following Mark Suchman.

Legitimation is often associated to discourse, and specifically how discourse builds legitimation for social practices (Van Leeuwen, 2007). The main objective is to explain how legitimation happens. Theo Van Leeuwen defines from classical authors:

“Legitimation provides the ‘explanations’ and justifications of the salient elements of the institutional tradition. (It) ‘explains’ the institutional order by ascribing cognitive validity to its objectivated meanings and (...) justifies the institutional order by giving a normative dignity to its practical imperatives. (Berger & Luckmann, 1966)

A first key difference to legitimacy is that legitimation is looking for explanation, rather describing the perception. So that the second difference is legitimation looks at why it happens when legitimacy focuses more on how this happens.

The focus on finding causality can be summarised in: “Legitimation, finally, adds the answer, sometimes explicitly, sometimes more obliquely, to the question Why, Why should we do this and Why should we do this in this way?” (Van Leeuwen, 2007) p93.

From now on this research will use preferably legitimacy to legitimation, and focus on how changes in legitimacy happens, how fast and how different from one organisation to the other.

## **2.2. LEGITIMACY AND ENERGY, HOW DOES IT RIME TOGETHER**

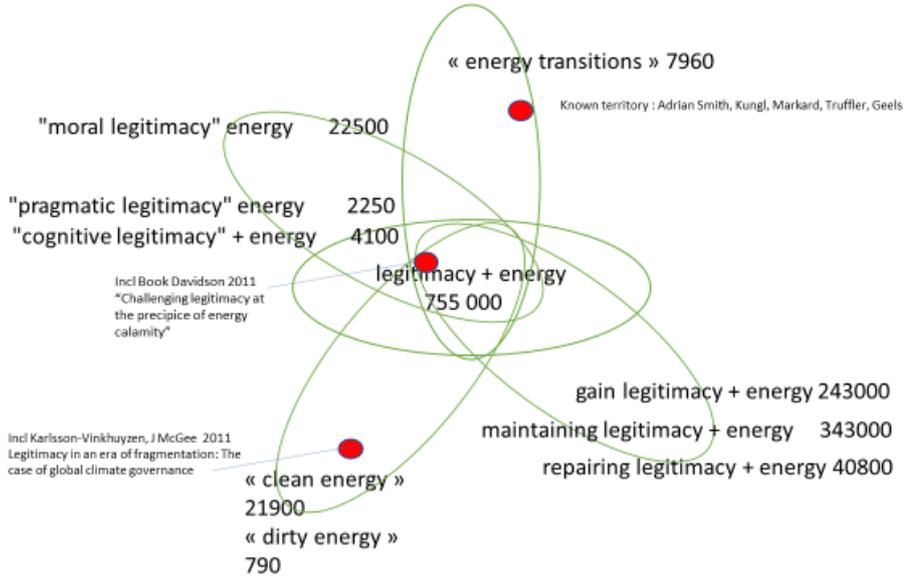
After an introduction on legitimacy research, this section covers legitimacy and energy together and they can rime together. In energy transitions studies, legitimacy comes as a theoretical and practical question. What makes energy systems legitimate? How does legitimacy change when energy solutions change? And as a practical question, it can be why go through a large electricity company when rooftop solar and peer to peer relations can satisfy energy needs.

Following section is organised in three steps. First, an overview of the very abundant research looking at legitimacy and energy. Then from the three key steps from Suchman, gain, maintain and repair legitimacy, we present a detailed case study of gaining legitimacy. It is about structuring of electricity sector in America from 1880 onwards with works from Mark Granovetter and Patrick McGuire. Last, we present some typology of research work in legitimacy and energy and choices made for this research.

### **2.1.1 A large stream of research**

There is a large stream of research associating energy and legitimacy. Some are research in energy that inquire legitimacy of stakeholders, others are research in organisational theory,

applying legitimacy to energy cases. Last, some research work is not relevant to this section, either because they view energy in the meaning of empowering, bracing up people, which is far from our purpose. Or because they use legitimate or legitimation in a soft sense, giving good reasons for acting a particular way, which is not linked to the theoretical frame of legitimacy. This can be shown from rapid search in academic literature in Figure 14.



**Figure 14 Mapping legitimacy types and energy keywords**

From this large literature, some specific streams of research are presented below. This will come after the case study of gaining legitimacy in electricity sector in America. Repairing legitimacy would be best studied with large industrial accident: catastrophe of oil platform Deepwater Horizon in 2010 offshore Gulf of Mexico and its impact on BP’s legitimacy is a good example (Matejek & Gössling, 2014). And maintaining legitimacy is the main step studied in this research.

**2.2.2 Case study building and gaining legitimacy – electricity in the US 1880-1920**

**Introducing the landscape of electricity in USA in the 1880s.** For a good case study of how legitimacy is developed in energy, we have chosen emerging electricity sector in the USA in the late 19<sup>th</sup> century. Inside the large stream of research studying how sociology and economics dialogue together, we use work initiated by Granovetter (Granovetter, 1983). Many aspects of how sociological factors help to understand emergence of economy, for example one of them exploring trust and how social relationships are embedded or intricated in the middle of

economic relationship (Brousseau et al., 1995). Here we follow the stream of social relationship contributing to legitimacy of a new sector (Chan & Makino, 2007).

Our starting point is the emergence of electricity and electricity sector with light bulb manufacturers, invention of high voltage lines, first power plant producing electricity or supply of electricity only to an isolated building.

An intuitive development of a technical and industrial sector as we know electricity today, would be a series of power plants construction, transportation network development, along rising demand and diversifying needs.

This is not the main explanation. Instead, (Granovetter & McGuire, 1998) stresses that “it arose because a set of powerful actors accessed certain techniques and applied them in a highly visible and profitable way”. Of course, there are a series of technical innovations, and a series of new users, different usage arising, but some actors will gain sufficient legitimacy. That includes economics, power in the market, marketing and brand which will contribute or not to make some actors more legitimate than others.

**Summary of the business case of USA in the 1880s.** In their study of how the electrical industry started in the USA, Granovetter & McGuire (1998) mix sources from history, innovation, and economics. Their intent is to demonstrate how a sector dominated by invention of new techniques structures itself, how boundaries are set by people and companies, then changed for different boundaries. It is built on previous work on the importance of network and power relationship (Granovetter, 1983) and on work on emergence of electricity regulation in the USA (McGuire, 1989)

As suggested in the title, “The making of an industry: electricity in the United States” Granovetter and McGuire suppose that electrical industry is made rather than arisen primarily from products and market, from supply and demand. But if the industry is made, it is made by people, and actors of electrical firms.

We briefly present structure of the case before studying detailed mechanism at stake that contribute to legitimacy, or adversely hinder it. Authors establish 4 steps in the structuring of electricity sector. They use the concept of boundaries which define what is in the sector studied and what becomes outside of it. A chronological view has been constructed as per Table 3 before:

| Year | Event   | Innovation/Relation |
|------|---|---------------------|
| 1880 | Edison begins to develop the incandescent electric light  | innovation          |
| 1882 | Around 12 privately-owned central electric companies      |                     |
| 1885 | More than 1,500 arc / incandescent systems companies      |                     |
| 1885 | Creation of association of all non-Edison companies       | Relation            |
| 1890 | Split between local utilities and equipment manufacturers | Relation            |
| 1891 | almost 2,000 independent electric local firms             |                     |
| 1911 | cross-licensing agreement General Electric-Westinghouse   | Innovation          |

**Table 3 Chronology of events (adapted from McGuire and Granovetter)**

**The first period starts with an open field after discovery** of the many applications electricity could have. It is a world of inventors and business men, with new use for electricity creating new devices and new product offered attracting new adopters. In this blossoming of ideas becoming businesses, our authors explain a separation between suppliers of electricity for lighting, and manufacturers of equipment using electricity. This boundary is progressive, mostly made by individual decisions or preferences. And after the fact it seems so obvious that this boundary appears fully legitimate. Even today we would not expect that an electrical production company manufacture or sell any fridge or oven. To some extent, we could see today a remnant of this boundary; Siemens Corporation, was both manufacturing turbine and full power plant, while selling up to oct 2017 light bulb via its subsidiary Osram.

**The second period** is characterised by stabilisation or consolidation of the market. It is coming just after the first one. Here product and usage seem stable, while fierce competition start between actors. We see that all actors become legitimate on a market of commodity, of standard goods. Since transaction costs are low for customers, private and public companies start competing for volume, market share, exclusivity. Authors cite private companies denouncing public utilities belonging to cities. Inside boundaries previously set, there is a consolidation of actors.

**The third period** identified by authors is a progressive selection of one main business setup when other disappear. One main way of doing business is a private central station powering an area and connecting to neighbouring stations. That is detrimental to many other offers that existed, for example providing electricity mostly during low demand time, like during the night. That is anew protected by a boundary when a series of patent prevent others actors to build isolated station with the same technologies.

**Fourth and last period** up to 1925, when main actors focus on internal growth, with their model of central stating. Competitors coming with other solution are pushed to small corners, where they can get no legitimacy. According to authors, persuasion and influence drove small companies into inefficient technologies. As a result, main players gain again in legitimacy, as no one else is accepted on the market.

**Mechanisms for construction of an industry.** We observe in the case 3 main mechanisms which contributed to build the construction of legitimacy.

The first mechanism at stake is the emergence of an ecosystem of ideas in electricity. It is not Edison alone but many people putting new devices and tool into electric product. This is bringing all the flow of new product that will help build relationships, and boundaries.

The second mechanism here is personal relationship, association. Continuing of previous work (Granovetter, 1983) power of individuals is presented as essential to influence creation of boundaries. It can be in the form of prescription to customers or creation of norms for example.

The third mechanism is the mutual challenge of centralisation and decentralisation. There is not one final stage between the two, but they coexist. Central power station model tends to vertical integration and larger networks, while city owned or state-owned electrical company tend to a utility model focused on low prices and high service.

**Factors that builds legitimacy and those who delay it.** We can sort two types of forces which build legitimacy of the sector or hinder it. In the forces contributing to legitimacy, for customers, users and other parties, we see multiplication of companies. confronted to more manufacturers, more suppliers of goods and services, adoption electrical sector becomes less weird and gets into the technical landscape, finally into the social landscape too, as a day to day usage (lighting streets and houses, electric appliances in households). Then progressive distinction in the sector, like the divide between utilities producing and supplying electricity, and manufacturers of electrical goods helps also customers to understand who does what.

On the other side, some factors delay or hinder legitimacy. To some extent, numerous inventions and new technologies are blurring acceptance by new users. The question of what product will work or not, for example direct current or alternative current standards, tends to postpone adoption by users. We suggest that another element that dims legitimacy is the number of companies exploring inefficient technological paths. Looking back in history it is much easier to tell wrong paths from good ones; but as they appear every new idea could become a legitimate market. This could be called mistrust, or higher transaction costs to determine the value of the product.

**Key takeaways from the Granovetter McGuire case.** We chose this case for building legitimacy because it demonstrates that technical construction of electricity is a social construction. Here technical issues like question of Alternative Current vs Direct Current (AC/DC) are dissolved into habits, acceptance, and usage. It has been also studied in adoption of QWERTY keyboard rather than better options (David, 1985). Sometimes it does not work and some events put a halt to the development. We think of use of LPG for cars in France, when an accident in a parking in Lyon Vénissieux in February 1999 was sufficient to restrict the development, even after the technical issue had been fixed. In the end, technologies that become accepted have built their legitimacy, and become durable until further changes.

### 2.3.3 Mapping research on legitimacy and energy and selecting a research stream

Research on legitimacy in energy is here presented first by types of research question, then with methodology used, often case study. Recent discussion in research pave the way for a discourse analysis perspective on energy transitions studies and legitimacy.

Research on energy transitions using a legitimacy frame is numerous and in many directions. Elaborating on Suchman categories, a few research articles can be classified as shown in Table 4. They we classified here in focus on gaining legitimacy, like previous case study of electricity in America in 1880. Then on works looking at repairing legitimacy. Here a good case study would be Californian wildfire impacts on the legitimacy of Pacific Gas and electric. And maintaining legitimacy will be the centre of this research work.

| focus on         | gaining legitimacy  | maintaining legitimacy   | repairing legitimacy   |
|------------------|---|--|--|
| <b>pragmatic</b> | Rosenbloom D., Berton H. , Meadowcroft J. (2016) Framing the sun: A discursive approach to understanding multi-dimensional interactions within socio-technical transitions through the case of solar electricity in Ontario, Canada |  |  |
| <b>moral</b>     | Stephenson K., Doukas A. , Shaw K. (2012) "Greenwashing gas: Might a 'transition fuel' label legitimize carbon-intensive natural gas development?"  | Patala S., Korpivaara I., Jalkala A. Kuitunen A., Soppe B. (2019). Legitimacy Under Institutional Change: How incumbents appropriate clean rhetoric for dirty technologies.              |  |
| <b>cognitive</b> | B Huybrechts, S Mertens (2014) The relevance of the cooperative model in the field of renewable energy.   | Geels, F.W. Verhees B. (2011) Cultural legitimacy and framing struggles in innovation journeys: A cultural-performative perspective and a case study of Dutch nuclear energy (1945–1986) | Matejek, S., Gössling, T. (2014) Beyond Legitimacy: A Case Study in BP's "Green Lashing" |

**Table 4 Examples of research articles on energy from a legitimacy perspective**

This reflects that all aspects of legitimacy have been thoroughly explored. And it is even more the case with “cultural legitimacy” (Geels & Verhees, 2011) or “companies that adapt, manipulate or engage a discourse” (Scherer et al., 2013).

On the axis of gaining / losing legitimacy, there are some discussions ending in a black and white answer: are cooperative relevant in renewable energy? Yes, they are legitimate. Then, some articles focus on growth, apparition of new technologies, and explore how they become legitimate. for example, on solar power into energy mix (Rosenbloom et al., 2016). Next comes work on maintaining legitimacy, structured with incumbent / challenger relationship. Here there is: how much legitimacy of incumbent companies is eaten up by newcomers? Last, on the legitimacy repair research, there are large accidents and their damage to legitimacy, or fuels becoming illegitimate.

**Types of research by methodology show a majority of case studies.** Literature review shows that case studies are frequent, as shown with 4 examples taking one sector and one country:

- Nuclear in the Netherland (Geels & Verhees, 2011)
- Solar power in Canada (Rosenbloom et al., 2016)
- Biogas in Germany (Markard et al., 2016)
- Coal in UK (Turnheim & Geels, 2013)

For each of them, the richness of case explained allows a deep understanding of how legitimacy is evolving.

Next methodology used is narrative with input from rhetoric and discourse analysis (Patala et al., 2019). This is appropriate to study oppositions, like new technologies called clean to oppose them to previous technologies becoming dirty ones. It can also be oppositions of newcomers’ strategies to incumbent companies in the energy sector. The main dimension is longitudinal, with a focus on how change unfurls.

Finally, a more marginal stream here uses interviews of key people identified (Huybrechts & Mertens, 2014). This is especially relevant for emergence of new models, here the cooperative model in renewable energy.

Energy transition and legitimacy have been studied at length in the literature. A recent synthesis on energy transition studies lead by Jonathan Köhler, Frank Geels and many others indicates some open streams of research, (Köhler et al., 2019):

“A third key topic is about **firms targeting institutional change** in the context of **sustainability transitions**. Studies have shown how businesses and other actors shape their institutional environments with discourse

activities and framing, through political coalition building and lobbying, or by strategically influencing collective expectations. A closely related issue is the **creation (or undermining) of legitimacy** in relation to firms, business models and technologies, which has been observed as an essential element in the struggle for public policy support of new technologies.”

It shows that studies at company level, and more precisely at comparing companies is fitting both the case study stream of research, and the longitudinal aspect of emerging strategies.

At the same time, discourse activities have been used to highlight cultural, power, resistance dimensions.

This is the research stream that we follow, with two main dimensions: first dimension covers the typology of legitimacy, potentially more than one at a time for one company. And a second dimension of comparing case studies showing several companies confronted with legitimacy challenges. It assumes for the time being that different cases are similar from a gain /maintain/ repair point of view of legitimacy.

### **2.3. LEGITIMACY IN DISCOURSE ANALYSIS**

After review of legitimacy cornerstones, and how legitimacy has been applied to energy studies, here is an overview of legitimacy studies using discourse analysis. We divide it into: contradictory discourse using rhetoric analysis, then exposition of underlying mechanisms of affirmation, and a focus on Corporate Social Reporting. The first one is studies of pros and cons, the second is only positive side of discourse, and the third is a comparison in time for example.

#### **2.3.1 Legitimacy and rhetoric**

When looking at legitimacy with the point of view of analysis of discourse, a first approach is to compare positive and negative arguments. Opposition in rhetoric argument dates back in time from ancient Greeks of 5<sup>th</sup> century B.C., but much nearer to us was exposed in rhetorical strategies of legitimacy (Suddaby & Greenwood, 2005).

Authors developed a very essential method of how legitimacy is constructed or deconstructed by each party. The case study of a consulting firm buying a law firm is analysed from the firm point of view as consolidation of legitimacy, and by third parties (typically competitors) as a threat to legitimacy. Looking at how each party tries to consolidate its legitimacy and

deconsolidate each other one, results into typologies and establishes 5 theoretical ways of change. This successful design is based on dialogue and rhetoric of both argumentations. Preponderant role of words but also ambiguities associated is underlined in: “myriad ways in which words, logics and other symbols are used to legitimate or resist change, we can begin to understand how groups mobilize collective action to legitimate or resist institution change.” (Suddaby & Greenwood, 2005) p63. It leads to careful interpretation of words, including their context. Logics can be applied in energy studies to clean energy vs dirty energy; originated from hydrocarbon with opposition of clean fuels like gasoline to dirty products like heavy fuel oil, it acquired a new meaning where everyone claims a logic toward clean energy. And the rhetorical dirty energy has a different meaning for each player.

**Rhetoric is well adapted to discussion on “good” energy vs “bad” one.** Rhetorical studies apply first and foremost to positive and negative attitudes, they can be categorised into good and bad, as perception and values. Discussions on energy sources are full of such oppositions, often for historical reasons. Clean/dirty fuels, heavy/light products, carbon/carbon-free, ... This is one of the reasons why legitimacy studies in energy often used rhetoric analysis.

A further interest of exploring rhetoric in discourse is to use the tension between opposite argument to generate knowledge, thus saving use of an underlying explanation frame, like power struggles for example. This is the second type of research reviewed.

### **2.3.2 Exposing critical discourse approach**

Legitimacy studies with discourse analysis are not only dealing with opposite point of view, taking an opinion and its contradictor. Confronted to a single point of view, some other tools have been developed. A large stream of research is looking for underlying concepts in the discourse. This stream of critical discourse analysis creates reflexivity by addition of a level of analysis above the discourse.

When rhetoric goes back to Socrates to generate knowledge from discussion, critical discourse roots back to Marx to answer questions like: what makes you say what you say? Where do you speak from? This stream of research looks at verbal or written discourse and looks for explanation of form and content.

Critical Discourse Analysis can be presented as research school of “macro-level orientation with theoretical antecedents both in neo-Marxism and Foucault” (Mayr, 2015) p2. With these two names in sight, it draws attention to how discourse is influenced by power, domination, and more generally how discourse can be in contradiction with interests of those making it. This is

underlined in Handbook of Discourse analysis (Tannen et al., 2015): “in critical studies of institutions and their discourses the concept of hegemony has therefore been an important tool for explaining why people consent to conditions that are not necessarily in their interest” (Mayr, 2015) p758. This citation insists on uncovering, in the discourse, some elements, here about hegemony. And the explanation frame above the text is a critical view.

**Critical Discourse Analysis, its source and application.** Critical Discourse Analysis has been structured beginning of 90s around Teun van Dijk, Norman Fairclough, Gunther Kress, Theo van Leeuwen, and Ruth Wodak (Dijk, 2011). Founders, who call themselves here “the Group” call it a multi-disciplinary approach, rather than methodology, to explore discourse in general with use of external referential. Uncovering mechanism inside the discourse shows how power relationship, domination by actors, ideology, or determination of social groups are at stake.

The referential used can come from works from Michel Foucault, Jürgen Habermas or further back to Karl Marx. Philosophy concepts are mobilised to scrutinise how affirmation and opposition are structured in the discourse. This is a narrow sense of how external referential brings light into hidden elements of the discourse. Critical discourse has been fruitfully applied in many fields, exploring social practices and role of power within discourse.

Application fields of Critical Discourse are numerous. Fairclough lists research works in directions wide apart: “new management ideology, new sociology of capitalism, political correctness, change in political television,...(Fairclough et al., 1997). Each of them is in an oriented, and somewhat provocative, way to express. They are examples of how discourse is revisited at a different level. “Management ideology” for example, is a reference to Karl Marx and domination relationship, while “management communication” would have been a more neutral formulation.

**Critical discourse analysis in statistical text studies.** The critical approach to discourse supplies a frame which creates tensions in the text and offers potential interpretation which would not appear in a direct coding. Research in political science is particularly suitable for Critical Discourse, like statistical text analysis by Cedric Leterme (2016). Author uses Critical Discourse Analysis in longitudinal study of discourses from World Bank, OECD and International Labour Organization during 40 years. With a lexicometry methodology quite similar to our research design, concept of hegemony is at the centre of research to observe how liberal vocabulary and ideology spread in the discourse.

**Critical discourse and legitimacy.** Critical Discourse Analysis is a powerful way to explain legitimacy in discourse: “The more legitimate and common sensical the discourses and practices of dominant groups appear, the greater is their capacity to rule by consent. In critical

studies of institutions and their discourses the concept of hegemony has therefore been an important tool for explaining why people consent to conditions that are not necessarily in their interest” (Mayr, 2015), p758. This citation shows how domination and hegemony create a form of discourse which becomes labelled as legitimacy. It also pushes into a cognitive legitimacy where acceptance is created in the discourse, rather than a thoughtful choice. In a Critical Discourse perspective, legitimacy is a construction, and with a purpose from those who built it.

More specifically in management studies, Critical Discourse Analysis was used with research objects such as industrial restructuring (Vaara et al., 2006). Here, the discourse is analysed as a legitimisation method to implement the restructuring of a given sector (in this case, paper industry in Finland in 1998). It offers interesting ground to study other sectors under restructuring, from the point of view of change in legitimacy. This is particularly the case for changes of audit and law firms (Suddaby & Greenwood, 2005), or restructuring of electricity sectors (Kungl, 2015).

### **2.3.3 Studies on CSR**

One specific form of discourse in management studies is corporate communication. We detail here how research on Corporate Social Reporting (CSR) has mobilised rhetoric and critical analysis. This choice of looking at research on CSR makes a link between theory mobilised and type of data used in this research.

**CSR can be viewed as affirmation of legitimacy.** CSR reports retain a special place in discourse analysis and legitimacy. An interesting statement on how CSR links to legitimacy is: “being a controversial industry, oil companies turn to CSR as a means to obtain legitimacy » (Du & Vieira, 2012). This illustrates that CSR is not first and foremost an obligation to fulfil but a plea for companies. If for controversial companies it includes obtaining legitimacy, for most companies it is a mean to develop their legitimacy.

The affirmative style of CSR can be directly read as affirmation of legitimacy. It can be object of analysis at a Critical Discourse Analysis level, or only at discourse analysis. Staying at the level of discourse itself, case studies allow comparison across companies or during time period. The beginning of reports, often with mission and vision of companies, is particularly meaningful, since it has been thoughtfully chiselled by companies. “Integrating CSR into the company’s mission and slogan is a powerful way to boost CSR credibility. In general, the greater the extent to which a company integrates CSR into its mission and values, the more

likely stakeholders will view CSR as an indispensable part of the company's identity and consider its CSR engagement as authentic and enduring (Du & Vieira, 2012) p6.

Authors add here the idea that all parts of the report are not of equal importance. Credibility and affirmation of legitimacy are more present in such a statement, while other dimensions of justification by numbers, by action taken or commitment might be present elsewhere in the reporting.

### **CSR definition according to Archie Carroll**

Tracing origin and definition of CSR is closely linked to Archie Carroll. He rooted back the term in history and explained how it has changed.

**A first definition** is tracing back to Bowen in 1953: "It refers to the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society" (Carroll, 1999).

It is mainly the responsibility towards the society which is put forward.

Then a **second definition is given by Archie Carroll** himself in 1979: "The social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time" (Carroll, 1999).

This time, CSR is defined along four axes with society expectations as pivot. Society can expect company to make money, to act according to laws and in an ethical way. The definition leaves an open door with the discretionary dimension. Maybe environmental would fit here.

**Last, an updated version** by 1991 clarified that "the discretionary component as philanthropic and suggesting that it embraced "corporate citizenship." For CSR to be accepted by the conscientious business person, it should be framed in such a way that the entire range of business responsibilities is embraced." (Carroll, 1999).

In a nutshell, "The CSR firm should strive to make a profit, obey the law, be ethical, and be a good corporate citizen" (Carroll, 1991).

Many developments since that time have incorporated into CSR a sustainability and environmental dimension (Carroll, 2016).

**Could CSR reporting be held for responsible reports for irresponsible behaviour?** What is the real value of CSR reporting? In a very provocative statement, "Communicating responsibility-practicing irresponsibility in CSR advertisements" (Perks et al., 2013) the immediate tension between speaking and doing is exposed. This is a cornerstone of discourse

analysis which discuss what is the practical value of discourse. Authors analyse here the semiology and text analysis method on visuals and texts. This gives a responsible and positive value of CSR communication. The distance to reality can be very wide, in energy studies we could call in greenwashing...

A more neutral perspective is to study discursive tensions in CSR. In the dialogue with all stakeholders, Critical Discourse Analysis is mobilised to explain how power relationship are structured (Høvring et al., 2018).

**CSR and rhetoric.** From a more structural point of view, research studied whether CSR was motivated by legitimation concern (Pétrin et al., 2013). If this is the case, then CSR relies on rhetoric and visual representations as a one direction communication. Alternatively, it can be a dialogue with third parties.

CSR can easily be analysed with text content analysis. It can ben with analysis of advertisement on CSR to show ethical behaviour (Farache & Perks, 2010). Another application was performed on testing all Twitter communication on CSR with at text mining algorithm. This explains how communication strategy aligned with expectations by stakeholders (Colleoni, 2013).

**CSR as a signal.** An interesting synthesis of role of CSR is to consider it as a signal to stakeholders (Buisson, 2008). In this view CSR becomes a process of legitimation. “We claim that dialectic rhetoric seems to signal a new understanding of the firm’s role in society and a search for moral legitimation” (Castelló & Lozano, 2011). It allows to consider evolution of CSR reporting as different messages sent, and evolution of claims of legitimacy. But it hits two limitations. First, what could be the legitimation potential if the signal is changed each year? And if the signal remains constant, it becomes less a process and more and assets of the company (like moral value, or business ethics...). The second limitation is the audience of CSR reports. Who reads this signal? When CSR reports are read by rating agencies and independent evaluation bodies the legitimation is indirect for customers, converting the signal into an echo interpreted by intermediate actors.

| Characteristics         | Strategic CSR                                 | Institutional CSR   | Dialectic CSR                                 |
|-------------------------|---|---|---|
| Discursive elements     | Legitimated by the economic logic of the firm | Legitimated through the value of the enthymeme                    | Legitimated by appealing to an engaged dialog |
| Time scale orientation  | Short- to mid-term                            | Long-term (sometimes used as temporal)                            | Long-term                                     |
| Position in text        | Supports the most important enthymemes        | Used in introduction and linkages                                 | Marginal, additional                          |
| Rhetoric strategy       | Provides the <i>logos</i>                     | Provides the <i>ethos</i>   | Supports the <i>pathos</i>                    |
| CSR Foundation          | Positivistic                                  | Positivistic  | Post-positivistic                             |
| Main concepts           | Performance                                   | Social contract/duty  | Inclusion; dialog                             |
| Management theories     | CSP; strategic management; project management | Business ethics; stakeholder theory                               | Corporate citizenship/ political view of firm |
| Role of legitimacy      | Pragmatic legitimacy                          | Cognitive legitimacy  | Moral legitimacy                              |
| Message to stakeholders | <i>We are accountable; we manage well</i>     | <i>We are "good" and responsible; belong to the CSR community</i> | <i>We want to engage you in a dialog</i>      |

**Table 5 Potential of CSR rhetoric strategies for legitimation (Castelló & Lozano, 2011) p22**

Table 5 shows how different aspects of rhetoric reinforce aspects of legitimacy vs others. It opens an interpretation of discourse analysis on the three classical domains of legitimacy, pragmatic, moral and cognitive. CSR is no longer on the single dimension of affirmation. An additional dimension opened by authors is to consider that companies can be leaders or laggards on CSR. When transferred to energy transition, this could explain which companies are more advanced towards a future state. But leading or lagging suppose either an undisputed reference, or a relative scale to compare companies. And CSR is not the easiest tool to measure efforts and accomplishments.

It turns out that Corporate Social Reports are rich material for studies on legitimacy and discourse analysis. The possibility to study positive/negative opposition suits energy sector, showing a tension between fossil fuels and renewable. And the possibility to compare reports or companies suits analysis of how energy transition became a concern.

#### **2.4. LEGITIMACY AND ENERGY TRANSITION AND DISCOURSE ANALYSIS**

This theoretical section explores how discourse analysis was applied to legitimacy in energy. Discourse analysis in energy studies is an active stream of research. Three theoretical starting points have been identified on legitimacy of actors in energy. How legitimacy evolves? How to compare legitimacy of different actors? And opposing one legitimacy to another.

#### **2.4.1 Discourse on evolution of legitimacy**

The first starting point here is to study evolution of legitimacy. Natural object of research is a company, a country, a technology. Discourse analysis highlights how to gain or maintain legitimacy. Diffusion of nuclear technology in the Netherlands (Geels & Verhees, 2011) is a good example of legitimacy of one technology. Texts, visuals, advertisement are analysed in many semiotic possibilities. With authors claiming as outcome “we theorized the mechanisms that influence the creation of cultural legitimacy”.

Case studies are particularly suited to follow evolution of legitimacy in a consistent environment. Dramatic examples of an accident with loss of all legitimacy constitute good starting point, like explosion of a British Petroleum offshore platform in Gulf of Mexico (Matejek & Gössling, 2014). Another type of research is to take an ambiguous case study, with apparent legitimate and illegitimate sides. With a case study of the shale gas industry in British Columbia, Canada, Stephenson et al. (2012) compare shale gas to ‘a greenwashing gas’. This creates a frame to discuss how the industry may gain legitimacy.

The need for more sustainability is a good reason for legitimacy to change. It forces companies to answer in a discourse protecting their legitimacy, in one of the three ways: “adapt to external expectations, manipulate the perception of their stakeholders, or engage in a discourse with those who question their legitimacy” (Scherer et al., 2013) This quite provocative vision is very suitable to CSR reporting; at the same time addressing questions of sustainability and legitimacy, and manipulate by choosing best figure or best stories, and also targeting specific audience who could question their legitimacy.

Based on legitimacy evolution in one give case study, we could develop potential research questions at different levels of observation: For a technology, a research question could cover how wind turbines are presented in the press and become part of the energy production landscape. This is partly covered in research on acceptability for given territories (Zelem, 2012) For a company a question on impact of energy transition on internal legitimacy perceived by employees vs external stakeholders could be relevant. The discourse analysis here is either official internal and external conferences, or interview analysis. For a country, it could be a research on political discourse on energy policy, and whether it is perceived as legitimate.

#### **2.4.2 Discourse on comparison of legitimacy between companies**

The second possibility is to study comparison of legitimacy between different research objects. Either they are in different phases of legitimacy, typically two apparent close companies gaining

vs repairing their legitimacy. Or they are relying on different mechanism to claim their legitimacy.

The difficulty here is to find sufficient comparable cases. This was achieved for a national comparison across five countries in Northern Europe on legitimacy of contestation or participation to electrical vehicle (Sovacool, 2020). An interesting solution to the difficulty in finding comparable cases is to use one single case, but studied with two different methods. This was performed with two critical discourse methods applied to the discourse of Exxonmobil on global warming (Livesey, 2002).

Comparing legitimacy between different cases could be imagined in research questions like: Across energy majors, oil and gas companies with worldwide presence, how legitimacy is managed differently in the corporate discourse?

#### **2.4.3 Discourse on opposite legitimacy viewpoints**

A third viewpoint is the rhetorical opposition between two parties. Legitimacy is at the centre of the debate while two parties try to appropriate it. This is a direct reference to classical rhetoric debate (Suddaby & Greenwood, 2005) and finds application in energy with opponents and defenders of coal industry for example (Ayling, 2017).

In some energy cases, the choice is self-explanatory: if clean energy is the opposite to dirty energy, then the discourse will only explain why companies turn away from the dirty one. This appropriation of clean energy compared to dirty energy (Patala et al., 2019) is also based on rhetoric.

Potential research questions with high degree of rhetoric could be taken from heated debate: what rhetorical strategies are developed by defenders and opponents of nuclear power, in France or in Germany?

We believe a further potential point of view could be to look at comparison of actors and use a critical discourse point of view to study legitimacy. Although no example was identified, restarting from the comparison of Kyoto protocol in American and Italian press (Bassi, 2010), there could be a research question on how power relationships explain that legitimacy of renewable is more or developed for different countries. In this example, the differences of data and content by country is overcome by an overarching theory on acceptability and resistance.

This intersection of legitimacy, energy and discourse analysis is the area where our research question belongs. This intersection is a dialogue between energy studies and legitimacy as an

asset or a process; and among levels of analysis, discourse analysis takes individuals, companies, or institutions point of view.

## 2.5. EPISTEMOLOGY

**Why do we need epistemology?** This section makes a link between reality, as we can observe it, and the method we use to look at it. A detour is necessary to explain which conception of the world is assumed in this research; hence to propose a research methodology consistent with the formulation of research question and with analysis of results (Thietart & Perret, 2014).

This section is made of successive choices rather than a definite answer once for all. We follow four steps (Saunders et al., 2019) including our access to the real world, our approach to produce knowledge, how the researcher stands amidst the research work, and the method followed. In energy systems, as they stand today and as they will become tomorrow, we see some reality but can only build our clear view of it. The following step from this ontological position is that we can only interpret what we see. Hence the uncomfortable researcher's position: always trying to stay above the data and reality, but in fact floating in the middle of the reality observed. Last, methods associated to this approach are qualitative. To be able to interpret reality in energy transitions, it will be necessary to use different cases and to treat them with methodologies like interviews, discourse analysis, observation...

### 2.5.1 Ontology

Energy world is full of technologies, of consumers and producers, as was largely discussed in part 1. But what is the essence of energy transition? Words are misleading here, since "transition" can mean shift, turn or maybe jump. It is true for any reality; there are layers of techniques; one on top of each other, and many audiences using some of these techniques. But this does not explain change, apparition of new ideas and how they blossom. In the end, there is little ontology of energy here, instead world gets meaning only as we screen it.

**That reality is socially constructed.** If energy can be measured in watt, joule, volts and amps, energy transition cannot. Reality of energy transition is socially constructed (Berger & Luckmann, 1966), as intertwined between those who create new concepts, and those listening to them. Many concepts we deal with in this research are related to usage: conventional energy can be defined only as opposed to non-conventional, not as a comprehensive list of techniques; in renewable energy, does the silicon for panel or the composite for wind blade renew

themselves, or just the sun and wind? As a result, our ontology in this research is that there is a world out there; but we cannot have a direct access to reality.

### **2.5.2 Epistemology**

Unfortunately, if reality is not accessible, it becomes very difficult to build knowledge on change in energy. This is why we need to start from a theoretical approach of how scientific concept are produced, then build on these principles to propose a research methodology. Our entry point is sociology, and how people shape reality. First, because energy transition is a constructed concept, mixing technologies and how people understand it, and second because legitimacy roots on perception and on discourse communicated.

**Four dimensions leading to a constructivist approach.** First, knowledge is relative. This research does not pretend to find the enshrined unique explanation of how companies will reach exit to energy transition. On the contrary, we take a humble view of adding a few perspectives to knowledge on energy transition, on legitimacy, and on how discourse analysis can be mobilised. Assumption here is that construction of knowledge can only be relative. Taking a relativist approach as opposed to positivist approach (Van de Ven, 2007) fits the idea that there are many trajectories and solutions in energy transition. And that the solutions will not come solely from data and facts.

Then, technology and society can be viewed as intertwined. Our research question is at crossroad between technology and sociology. Technical evolution in energy solutions and how they are accepted and used go hand in hand. In that sense, we adopt the view that sociology and use of successive innovation and technique will solidify at one point as technology: “technology is society made durable” (Latour, 1990). As an example, what makes solar panel a relevant solution is that many people install them on their roof (society) and not the progress made in % purity of the solar cell (technology). This approach claims that there can only be a relative view of scientific knowledge. Sociology of science shows results are always dependant on some contingencies (Callon & Latour, 1991).

Our research aims at proposing a map. But “A map is not a territory” (Korzybski, 1995). There are many entries to look at reality. Choosing one entry is equivalent to select one map to explore a given territory. But there are many scales possible for maps, and maps of rivers only, maps with contours line, or maps of wind speeds and direction for wind power energy. Similarly, legitimacy of electricity companies can be looked at with many different maps. Some are methodological maps (what companies tell about their legitimacy, or what credit external

parties give to these companies), and some are at different levels (for example company level, country level, world level). Considering that energy transition is our territory, with companies, technologies or countries on it, several maps can be used to look at it. Here we select a map of how legitimacy can be traced in discourse analysis. This will not exhaust the territory to explore, but illustrate this aphorism between map (which could be labelled a research design) and the territory (that would be the issue to explore).

Last element here is that we can only interpret the world as we see it. There is no objective point of view, only subjective choices. In this research we work with texts, and corporate communication. Even with very large quantity of data, we consider that we can only interpret the data and facts that we see. If all occurrences of “energy transition” were retrieved from the web, there could only be a data mining from data. On one side many actors do not use these words at all, and on the other side potentially abundant knowledge cannot be retrieved (like interviews, observation, in depth case study...) this necessity of interpretation has been summarised as: “The constructivist or interpretivist believes that to understand this world of meaning one must interpret it” (Schwandt, 1998).

**Research question is taking a constructivist perspective.** This section is not so much labelling the perspective used, as linking to the constructivist school of thought (Charreire & Huault, 2001). Production of knowledge is defined here as a construction, building on reality, and representing reality. There is no straightforward definition of what constructivism is, because it is better described by what it does. “Constructivists endorse the claim that contrary to common-sense, there is no unique 'real world' that pre-exists and is independent of human mental activity and human symbolic language (Bruner, 1986) p.95” cited by Schwandt (1998) p.236. In this description, Schwandt insists on the construction of reality. It also implies that there is more reality as we live and experience it, than there pre-exist to our experience.

Some elements of constructivism can be traced back to Kant. In his philosophy of rationality, detailed in his book critique of the pure reason in 1781, he describes reality as beyond limit to our knowledge. Reality itself may be present, but is not accessible in the representations we can build. The world we can access to is an experienced reality, a representation.

Constructivism also borrows from Popper a vision of relationship between problems and knowledge. Any knowledge comes by solving problems, but no problem appears without some previous knowledge (Popper, 1957). So that any knowledge is created somewhere before and after knowledge.

**This epistemology has some impacts on the research.** Data collected are always supposed to be value laden. This matches a research focused on words, choice of words, and meaning of

words. Energy words are particularly constructed to carry specific values: when “renewable energy” promises an evergreen source of energy, “new energy” insists on technologies and innovation.

The validity of research work continues up to refutability. With different texts, and different data, outcome of result interpretation could be different. Allowing refutability in the production of results is a strict criterion of what is demonstrated (Popper, 1957).

We believe that the same data could be processed by different researchers with some differences (repeatability). And should the data observed be expanded to a few more years, or a different sample of companies (reproducibility) different patterns could be identified.

### **2.5.3 Researcher’s role**

Ideally the researcher would sit on top of the world to have a better view of what is happening. That is also true in this research where the quantity of text available could lead to think that the knowledge is there to pick.

But the researcher is giving meaning to what he or she sees. In this research we cannot stay at a position coming from data mining where scales would indicate a % of transition accomplished nor a % of legitimacy gain or lost vs last year. On the contrary, each concept that is tested has to be chosen. It can be selecting what words to be examined in the text. Or by using concepts from the literature to test inside the data.

### **2.5.4 Methodology within discourse analysis**

This epistemology section makes the link between theory used and the methodology we use.

A quantitative design would not be suitable for a question on how things change, neither for finding when these changes become visible.

In qualitative designs, this research would be suited for multiple case studies, where some companies would be studied along several years in detail.

By doing so, we accept that comparison across companies will be limited by the meaning given for each of them, whether in interviews, discourse, internal documents. And we have to accept as well that content of concepts changes. An example from our research are CSR reports tend in the beginning to cover mostly quantity of water and paper used per year, changing progressively to a contribution against climate change.

This heterogeneity in data is a strong constraint on knowledge production, which will be discussed in presentation of methodology in part 3.

The philosophy retained here is to consider the energy world as socially constructed. Following a constructivist approach, we look through corporate discourse at wanderings of legitimacy as energy world changes.

## **2.6. CONCLUSION OF PART 2 AT CROSSROADS OF LEGITIMACY, ENERGY TRANSITION AND DISCOURSE ANALYSIS**

From the initial point of legitimacy in the neo-institutional theory, we have explored how it was associated to energy studies and to discourse analysis. We have demonstrated how research legitimacy can provide a fruitful theoretical framework for looking at changes in energy companies. Our research question is adjusted into: how does legitimacy change in the discourse utilities companies, in a time of energy transition? Before choosing a methodology and selecting primary data, we imagine there could be several possible answers. The most optimistic perhaps, would be to find that all selected companies increase their legitimacy by the same strong commitments. But this isomorphism is far from certain. Another answer could be to find two teams, the leaders and the laggards. This supposes some degree of convergence, and identification of tipping point when differentiation changes. And a last option would be that each company continues on its own path, but not necessarily in the same direction.

### PART 3 RESEARCH DESIGN: STATISTICAL TEXT ANALYSIS AND CONTENT ANALYSIS OF CSR REPORTS

Our qualitative research design uses for primary data Corporate Social Reporting, hereafter called CSR, of several electricity companies which are scrutinized with a statistical text analysis as well as content analysis software. It allows to observe variations of legitimacy through choices of words: converging, emerging, diverging, disappearing... Studying how legitimacy evolves suits a qualitative research linking facts with how companies declare to deal with it. Corporate communication is a rich literature that constitute rich and structured primary data. Press releases, annual reports, corporate social reporting are the main sources out of which CSR report proves to be more relevant here. Constructing a series of CSR reports, for a selection of companies, and during at least 10 years, allows to build a corpus above 100 texts. It is structured with a longitudinal dimension between 10 and 15 years and a variation dimension across companies. This corpus of texts is inserted into a textometric software. Requests and features of TXM software are presented, together with some benchmarks from other research fields (such as linguistic, geography, history). We show hypothesis to test, on evolution of vocabulary, and on variation between companies.

**Inside Van de Ven research process, research design is a link between a model to test and an explanation** highlighted in Figure 15. The research design chosen here, textometry analysis, is used to explore how discourse on legitimacy is changing under energy transition. The outcome is made of paths and patterns common or specific to some companies and some periods. It can be interpreted as change in type of legitimacy.

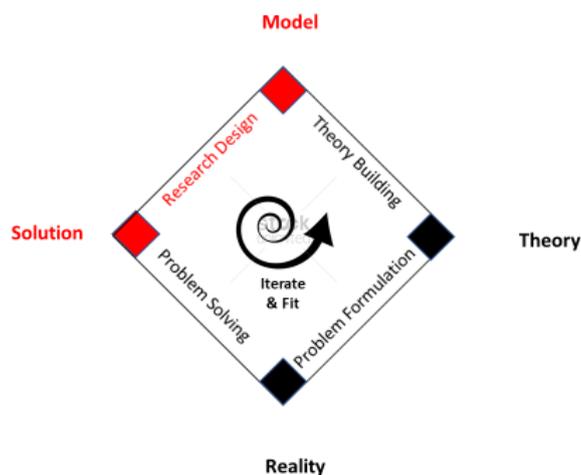


Figure 15 Research design phase, adapted from Van de Ven (2007)

**The methodology selected is consistent with research question and theoretical frame considered.** At this point of the research process, there is an interest to check the overall alignment. In metaphor from energy production, if research question and theory can be considered to be the steam turbine, on the other side methodology and construction results would be the generator. Mechanical energy is converted into electrical energy. But this only work with perfect alignment of the shaft line.

This is a methodological fit (Edmondson & McManus, 2007), defined as “internal consistency among elements of a research project”. The research question stated here, how does legitimacy of electricity companies change under energy transition, can be answered in the form of typology, or in a direction of change. This question is constructed on prior work on legitimacy in energy and legitimacy in discourse analysis. Here the conjunction of these two streams results into a literature of energy studies looking at legitimacy of organisations through discourse analysis. To answer this question, the research design is rooted on discourse analysis of corporate communication in energy companies. Legitimacy is the red tape across a large corpus of text. The outcome of research with different paths and speed identified is a contribution in energy studies, in legitimacy in organisation. It is also an application of statistical text analysis methods into further fields.

### **3.1 METHODOLOGY**

Our objective is qualitative, as we are looking for how company changes, how they develop various paths. But the reality behind is also made of quantitative economic data. Change can be measured somehow in energy production mix (% of gas, or coal or wind in the production) or in quantitative efforts in Euros (investment, divestment).

Timeline of decision and implementation of change necessitates a longitudinal design of 10 years or more to incorporate preparation, decision, implementation. That rules out interviews, surveys, observation as primarily sources of data. We select discourse analysis method, based on previous literature, and demonstrate how it is relevant with our theoretical frame, and with our research field.

### **3.1.1 Qualitative over quantitative**

In energy transitions studies there are numerous data, actual and forecast, and trajectories are often plotted on these quantitative data. This can be illustrated with a single example is how text-mining can “read” in American annual forms 10K a trend from product orientation to service orientation (Lee & Hong, 2016).

Is the global warming of 2° not by essence a quantitative target? But reality tends to prove that changes for electricity company do not follow a numerical trend.

Here the point of view taken is that qualitative research can shed more light on how things happen, and not only by how much. A qualitative approach fits the Multi-level Perspective used in part 1 as it explores emerging tendencies and paths taken that do not necessarily come in number. The second argument is that many data exist on all energy transition aspects, so that a qualitative design can contribute to explain low signal, tipping points before they materialise in M EUR investments and K Tons capacities.

### **3.1.2 A qualitative and longitudinal design**

Energy transition and strategy of utilities typically calls for two main dimensions. First one is the importance of time, observing how change unfurls, with a yearly or longer unit of time. With the time needed for diffusion of renewable energy technology we are in a longitudinal study, and use a process research design (Grenier & Josserand, 2014). Time is not linear here, with periods of slow tests, then quick adoption in some countries like Northern Europe, and increase in resistance in others, hence an accelerating and slowing down process. Time dimension can be a tipping point, like more research and production on coal, up to a point where it changes; it can be business disruption, like first wind turbines in small islands in Denmark which started unnoticed. And time is also producing critical events, with short term or long term effect (Clemente et al., 2017).

The second dimension is variation from one company to the other. This implies that research design here needs to account for how innovation is used in each company, depending on actors, on countries, on local resources (wind or sun or wave or geothermal resource or all of them). These variations are path dependent, each company building on existing developments and previous trials. Research design will have to include identify and describe factors of variation, and choice among them.

### 3.1.3 Why discourse analysis?

Starting the research design with interviews of senior managers could have been the most obvious solution to have different companies up to saturation of each kind of path. But it cannot address present research question of changes over 10 to 15 years. And access to senior management of large utilities in USA, most European countries and more seems very presumptuous.

Hence the choice of discourse analysis. All reports, speeches, press release allow to screen by company and by years how strategy communicated is changing. The difference between strategy implemented and as discourse is important, and this research takes the point of view of how it is presented and communicated. This does not mean that we minimise the distance between saying and doing.

Then, energy matters have been studied with text analysis tools. Some early works compared how Kyoto Protocol was covered in newspaper, when comparing New York Times and Italian La Repubblica between 1997 and 2006 (Bassi, 2010). Word environment for Kyoto Protocol differs between the newspapers and are analysed by keywords, for example with what kind of alarms are associated to articles mentioning Kyoto Protocol:

“in La Repubblica, we have explicit alarmist words, reference to general words indicating natural calamity, nomination of concrete problems, and words that point to warming. In the New York Times the alarm is launched mainly in reference to the ice melting, the sea rising and to the animals that will suffer the consequences of climate change: birds and bear. In the New York Times the problem is thus presented as remote and faraway” (Bassi, 2010) p212.

A first choice to make is verbal or written communication. When verbal communication on press conference, recording of shareholder’s meeting is closer to interviews, with much more information than the word themselves, here the choice is to focus on words, singular or equivocal meaning of words and it suits more written documents.

Next choice is between external discourse, in press and newspaper, or discourse from the company. The main advantage of external view is not a more objective look on strategy announced, because it will be also value laden to some extent, but rather to bring a critical view with arguments pro and against the discourse. It can be applied for example a controversy between defenders of coal power and opponents (Ayling, 2017).

Then corporate communication takes many forms: press releases are very easy to access (e.g. FACTIVA database), press conference, annual reports and corporate social reporting are very

structure communication, but only once a year. The decision between short press release on a very regular basis and yearly report will be taken in next section after testing.

#### **3.1.4 Why words matter? A starting point with company's motto**

Energy terms are often value laden as demonstrated in part 1. As an example, 'clean energy vs renewable energy' refer more to local context than to physical definition of what energy sources are included. Similarly, in corporate communication choice of motto is a carefully thought process. For a specific company, how does the motto of GDF-SUEZ in 2008 compared after renaming into ENGIE. 2008 and 2017, what do they say?

2008 annual report opens on "rediscovering energy" while 2017 opens on "committed to the energy transition" (p1 of integrated management report).

In comparing the two, what has changed and what has remained the same? Energy remains at the heart of the company's business. And energy is source of action, fuelling inspiration for GDF Suez in 2008, then renamed into ENGIE. But the point of view is completely different. In 2008 discovering is a very neutral term, like a newcomer on the market. GDF SUEZ is focused on gas and looking at expanding its core business. In 2017 it is quite different the group has taken a bold move into energy transition. There is a move from an open field position to a special purpose: the group communicates on commitment.

#### **3.1.5 Design as an iterative process**

The starting point of research design here was how the discourse on energy transition changes and what it reveals in strategy. In an iterative process of elaborating a suitable design (Royer & Zarlowski, 2014) we come to one design on statistical analysis of company data, that shows time evolution and variation. A first iteration was to evaluate press release vs annual report, comparing short communication vs long reports, and frequent as opposed to yearly. It ended with choosing annual reports or equivalents. The second iteration was prototyping several years reporting for one company, RWE in Germany, and a few reports in utilities for a given year, 2017. It showed poverty of annual report in terms of discourse on strategy, when CSR reports provided more material. The third iteration was a real scale analysis of about 100 CSR reports, when this final round completes the difficulties to retrieve missing data for some years.

After this process, the research design is qualitative, with a longitudinal dimension of 15 years, and a variation across 12 different cases. It relies on discourse analysis with the use of statistical software for collection, calculation, and interpretation of results.

## 3.2 DATA

Corporate communication is a rich literature that constitute rich and structured primary data. Press releases, annual reports, corporate social reports are the main sources, out of which CSR report proves to be more relevant here.

This research is based on constructing a series of CSR report, for a selection of companies, and during at least 10 years, to build a corpus of above 100 reports. It is structured with a longitudinal dimension between at least 2008 to 2018 and a variation dimension across companies.

Discourse, press conferences or reports are good indications of how company changes. This section explores advantage and inconvenient found, both in the content and in technical solutions to retrieve information. Corporate discourse is a way for companies to express change both as a direction to go as well as for the path achieved. Annual reports are good examples of description of past achievements. They contain financial information and company information. Part of the information is in a very coded format of accounting, controlling standards. And some other parts are much more open and tailored to each company. Discourse on the past achievement is largely a reflexive exercise of justifying actions taken and make them shine. But at the same time, it is how company sets goal, vision, mission for the future.

### 3.2.1 Using data from press release?

**Many studies use press articles or press releases.** Statistical text analysis uses press articles in a large literature flow. It is a rich material easy to access. Expanding the years of collect creates the time dimension and increasing the number of press sources increases variation. Press source is a practical solution to get some data saturation with many points of view in different newspapers. It is also appropriate for studies with controversial aspects which allow to separate discourse into opponents and defenders of the matter. Controversy on fear or opportunities from Big Data was studied with press articles and keywords with the similar tool used in this research (Bilet & Liottier, 2019). As example of controversy in energy, studies have been made in Australia between coal producers and NGO opposing it is based on 303 media releases (Ayling, 2017).

As it seems appropriate for this research, we tested successively several kinds of text that are structured into corpus. We differentiate corpus from text, in the sense that a corpus is a

construction of various text elements; for example, all press release from ENGIE in 2018 is a corpus, or all press release on nuclear power plants investments in 2018. The structuring of the corpus is a set of assumptions. An example of criteria for building corpus is “all press articles containing “authors” rights”, “artist” and/or “music” for a period of time from January 1988 to January 2008” (Blanc and Taupin, 2015).

**Comparing data source from press release or from annual report.** Press releases tend to be short, from 1 to 4 pages, in a very controlled communication from the company to open stakeholders, as opposed to financial community only. Subjects are diverse: quarterly financial results, investments, sales order, change in governance, cost saving programme. This leads to facts, numbers, announcement. On the format side, these press releases are issue on corporate websites, in a pdf format, that can be transformed and coded as doc format. We have performed a test sample of 2 press releases from company ENGIE coded into TXM. Another way to access to the press release data is to extract it from the large press database Factiva. Here too we have performed a test sample for press releases during full year 2017 and downloaded 380 press releases in doc format while the corporate website contains only 92 news releases to be downloaded one by one. Data quality and data source, as illustrated by our test on company ENGIE, when issuing a message, or when Reuters and AFP relay the same/close message, need to be refined.

Annual reports tend to be very long documents 200 to 300 pages, with a focus on issuing financial results, but also explaining to a broader audience, shareholders, lenders how the company is evaluating its business and strategy. The written section is typically 30 to 50 pages. This allows for narration, evaluation of goals and achievements, strategy setting. On the format side, corporate results are issued in pdf format relatively unsuitable for textometry. We have performed a trial to convert one annual report into doc format, and upload into TXM.

Our design will remain in trial and error to identify a better solution, based on the comparison on Figure 16. Some technical issues have been identified: how to deal with the tables in annual reports, discard them completely or use them? how to treat in press releases the redundancy of company registration, or disclaimer at the end of texts?

|              | <b>Annual report</b>  | <b>press release</b>   |
|--------------|---|--|
| number/year  | 1   | 1 - 80   |
| text length  | 200p (40p of text)  | 1p   |
| format       | pdf   | rtf, text  |
|              | yearly picture  | film of events   |
| audience     | finance community   | press, media   |
| type of text | long text, numbers<br>explanation<br>vision, strategy<br>careful construction | short facts<br>declaration<br>announcement<br>focussed message |

**Figure 16 Features of press releases vs annual report**

**Press releases are not appropriate in this research work.** Choice of press articles and press release has been discarded in the end. On one side because of several technical difficulties identified, and on the other end because yearly reports brought richer content.

When retrieving mass press article, with Factiva or another database, one single announcement by a company can be repeated, in Reuters, AFP, and reused. It requires to design a proxy to identify which one to use, maybe the first one if date is available, and ensure only one is selected. It could be done by hand for 50 press for 12 companies in one year, but has to be automated for 10 years (50x12x10 makes 6000 articles to screen). Among other issues, there is an overrepresentation of company names, and often a general statement on the company which comes a standard. This would require carving out repetitive information, and manage company names so that they serve more as identifier than for the content. These arguments could be revisited for future research, for example rhetorical strategies of two companies as viewed in the press.

Yearly reports appeared to be available over a 10 – 15 years period, which allows to see changes even if data is not retrievable up to Kyoto Agreement 1997. As structured communication they reflect not only facts but opinions of companies and how companies present themselves. But within yearly reports, there are still several options, first of them being annual reports.

### Text or image?

Beyond text, visuals communicate also powerful messages. This is the case here with EDF reports carrying no name but a cover picture. The change in perspective between 2015 and 2018 is tangible in Figure 17.

EDF presents in 2015 the company in the middle of a centralised, technical, controlled environment. The underlying messages could be that the company will deliver power, and master the distribution.

2018 is a different world. Here the environment is only renewable, local, focus on citizen gardening potentially in self-consumption. The underlying messages could be local distribution and proximity to customers.



2015



2018

**Figure 17 EDF cover of Reference document**

### 3.2.2 Evaluation of annual report vs CSR report

Annual reports are comparable standards for large listed companies up to a certain point. They have been used for qualitative research in many research designs, including statistical discourse analysis. Either it is research on explicit content, comparison or evolution or it is for implicit content, like finding hints of fraudulent acts not explicitly mentioned in the reports (Goel & Gangolly, 2012).

One direction of research on annual reports is critical discourse analysis. Aim of research becomes to bring to light rhetorical strategies. Applied to the World Bank, OECD or

International labour organisation, this can be how managerial or neo liberal vocabularies influences develop into international organisations (Leterme, 2017).

Another direction is to compare annual reports to find new information out of them. This is the case for studying change in business like the case of industrial companies with emergence of new activities (Lee & Hong, 2016). Based on methodology of analysis corporate discourse in annual report (Beattie et al., 2004; Rutherford, 2005), there are many research possibilities which justified to test using annual report in this research.

**Testing a sample of annual reports.** Annual reports from a few energy companies were tested for statistical text analysis. A preliminary reading confirmed that reports contain argumentation on energy transition and change. Samples were companies ENGIE (electricity and gas, headquartered France), EDP (Energias de Portugal, headquartered in Lisbon) and RWE (electricity, headquartered in Germany) all taken over a 10-years period. It has proven to be difficult to access longer series of data. Corpus contains presentation of company business, challenges, innovation, risk and strategy of the company. Length of corpus has to be minimum 10 pages with a target of 50- 150 pages.

**Comparing annual report to corporate social reports.** Yearly reports do not only include annual reports but also others, including corporate social report. Interest for this research of corporate social report, hereafter CSR, is the focus on environment, on responsibility towards stakeholders and often a large section on strategy.

In using statistical tool on annual report, it turned out that large amounts of tables and figures tend to blur potential analysis. Accounting linked verbs (as for example “increase, decrease, depreciate”) are very dominant in the total analysis and make other changes appear as soft signals in the main financial discourse.

On the contrary tests performed with CSR reports showed higher amount of text in proportion and in total; then more variety of vocabulary; and much larger section on strategy and business model than in annual report.

**Using CSR report seems preferable to annual reports.** For most of the utilities looked in this research, comparison has been made between annual report and CSR report, showing the latter to bring much more results.

Hence the choice of continuing with CSR report for the present research design. The CSR genre compared to annual report is not that clear cut, especially with the initiative of Global Reporting Initiative which tends to bring the two together.

### **CSR, GRI or integrated reporting?**

Unlike annual reports, which have a very formatted content following strict accounting rules, non-financial reports have a more open format.

Some companies publish two separate reports, usually annual report and CSR. Others follow the Global Reporting initiative.

Open options are exposed by accounting firms (PWC et al., 2012)

Conceivable alternatives on the way to integrated reporting are:

- a) publishing a stand-alone integrated report as an addition to the legally required annual report and other mandatory or voluntary reporting;
- b) integrating the information usually included in additional reporting (like sustainability report) with information suggested for an integrated report while maintaining an annual report that includes the financial report and the management commentary (combination);
- c) publishing one document that follows the guiding principles for integrated reporting and covers the content elements of an integrated report but still includes all regulatory financial and non-financial information (integration with retention of previously reported information).

Global Reporting Initiative is an independent international association that progressively developed sustainable reporting guidelines since 1997. They are widely used among large corporation and include both financial elements as well as sustainable development and transition elements (<https://www.globalreporting.org/standards/>).

For one given company, the choice of reporting often varies over time. But for one specific year no examples were found of ambiguity in choosing report.

Primary data for this research will always be annual corporate communication, but with a mix content of:

- Standalone corporate social reports, like E.ON, (Germany) with ‘sustainability report’
- Standalone annual reports with a large portion of strategy and corporate social matters, like EDF with reference document, often containing more than 500pages, which will be split to retain the prevailing part, after carving out the financial section.
- Integrated documents covering financial and non-financial reporting, like ESKOM (RSA) with its integrated reporting covering both.

For the purpose of this research, there has not been a deliberate choice between annual report and CSR reporting. But we underwent a trial and error process to capture the maximum text available. Whenever possible, CSR report was used as primary data. One large exception was

EDF, such a large utility in Europe that it could not be left out of the sample. Since a dedicated CSR report did not exist, the full report “Reference Document” was used; but if EDF reports are very lengthy, 500p and more, the accounting and financial part is dominant in the report, and generate noise in the statistical text analysis. After testing in the analysing tool, it was decided to cut in two reports from EDF and stop when the financial section started.

Could there be a solution to take more comparable documents? A cursive reading of annual report and CSR report for different utilities show how difficult any comparison between them could be. There is no one size fits all to compare, with large span of size, content and format. If the option is to take only CSR reporting, then the longitudinal part is eliminated (EDF, EDP) as well as companies who issue a mix annual and CSR report (RWE, IBERDROLA). On the contrary if the option is to take only annual results, then the content which was tested is a very low text content.

Rather than creating or finding a homogeneous material, this research takes the point of view of managing heterogeneity and documenting it. When E.ON issue as CSR report specifically avoiding any mention of Euro or financial impact, RWE “our responsibility” wipes out the limit between financial and non-financial information. And management of heterogeneity receives special care. Counting number of occurrences of any concept in texts of different size and structure is only relevant in taking the context of use.

### **3.2.3 How to deal with heterogeneity of reports**

**Overcoming the heterogeneity or homogeneity paradox.** The initial assumption is that communication to shareholders, investors, financial analysts, lenders, banks would be a good homogeneous communication, and the main source of corporate communication. Some accounting rules may have changed, for example in the form of integrated reporting, or in the link between corporate social responsibility and annual reports. Between the different corporate communication and description of change a tension appears. Our research question creates a discrepancy between corporate communication tools in various forms, and the study of how change happens.

**Heterogeneity is grounded in the discourse.** What we have discovered so far is that heterogeneity is deeply incorporated in each corpus. In the same way that lexical choices are taken, using fossil energy, exhaustible energy, or conventional energy are not synonyms but choices, structure of corporate communication is also made of choices. What is true in choice of words is true in the form of corpus. Each company is faced with choices such as where to

put Corporate Social Responsibility data, whether in a separate report towards NGO, or on a UN platform, or inside the annual report. Choices made in to insert environment report into financial annual report is a signal on how the business is steered. Hence, the solution is to adapt the method to the corpus, and not select a homogeneous corpus to fit the method (Pincemin, 2012). This means selecting different lexical tools depending on corpus we have. If a word by word analysis is not working overall, maybe overall visualisation will be a better starting point. In fact, a homogeneous corpus is simply non-existent. It would require one company to stick to the same vocabulary for 10 years, the same format... this would be either theoretical, or constructed on purpose. Here we use real data from several companies, allowing to derive real learnings, by taking some precautionary measures in methods of analysis.

### **3.2.4 Preliminary findings on lexical content**

Research design was done in iterations of several series of texts, or corpus. Adding more yearly reports and adding more companies led to a first set of findings

**First discovery in the use of word around change** is that there is little use of words around change, transform or energy transition compared to other concepts (in this research 9369 “change”, 433 “transform” but 16 113 “management”). It opens a question whether it is lack of interest, wrong text chosen, or presented in another way.

**The second discovery is that choice of words varies greatly** from one company to another. The initial intuition was to avoid coding by letting categories emerge from corpus; this has proven to be misleading. When EDF uses, in French “énergie décarbonée” they have constructed a concept that can put together nuclear, hydro, and some decreasing gas energy in it. This is a socially constructed term, reflecting reality as they see it. This questions variation between companies and evolution within one company

**A lexical discovery on the hypothesis of calling a spade a spade?** Inside a specific company corpus, evolution in the choice of terms is not easy to capture. When the company want to tell in year #3 that change is three times more important than in year #1 they do not necessarily write “change change change” in the reports to make the point. Or is it with more words, more arguments, more examples. There should be other ways to describe an increasing focus.

**Different companies use different content, and different format.** On the variation dimension, we face an issue of heterogeneity of corpus. Each company uses different format. Some are much more into financial information than strategy and business model (ENGIE), some are sharing at length vision for the company (EDP). Heterogeneity of corpus is an issue

### 3.3 TOOLS

After data selection, this section looks at options to analyse them. Using quantitative tools to study large discourse, texts amount is widespread in research. Some numbers of research references are extracted from Google Scholar on Table 6:

| Nb of references                  | Tool + “energy” | Tool + “legitimacy” |
|-----------------------------------|-----------------|---------------------|
| “Data mining”                     | > 3 000 000     | Around 227 000      |
| “Text mining”                     | > 2 400 000     | Around 172 000      |
| “Quantitative discourse analysis” | Around 400 000  | Around 222 000      |
| “Lexicometry”                     | 63              | 332                 |
| “Textometry”                      | 27              | 45                  |

**Table 6 Number of references of analysing tool applied to energy/legitimacy in Google Scholar (July 2020)**

Strongly influenced by ‘big data’, ‘data analyst’, text mining stream of research focuses on a bottom up approach, mining very large data (starting at 1 Mio words) into metrics. This is not the direction taken here.

Quantitative discourse analysis is also an active stream of research, inside the family of computer-assisted qualitative data analysis software (or by its acronym, CAQDAS). In this range of software, NVIVO alone represents more than 15 000 references since 2016 on energy sector. With mostly high manual treatment and low automated results it was not retained for the present research on long texts, 200 to 500 pages here.

Choice made here is TXM tool which allow a dialogue between text and statistics. First step is analysing text with some statistic reading keys (this kind of coding could be structures like nouns, verbs or themes like energy, management). Then statistical results allow to come back to individual verbatim, to refining searching engine, in an iterative process.

#### 3.3.1 The large family of discourse analysis tools

**Relevance of statistical text methods in management studies.** Here are few research developments in management taking statistical analysis of texts as primary data.

First source of data used is press articles, with the underlying assumption that coverage of a phenomenon in the press is a representative sample of its content. This design was applied in management field with analysis of press articles to illustrate how music companies developed strategies of legitimacy to maintain, or not, control over their industry (Blanc & Taupin, 2015); and similarly on how music companies in France in the period 1998 to 2008 have fought against digitalization of their sector (Blanc & Huault, 2011). In the field of energy transition, there is a textometry paper comparing USA press and Italy press on Kyoto Protocol (Bassi, 2010).

Then a second source is **corporate information issued by companies**. There is also a stream of research using annual reports. Most of them have a focus on accounting, for example an attempt uses annual report to detect vocabulary that could be a hint for a fraudulent behaviour, in "beyond the numbers: mining the annual reports for hidden cues indicative of financial statement fraud" (Goel & Gangolly, 2012). There are nevertheless research extracting pattern and information on more qualitative and transformational elements, like market intelligence in new service developments, "extraction and visualisation of industrial service portfolios by text mining of 10K" (Lee & Hong, 2016) or importance attached to quality by management of firms, in "A methodology for analysing and evaluating narratives in annual reports: a comprehensive descriptive profile and metrics for disclosure quality attributes" (Beattie et al., 2004).

**Methods and software associated.** Many research methods coexist, mixing the way to look at data, (meaning of words first, or number of words first) and what to do with them (figures, graphs, verbatim, categories...). What these methods teach first is that lexicometry, text mining, textometry are not only a question of words. Name of method itself refers to text considered as meaning or as numbers. Is a text only a series of word? This would be caricatured into text mining. Or is a text first and foremost association between words? This could be illustrated by "energy transition" being very different from different energies, and very different from any transition in general.

Within text statistical analysis, there are different streams of research. These methods of using statistics to explore text are ways of quantitative analysis on qualitative data. The common and most popular term for these methods is lexicography, sufficiently widespread to have a full dedicated dictionary (Hartmann & James, 1998). With different schools of thoughts and practices, along the term lexicometry appeared on one hand, text mining, focusing on analysis of large corpus, with the metaphor of the mine in the text mining: as we dig, we find a lot of material embedded in the text, but we lose the initial structure; and on the other hand textometry, focusing on methods that allow a back and forth analysis of the whole corpus and signs, words,

sentences. The latter appears more like archeology, where each finding can be traced back to how it was constructed and found in the text.

From now on in this research, we will use the term textometry, in a large definition comprising “textual statistics, lexicometry, logometry, as an instrumental approach of corpus, that brings together quantitative statistics and detailed analysis of the text” (Lebart & Salem, 1994; Pincemin, 1999)

### 3.3.2 Choosing text analysis over text mining

In one of his books, Mintzberg was comparing management research to a miner digging gold. “You need to dig one ton of ore to find one kilo of gold. But if you do not dig it, you will not find gold”. This is well suited for the concept of text mining or data mining: if we dig/crunch/download sufficient data, results will come. But the role of research appears to be how you define gold, how to measure or qualify it vs other kind of metals or crystals in the ore.

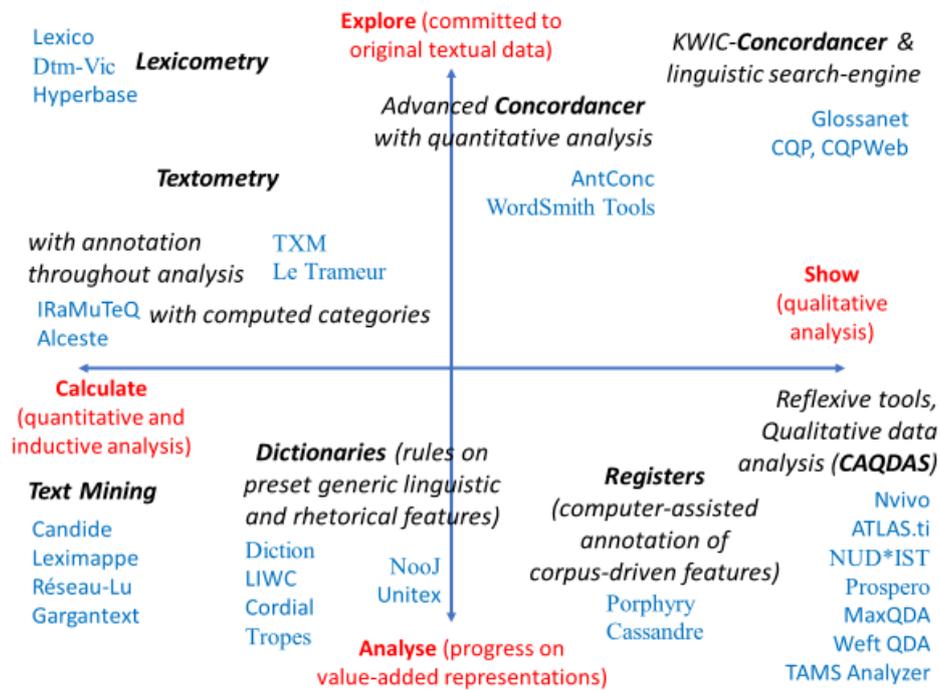
**Comparison of tools.** There are an increasing number of tools and research developed on discourse content, whether from the internet, from verbal or written sources. To keep the metaphor of digging for gold, all the potential tools for discourse analysis can be classified for digging: with one hand, both hands, with a spoon, a shovel and a pickaxe, a bulldozer... Each software will be on a different granulometry, more or less observation, calculation, interpretation.

All these tools have differences in level, not in nature. They share data, linguistics elements, and produce knowledge which would not be accessible by a cursive reading. Two families can be specified, one around text mining oriented a more quantitative approach, and a second around discourse analysis, oriented toward more interpretation. They are defined (Née, 2017) p11: “on one side, text mining or automated language processing, which aims at producing software to process automatically language elements into a field application . And on the other side discourse analysis tools which “consider verbal or written texts not for themselves but in relation to their context”.

This section tries to avoid opposing different approaches, but to suggest how they can complement each other, while we expose which options we take. For example, text mining can generate synthesis based on very large amount of data, starting at 1 million words. And this outcome can be a perspective to evaluate in discourse analysis how theme emerge, when, and interpret the changes by statistical and textual results.

There are many **reviews of tools and software existing**, in a very active research community

(Née, 2017; Tannen et al., 2015). The panorama of what exists is probably growing larger every day, with communities gathering around various software, and software blossoming to additional research communities. Emilie Née raises the most important question “what software and to perform what?”.



**Figure 18 Classifying tools by family of functions adapted from (Lejeune, 2010, 2017)**

Figure 18 started with a typology by Lejeune (2010) and was updated with research and software developments since then. It first classifies tools into explore or analyse. Exploring tools focus on observation, organising data, and provide good ways to compare or synthesise. Analysing tools are looking more at coding material, or elaborating knowledge from inside the text. The second dimension is calculating vs showing. Calculating tools are backed by statistics, from trivial “counting words” to hypergeometrical distribution and following research in statistics. We plotted on this graph some past and current tools. They are more complementary than in competition: concordance tools are a good entry to move to textometry, interview coding could be done with NVIVO or TXM with different ways to analyse.

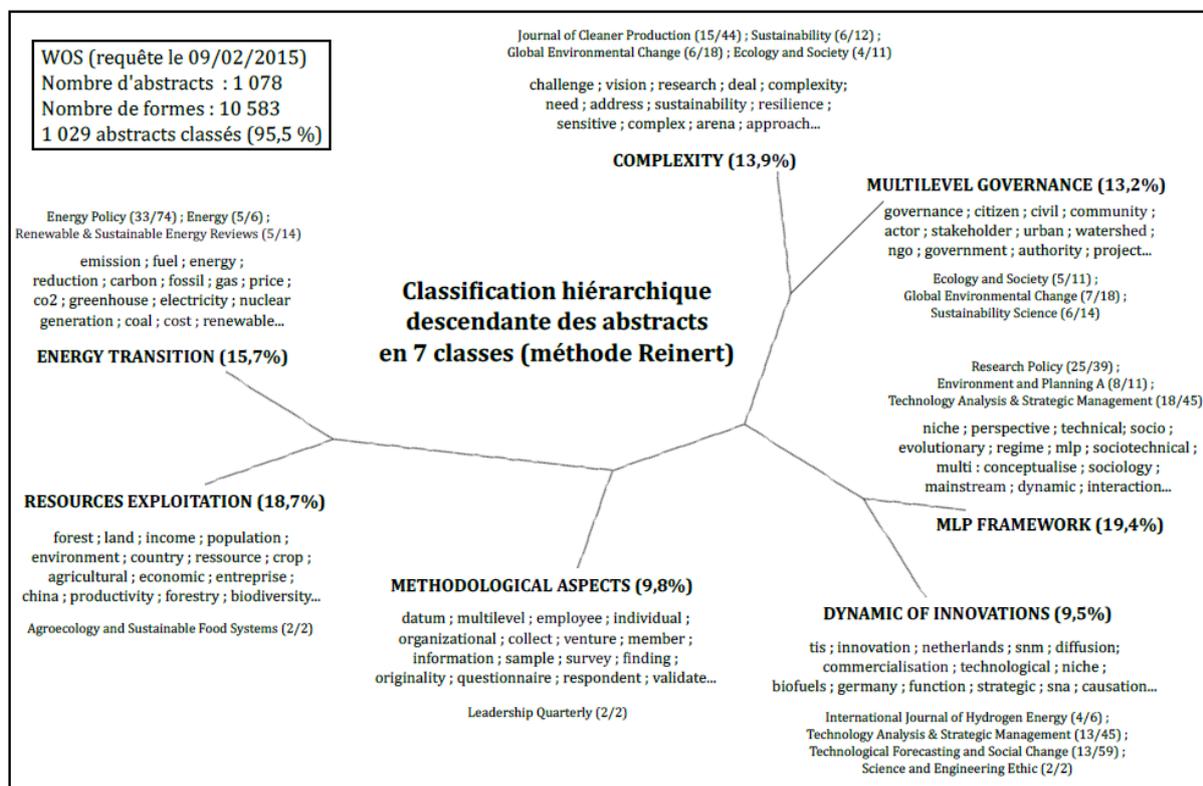
**Some examples using some software.** As an example of concordance type of work, a relatively old paper (Bassi, 2010) looks to compare of press articles on Kyoto Protocol, with 832 articles. It was performed with TreeTagger for identifying grammatical forms, then WordSmith Tools. In reflexive tools, a good example with Prospero is an analysis of in the music industry of the thematic of authors rights with 800 press articles in France (Blanc & Huault, 2011; Blanc &

Taupin, 2015). A more comprehensive review of how to analyse narrative in annual report was made by Beattie et al., (2004). They relied mainly on QSR NUD\*IST.

And for the use of dictionary tools, one example was how to detect fraud in companies, by screening 126 American companies through their annual reporting 10-K form (Goel & Gangolly, 2012). Here the authors used DICTION 5.0 among several tools.

**Research in theoretical frame with statistical text and Multi Level Perspective.** There is a stream of statistical text research using Multi-Level Perspective. One source of data is peer reviewed articles. Ollivier & Plumecocq (2015) explored occurrences, use and concepts associated to multi-level perspective in the academic literature.

Figure 19 shows a classification with the lexicometric tool Alceste of citations based on Web of science. Authors using socio technical transition have been ordered in classification in a mix between statistical importance and text content.



**Figure 19 Classification with Alceste tool of socio technical transition in research articles (Ollivier & Plumecocq, 2015) p3**

This past work on linking specifically multi-level perspective diffusion, in different research fields, with statistical text analysis, contributes to legitimate a research design of using-multi-level perspective with textometry.

**Rationale of TXM selection.** For the present research design, we went for analysis. From the large corpus assembled we search how legitimacy is changing, in the middle of the text.

Then we select calculation over representation, in order to increase the sample size, and minimize a priori coding from the text. If this leads to statistical treatment to manipulate some 18 000 pages, elaboration of insightful visuals is mandatory, which leaves large space to the dimension hereabove called showing.

### 3.3.3 Introducing TXM software

As discussed in previous section, there are numerous ways to generate statistical analysis on all kind of written, or oral discourse. As such, there are also several methodologies and software to approach the question of evolution of legitimacy of utilities under the pressure of energy transition.

Main criterion here is to have a balanced design between qualitative elements, down to titles, verbatim but also a quantitative part to compare companies, years, specific vocabulary used. This is ruling out bottom up approaches of text mining.

**Choice of textometry software TXM.** Entering in the field of statistical text analysis, we first look at Prospero software. Use of Factiva for press source and Prospero for analysis has been for example longitudinal study 1988 -2008 music sector in France (Blanc & Huault, 2011; Blanc & Taupin, 2015).

Then, looking into the family of lexicometry and textometry software, TXM offered interesting intersection between linguistic expertise, and application into many fields. If one of the first field was medieval studies, then history, there were also developments in finance (Bédécarrats, 2012) and some energy comparison between China and France (Shen, 2016). Political science research looked at studies on 1970-2000 for international institutions of World Bank, International Labour Organisation and OECD (Leterme, 2017) at the crossroads between economic history and political discourse.

The software TXM (Heiden, 2010) was developed by ENS Lyon and Besançon University. The development team continues a tradition of statistic and linguistic developers in France. Some historical authors have created methods and tools with a large echo (Benzecri, 1969; Lafon, 1980; Lebart & Salem, 1994). Tool development continues to be very active, last release TXM 0.8.0 in 2019. A short introduction can be found on <https://halshs.archives-ouvertes.fr/halshs-00549779/>

We performed a benchmark between textometry tool in a seminar at Paris Sorbonne in January 2019, which confirmed the use of TXM. Other tools exposed on this occasion were IRaMuTeQ, NOOJ, HYPERBASE, LEXICO5 which made a sufficiently large panel to confirm choice of

TXM for this research. Many of these tools, which is also the case for ALCESTE, have much more in common than in competition. Statistical calculations complement each other.

**TXM Research community and technical support.** A precious characteristic of TXM is the large community of TXM users and the support from TXM developer team. The two main principles which have guided its development were open source coding, to ensure full evaluation and reproducibility in the research community. The second principle was to ensure full transparency and avoiding any black box effect, so that a community can participate to its further development.

This will not be developed further in this research, but mastering import, in the proper format and with metadata to recognise the structure of corpus is about half of total acquisition cost in time and effort. TXM team proved to be lovers of numbers and lovers of words, both are precious.

Two aspects of TXM are very suitable for this research. First, an **iterative approach for collecting data**. In the various forms of corporate communication, there is no evidence from the start which kind of documents will prove to be the most relevant. TXM software allows to start with a small corpus, simulate analysis, and then enrich and automatise text data into the research. We tested small selection of a few press release for 5 pages, a single annual report for 150 pages just for tuning.

**Text statistics allows to go back to the text.** Design with textometry is not one a way process from the corpus to statistical analysis, but allows for back and forth to the text content. Each time we develop statistics on ‘decision’, our design ensures that we can come back to initial sentences, highlight their context and determine if the analysis needs further tuning.

Another advantage is the automatic identification in corpus of grammatical forms, that can be used for analysis of verb + noun, or adjective + nouns. This is achieved by parallel execution of TreeTagger, performing automatic recognition of text structure (Schmid, 1994). As an example, in our research it can be interesting to measure when energy is associated to new energy or conventional energy.

### 3.4 TYPES OF ANALYSIS GENERATED WITH TXM SOFTWARE

**Introduction to statistical analysis in TXM.** This section aims at presenting statistical objects in a pedagogical way. Before using a whole set of requests to produce results, here is a short explanation of each statistical treatment together with examples. Requests and features

of TXM software are presented here, together with some benchmark from other research fields (such as linguistic, geography, history). This section covers main linguistic concepts used in this research. It refers to features in TXM software with definitions followed by examples. For clarity, we use an extract of CSR report of 88 words to explain the statistical treatments performed.

**From text to corpus.** The starting point is an extract of text, from ENGIE, named “2016 Integrated Report/Group profile report”.

ENGIE has put responsible growth at the heart of its electricity, natural gas and energy services businesses to rise to the major challenges of the energy transition to a low-carbon economy: access to sustainable energy, alleviating and adapting to climate change and the rational use of resources.

The Group develops effective and innovative solutions for private customers, towns and businesses, particularly drawing on its expertise in four key sectors: renewable energies, energy efficiency, liquefied natural gas, and digital technologies.”

It has all the characteristics of a text. It is considered as a corpus when additional information is added inside and outside the text. Outside is delimitation from another text which could be the report just before or just after. It is also the metadata attached to the text, here name of company, year which will allow to perform analysis in giving dimensions to the corpus (one company, all years for example). This is analogous to reference coding in Zotero or other similar reference software. Inside the text it is mostly lemmatisation, when words are categorised in nouns, verbs etc, and words are recognised by family. The lemmatisation software running here is TreeTagger (Schmid, 1994) used together with TXM.

Difference between text and corpus is a very large theme in linguistic, and only very superficially evoked here. the seminal definition for corpus is “a collection of pieces of language that are selected and ordered according to explicit linguistic criteria in order to be used as a sample of the language”(Sinclair, 1991), still referred to in recent research (Lebart et al., 2019). What is most relevant for this research is explicit criteria, for us it is CSR report, and equivalent reports, and carve out of financial section. Then we retain that corpus is selected and organised, for us we take company and years.

### **3.4.1 Lexical table**

First feature used in TXM is a dictionary with the number of entries. Inside the dictionary everything counts, including punctuation, numbers. Number of occurrences is illustrated below

in Table 7 Lexical table of test corpus: all entries above two occurrences Table 7. “,” and “.” are usually the most frequent forms, but as the extract is so short it is only the case for the comma. These smallest entries will be the basis to select or deselect the words studied. As a general rule, this research will not detail punctuation and it will be discarded in all requests. This could have led to evaluation like how the sentences are structured for some companies (like very literary report by EDP) compared to shorter sentences.

| "word"     | nb occ. |
|------------|---------|
| ,          | 7       |
| and        | 6       |
| to         | 5       |
| energy     | 4       |
| the        | 4       |
| Group      | 3       |
| of         | 3       |
| —          | 2       |
| :          | 2       |
| .          | 2       |
| businesses | 2       |
| ENGIE      | 2       |
| gas        | 2       |
| its        | 2       |
| natural    | 2       |

**Table 7 Lexical table of test corpus: all entries above two occurrences**

### 3.4.2 Index

Query by index is the cornerstone of search inside the corpus. By keying in criteria for the index, occurrences for the total corpus or any part (partition, sub-corpus) are indicated. There can be as many criteria including or excluding, on word, lemma or punctuation, one or many words in a row...

For our small test corpus of 88 words, it can include requests such as:

By word directly: how many times “energy”? number of occurrences is 4.

By grammatical form: any adjective in the corpus? This brings “natural, digital, effective, innovative, integrated, major, private, rational, renewable”

Here appears the iterative part of statistical text research. If the number of occurrences is N, is it different by year, by company? When several words are associated, like in “energy transition” are the results different from each word individually? What verbs are typically associated to energy?



|                                   |                      |  |
|-----------------------------------|----------------------|--|
| and effective, leading to         | improved performance | <b>and</b> safety for our workforce      |
| highly engaged workforce not only | improves performance | <b>but</b> also improves company culture |
| strengthening projects to         | improve performance  | <b>Energy</b> losses Eskom’s overall     |

Concordance is a very old tool used to compare bible extracts. Lejeune, (2010) p23 traces them back to 1200s with Jews and Catholics starting to build innovative methods to analyse sacred text. This author dates the start of concordance tool from that context, when it was handwritten by monks.

### 3.4.4 Cooccurrence

As indicated in the word itself, cooccurrence indicates how two word can be found together in a corpus (also sometimes referred to as collocations). “Can be found” refers to frequency and how to analyse this frequency. And “together” refers more to a distance from the first word observed.

For example, in our full corpus we want to see the words most associated to “energy”. Out of a long list, the highest scores are:

|        | Frequency | cofrequency | Score | mean distance |
|--------|-----------|-------------|-------|---------------|
| solar  | 2945      | 794         | 303   | 3.1           |
| supply | 7370      | 1283        | 280   | 2.5           |
| demand | 3351      | 766         | 242   | 3.0           |

**Cooccurrence table of “energy, 3 highest scores**

This is to be read as “solar” has the highest score of cooccurrence in the corpus with “energy”. It is less frequent than “supply” for example, but statistically more strongly associated with “energy”. Average distance between “solar” and “energy” is 3.1 words on average, so that for each “solar energy” in the text, with distance 0, there are many cases where the two words are far apart.

This tool serves two purposes: first one is to explore environment of a word. Here what kind of words are present when the text contains “energy”? The second use is to identify words with a close meaning. Not necessarily synonyms but words that come often together. “affordable, reliable” for example come together regularly, as cooccurrence example, they are connected but not synonyms.

### 3.4.5 Correspondence Analysis (CA)

**Origin and description.** We do not pretend in this research on strategy and energy to present an academic overview of such complex tools in statistical linguistic. The purpose in this research is merely to use them and interpret correctly, which includes also supervision from experts in the field.

Correspondence analysis was developed by research school of French statisticians, called “Analyse Factorielle des Correspondances” (Benzecri, 1969; Lebart & Salem, 1994)

We simplify it here as a projection on two dimensions of relationship between words and corpus parts in a space of  $n$  dimensions; all words selected are grouped in vectors, calculated to represent the highest percentage possible of variations. Then two axes are formed with these highest vectors. And on these two dimensions, units of the corpus (for us usually years, or companies) and individual words are plotted. There is no easy textual definition, outside of statistical demonstration.

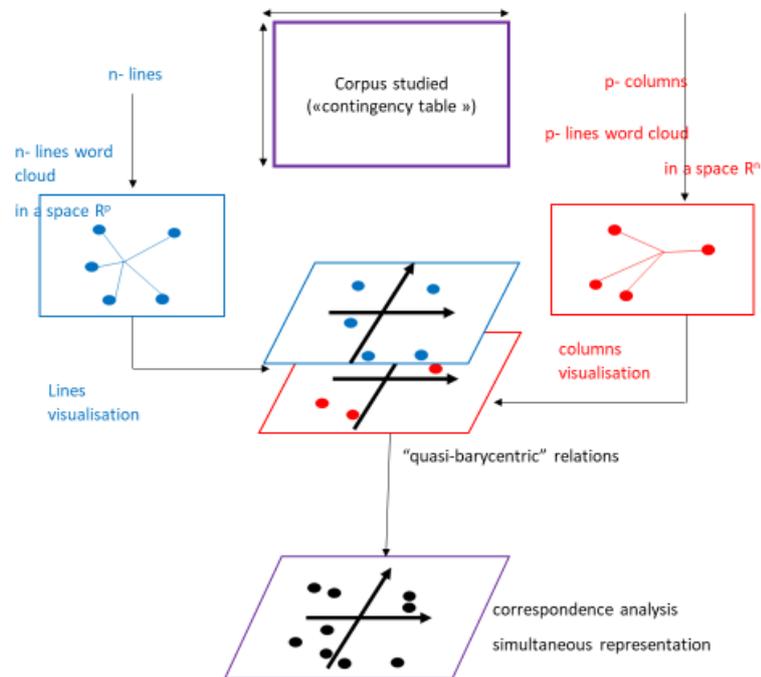
**How to use correspondence analysis.** Use and interpretation are well defined by (Lebart et al., 1991) “Thanks to these techniques it is possible to visualize the associations among elements (forms or segments) and groups of respondents or categories of variables. Thus, a visualization of the proximities between words and categories can help understand the responses of each of these categories”. The point we use the most is the visualisation between companies, years and categories which can be “energy, strategy” or series of words indicating legitimacy, or other themes.

A consequence is that axes (such as in example in Figure 22 are statistical representations without unit, no direction, they represent the projection on a surface of word associations with the highest percent explanations. The same correspondence analysis can be displayed with choice of other axis which has a lower percent of total variation but may present interesting patterns.

This tool is used here to show evolution effect, also called Guttman effect (Salem, 1988). In the word distribution a time effect appears as a horseshoe pattern, and the calculation creates the mix of words, or vector, on which this representation has the largest percentage of explication factor.

In our analysis of corpus, it happens that some values are irrelevant, which pushes in the correspondence analysis a point at one extremity without significance. It is neutralised by a “peeling exercise”. An example with words associated to carbon (in section 4.3.2.2) year 2010 contained many occurrences of “CR” for corporate responsibility singular to this year. By peeling off this anomaly, year 2010 is no longer peculiar in the series.

**Correspondence analysis as visualisation of statistics.** The way correspondence analysis is generated from the text has been visually explained in Figure 21 (Lebart et al., 2019).

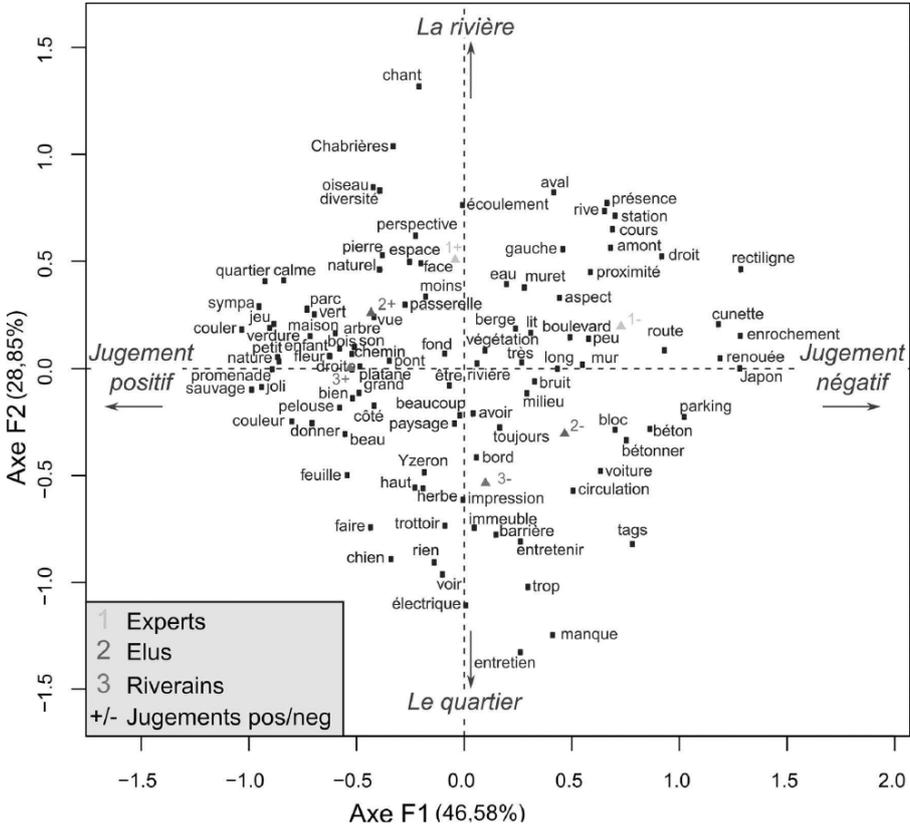


**Figure 21** Adapted from “simultaneous representation figure” (Lebart et al., 2019) p 221

The corpus studied is at the top of the figure, as a “contingency table”, it is analysed statistically as a series of columns in a space made of line number dimensions and simultaneously a series of lines in a space made of column number dimensions (or more precisely number of columns + number of lines – one). Each one is used to generate a multidimensional representation, one on the line dimension and the other in columns. As they mathematically share the same axes, these two visualisations can be brought together and projected on a simultaneous representation of all lines and columns. This correspondence analysis is the superposition of vectorial space of lines and numbers. To be noted here that from the unique correspondence analysis table several extracts can be made into different percentage representation of the statistical dimensions. So that at the bottom of Figure 21, correspondence analysis is an optimised visualisation of dimensions in the corpus.

Another formulation is given in “a correspondence analysis allows to generate a graphical view with factorials plan surface of how vocabulary in each part is used in different ways” (Gobin & Deroubaix, 2010; Volle, 1997).

**Illustration from another research field.** A very developed example is shown in Figure 22 where three kind of stakeholders, experts, representatives and neighbouring citizens are visualised on an inquiry: if here the purpose is landscape evolution of Yzeron river close to Lyon, our focus here is how each category gives a positive or negative judgment (horizontal axis) about the river / the surroundings (vertical axis). Correspondence analysis takes the whole inquiry and creates a vivid projection on how stakeholders align their arguments.



**Figure 22 Correspondence analysis, discourses on the landscape assessment by different groups of stakeholders (Flaminio et al., 2015)**

**3.4.6 Specificities**

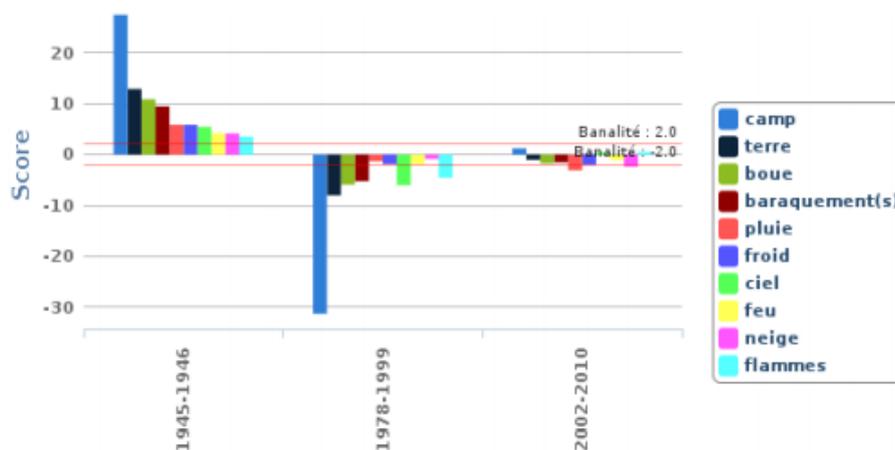
Last brick from textometry presented here is specificity calculations. As its name indicates, it is a calculation and visualisation showing how specific or generic a word is across the corpus. For one word, or several, the calculation shows how specific they are between companies, or across years. In an oversimplistic example, if we were looking how specific “2008, 2018” are in a partition by year, we would find that for the part of the corpus in 2008, “2008” is extremely over represented, and “2018” very low specificity score. And in the part of the corpus for 2018 it will be the opposite.

**Definition and sources of specificity.** A more mathematical definition from the TXM manual indicates that “exact calculation is derived from the probability that an event appears as many times as is observed in the corpus part, or even more frequently while following a hypergeometrical statistical distribution”.

For our purpose, ‘event’ means a word, or different ones when testing several specificities next to each other; ‘corpus part’ is the part overall of corpus on which the calculation is done, for example a partition or a sub corpus by year, or by company.

A main advantage of this tool with a long track record in statistical text analysis (Lafon, 1980) is to complement a correspondence analysis; when words or lemmas appear very close to a corpus part in correspondence analysis, specificity calculation shows whether it is the case or just an effect of the dimensional reduction from total word count into a 2D space.

**Example from history and literature field of research.** Specificity calculation is looked with positive and negative values. This is illustrated in Figure 23 with all positive values showing an overrepresentation in the corpus, and negative values an underrepresentation. When numbers are close to 0, usually in a -3 / +3 range, literature considers them unspecific. These are mean or expected representation, without further potential of explanation.



**Figure 23 Specificity calculation on memories of WWII concentration camp survivors (Mayaffre et al., 2018) p11**

This specificity looks at many autobiographical texts by survivors of concentration camps. Analysis show that all text written directly after WWII have very high specificity on immediate experience (“camp, soil, mud”). For later texts which were written in 1978-1999 at a longer distance from the event, this concrete vocabulary is on the contrary underrepresented. With the time, the narrative is concentrated on other dimension, reflexion or emotions, and has left the direct quote of some of daily environment details.

This list of tools used, lexical table, index, concordance, cooccurrences, correspondence analysis and specificity is not exhaustive. It covers elements used in the statistical analysis of part four. Some further tools would be very valuable to explore, especially clustering methods (Lebart et al., 2019) but have not been included in this research.

### **3.5 CONSTRUCTION OF CORPUS**

After description of main features of TXM software and links to linguistic, this section details the sample construction, which companies and for how many years.

As textometry is largely an iterative design, some three research iterations are presented. Then the research program for producing result is made explicit.

#### **3.5.1 Sampling and construction of a corpus of 129 CSR reports**

**Starting point for sampling electricity companies.** Using extensive data for all existing utilities worldwide seems inaccessible. So, what could be a reasonable list of criteria? Taking only listed company helps to ensure that reports are audited and shared with many stakeholders. Deciding size of company either in turnover or in employees or production capacity could have been a criterion, but not a satisfactory source for a worldwide comparison. Focusing on European companies has the advantage of a more consistent energy regulation system. Focusing on American companies has the advantage of more consistent reporting rules. But mixing some European, some American and others provides a wider range of patterns to observe. Time period for collection of data would ideally start at the Kyoto Protocol 1997 to capture how energy consciousness materialised, up to most recent reports published.

**Companies in the convenience sample.** The process of construction of the sample is explained in next section, here is the final selection, with a sample consisting in 12 companies:

European companies from France (EDF, ENGIE), Germany (RWE, E.ON), Spain (IBERDROLA), Portugal (EDP), Sweden (VATTENFALL), United Kingdom (SSE);

American companies Pacific Gas and Electric (PG&E) Duke Energy, American Electric Product (AEP); as well as south Africa, ESKOM.

Our time line ranges 2003 to 2018:

- Few companies published CSR report, or keep access on line to data. We did not attempt contact companies for more historical data than available on their website.

- Some years are not accessible. Either for change in reporting (when 2008 report succeeds a 2005/2006); or for technical reasons of conversion into text formats.
- Three companies have 2019 reports, which are 2018/2019 reports published up to March 2019. We kept their label of 2019 but did not consider them as full indications for 2019
- Data retrieval stopped in July 2019, and no full year 2019 report were included.

This results in following Table 8 in number of pages:

| nb pages    | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| AEP         |      |      |      | 54   |      | 68   | 72   | 56   | 54   | 56   | 115  | 145  | 155  | 112  | 101  | 111  | 129  |
| Duke Energy |      |      |      | 36   | 46   | 52   | 40   | 44   | 36   | 36   | 36   | 42   | 42   | 50   | 52   | 55   |      |
| Edf         |      |      |      |      |      |      |      |      | 508  | 532  | 496  | 524  | 313  | 510  | 538  | 508  | 532  |
| EDP         |      |      |      |      |      |      | 128  | 146  | 294  | 151  | 190  | 210  | 176  | 235  | 171  | 208  |      |
| E.ON        |      |      |      | 64   |      | 133  | 142  | 155  | 129  | 197  | 259  | 204  | 217  | 173  | 134  | 112  |      |
| ENGIE       |      |      |      |      |      |      |      |      | 484  | 412  | 404  | 408  | 388  | 52   | 56   | 52   |      |
| Eskom       |      |      |      |      |      |      |      |      |      | 166  | 140  | 96   | 128  | 76   | 80   | 80   | 95   |
| Iberdrola   |      |      |      |      |      |      |      |      | 255  | 221  | 202  | 266  | 246  | 272  | 336  | 414  |      |
| PG&E        | 99   | 104  | 77   | 84   | 86   | 96   | 123  | 203  | 225  | 188  | 199  |      | 163  | 165  | 167  | 187  |      |
| RWE         | 48   |      | 88   | 28   | 88   | 32   | 104  | 70   | 142  | 155  | 83   | 96   | 104  | 77   | 92   | 98   |      |
| SSE         |      |      |      |      |      |      |      |      |      |      |      |      | 19   | 20   | 28   | 31   | 39   |
| Vattenfall  |      | 94   | 86   |      |      | 90   | 90   | 80   | 37   | 125  | 137  | 162  | 174  | 186  | 192  | 184  |      |

**Table 8 Size of CSR corpus analysed, by company and by year (unit = nb pages)**

**Construction of the convenience sample.** We select a series of electricity companies which have been publishing Corporate Social Report for at least 10 years. All reports are taken in English to be comparable. It is assumed that each company communicates in its English version a similar content that what it publishes in the main language of operations. Figure 24 Logos of companies in the sample



**Figure 24 Logos of companies in the sample**

It is a **convenience sample**. By electricity company we include companies producing electricity, and selling electricity, sometime transporting and distributing as well. It does not

correspond to energy companies, that would include oil and gas production, or utilities that would include water distribution.

We use a **series of criteria or reasons** for selection, including consulting reports on Global Compact or open sources on size and transformation of companies.

It results in the following companies, with logos illustrated in Figure 24 , sorted by alphabetical order:

#1 American AEP: focus on transformation. They announced several closures of coal power plants.

#2 American Duke Energy. Focus on size.

#3 French EDF: focus on size and activities in several countries in Europe.

#4 Portuguese EDP: focus on size and takeover trial. With strong interest by Chinese company Three Gorges Corp, that makes them an interesting case of strategy, even if the takeover was abandoned in May 2019.

#5 French ENGIE: focus on transformation. The company put in place a new organisation by business units and started a large divestment plan of coal assets in Australia (Hazelwood in 2017) and Thailand (Glow in 2019).

#6 German E.ON: focus on size and transformation. They went under several organisational changes in the recent years.

#7 South Africa Eskom: focus on pressure to change. The company is expressing many weaknesses, and under strong pressure for production and reliability.

#8 Spanish Iberdrola: size and history in energy transition. This large utility has a long history in renewable, and engineering experience. Issues CSR since 2004.

#9 American California utility Pacific Gas and Electric (PG&E) was selected because of the deal to close last nuclear reactor Diablo Canyon and build large renewable projects.

#10 German RWE: focus on transformation, first splitting companies into conventional and renewable, and few years after reuniting them with exchange of assets, into a production company and a distribution company.

#11 UK company SSE: size criteria. And including one of the 5 large UK players allows to have a more balanced sample of energy companies in Europe.

#12 Sweden VATTENFALL: size and track record in energy transition.

This convenience sample is **leaving out many interesting cases**, at least in three directions. In Europe, ENEL (Italy) would have been an interesting company, together with EnBW (Germany). In America, Florida Power and Light, and Tennessee Valley Authority would also

have been interesting. And in Asia, at least TEPCO (Japan) and KEPCO (South Korea) would have been very valuable cases. This list could be extended much further...

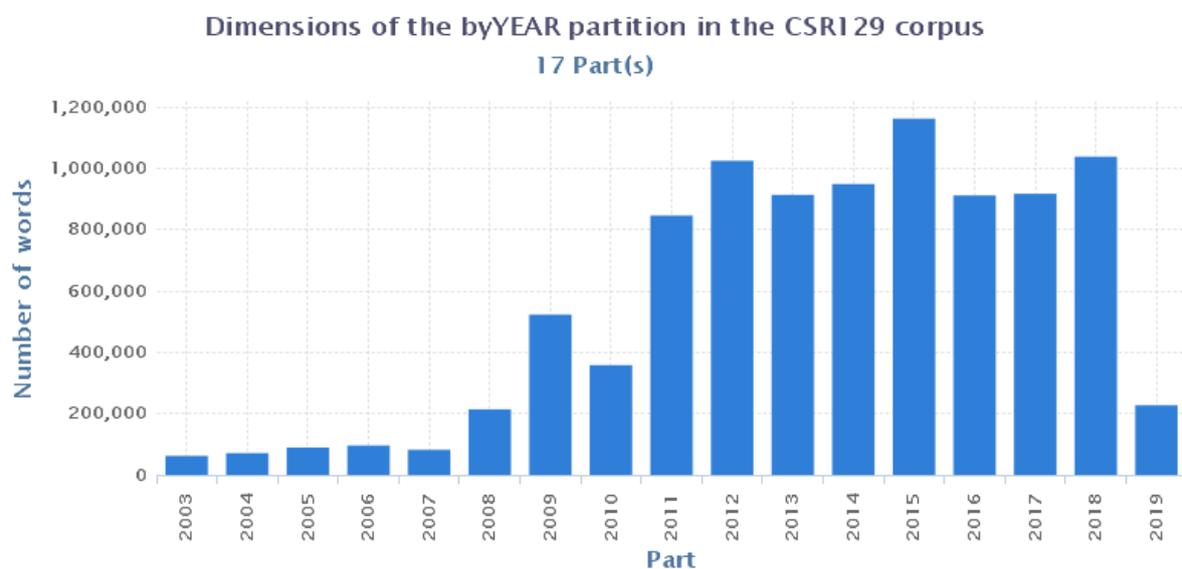
It would require further efforts to determine if they have been issuing CSR reporting for sufficient years in a row.

We see no reason why our sample would create a bias in the data, but no proof either that the sample is the best representation of all electricity companies. Construction of our sample was done to capture sufficient diversity, but to limit geographical range to maintain some common way of writing and presenting.

**Dimensions of the corpus.** CSR reports from the companies' sample make a corpus of around 18 500 pages; or representing some 9.5 Mio words. Word is defined here in a textometric comprehension, where a figure, or a punctuation counts for a word.

The corpus studied can be described by two main dimensions, by year and by companies. This is also the principal requests and visualisation which we use in part 4.

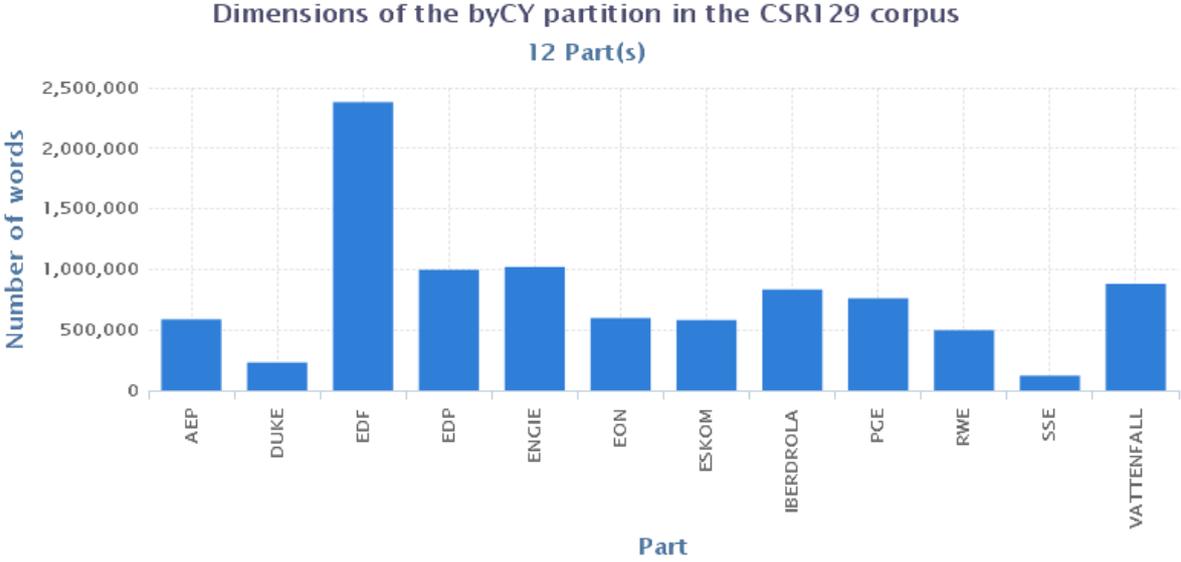
First a chronological dimension, with how many words weigh each year in the corpus, as shown in Figure 25 Bar chart of number of words in the corpus, by yearFigure 25.



**Figure 25 Bar chart of number of words in the corpus, by year**

This time dimension shows how each year weighs in the corpus. Between 2003 and 2008 there are few data points, both because few companies issue CSR report, and because these reports are often relatively short, 50- 100 pages. Then, 2009 – 2018 are large corpus for analysis. 2019 is made of companies that issue annual results April to March, so that it compares to full 2018 for other companies.

Then a dimension company by company, with a very wide range of how each company in the sample contributes in words.



**Figure 26 Bar chart of number of words in the corpus, by company**

The distribution of number of words by company raises the question of homogeneity and representativity of each company. In the bar chart Figure 26 some companies (EDF) weigh much more than others (SSE). We will take this into account for our analysis. A perfect corpus, homogeneous, is an illusion, hence the prerequisite to ensure that it can be interpreted (Lebart et al., 2019). One advantage of textometry is to take into account size of different texts making the corpus. Another option to bypass heterogeneity is look at ranking of words used by each company, not only total numbers; or looking at main association of concepts for each company. It also means to study partitions of the corpus, sometime early years vs 2016-2018 or sometimes evolution within one specific company.

**3.5.2 Iterations in research**

Construction and analysis of corpus were done in three main iterations as shown in Table 9: Iteration one and two are on a corpus of reports from RWE, Germany, 15 years for longitudinal, and 10 different report for 2017 for variation.

Iteration three was done on 103 CSR reports, for 10 to 12 companies, ranging from 5 to 12 years.

| Name | Date of upload TXM | Nb of corpuses | Nb of words |
|------|--------------------|----------------|-------------|
|------|--------------------|----------------|-------------|

|                       |                 |                                     |                        |
|-----------------------|-----------------|-------------------------------------|------------------------|
| Iteration 1           | Nov 2018        | 15 years for RWE<br>10 CSR for 2017 | 497 390 w<br>596 654 w |
| Iteration 2           | June 2019       | same                                | same                   |
| Iteration 3           | July 2019       | 103 CSR reports                     | 4 960 265              |
| <b>Current corpus</b> | <b>Dec 2019</b> | <b>129 CSR reports</b>              | <b>9 500 000 w</b>     |

**Table 9 Progression in the size of data analysed within textometry tool**

A large part of iterations not described here is the process from retrieving a report on a corporate website, usually in a PDF format (portable document format) up to loading raw text into the software (.TXT format, edited with notepad or libreoffice). Luckily, progress and integrity were controlled by supervision from TXM team.

Here some remarks show for the main three iterations main steps followed. Results achieved are here below classified in iteration of corpus. They are not ordered into a demonstration.

**Considering a first iteration as a prototype.** This initial set of analysis was performed on one longitudinal corpus (1 company 15 years) and a variation corpus (10 companies for 1 year). This is the discovery cost to start using linguistic concepts and requests to run on the corpus.

Results achieved can be summarised as:

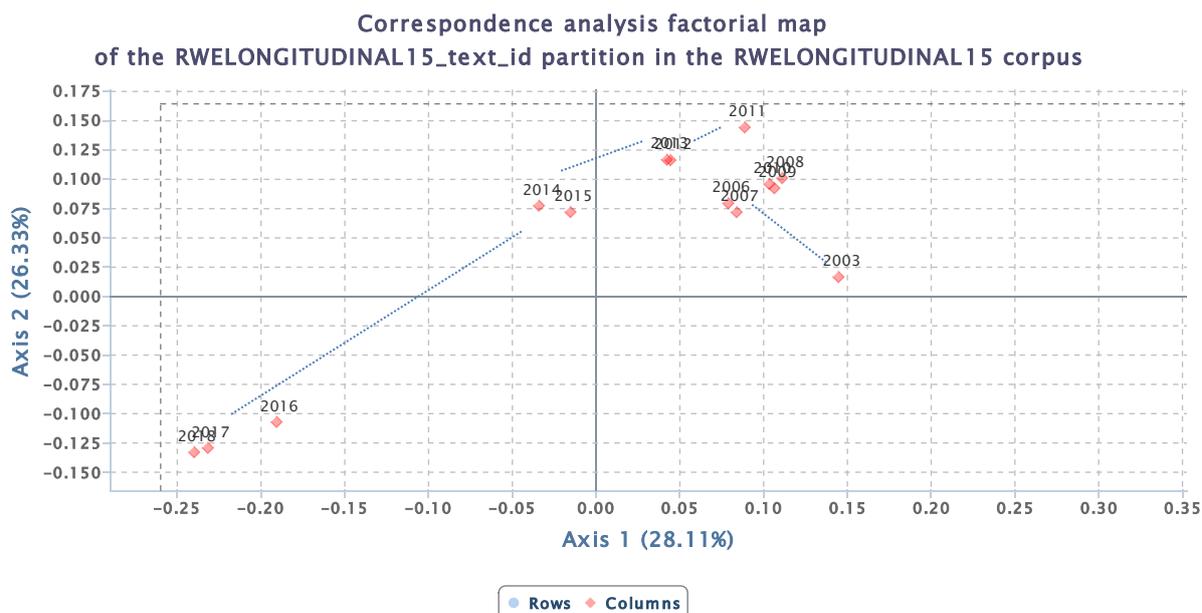
First, time dimension is appearing in the corpus and how it focuses on transformation. Based on a first reading, we aim at measuring discourse on: change, transformation, energy transition, innovation, climate change, business model. Performing a simple word count on first relevant concepts shows intensity of the subject and progression.

Second, the use of concepts indicates changes in business and priorities. This analysis was done alongside nouns, taking a view on most frequently used nouns.

And third, transformations look different depending on energy sources observed. This was focused on adjectives of the corpus.

**Next iteration with 103 CSR reports as corpus.** The move to this next iteration is to have the targeted number of companies and targeted number of years. All technical issues to upload into TXM were left out. These have been corrected in the final corpus. Some key learnings are summarised here below.

**Time dimension of the corpus** appears very strong in Figure 27 while a historical line is very usual in this kind of representation with a horseshoe pattern (also called Guttman effect, documented in the methodology section), we have drawn lines to indicate “a move”.



**Figure 27 Correspondence analysis, full corpus 15 years of RWE report**

Figure 27 allows to identify a chronological progression in the vocabulary of RWE from 2003 to 2018; this very simplified test is performed with all words of reports, including punctuation marks, and without any specific selection. We obtain the view that something looks chronological, but not how it can be explained by any contributors.

Axis are arbitrary, so that we have 2003 and 2006 to the right. Then we have a very consistent period from 2006 to 2013. Content of communication is very stable. Then 2014 and 2015 are together in a new direction, with a step change into 2016. At the end we see a group of 2016 to 2018.

This scheme is very interesting to associate to detailed life of the company: change in business model (away from nuclear and coal, into offshore wind), change in governance (split of activities between RWE and a new independent subsidiary Innogy), change of priorities or team writing the report.

At that time, we don't search for explanations outside of our statistical analysis. It will be done at a later stage.

For completeness, 2005 appears as a point bottom right, not apparent on this scale, which was not further inquired here. It does not invalidate previous assessments but shows a broken line between 2003 and 2006.

Lexical table of most frequent words corresponds to research question Analysis on decreasing ranking showed “energy, customer, employee” appearing among the most frequent ones. It confirms that methodology will allow the study of energy + transition together for example.

**Observing common parts and highlighting what is specific.** Content of vocabulary confirms the hypothesis that **some words are very consistent** across each company. This is the case for vocabulary based on energy, power, electricity and confirms that corpus includes our research object. On the other side **some specific vocabulary** shows potential contribution of different concerns or strategies for each company.

Vocabulary of the entire corpus can be looked as a benchmark for each company, how they compare to the market consensus. But each sub corpus of each company can also be screened as specificity: “energy” would be expected for illustration 5 times per page, why some are much lower than expected and some much higher. For the moment we keep the analysis on occurrences tables. We will move to statistical specificity calculation in a later stage.

**Observing common vocabulary on energy and management.** Further with this prototype corpus, we show that the three most frequent nouns in the global corpus “energy”, “customer”, “employee”, are present not only in almost all companies but most of the time in the top three ranking. This confirms that our corpus is relevant for what we study (energy in 9 companies, and among the top three for 6).

Then there are words referring to external stakeholders “customer”, present in 7 companies; internal stakeholders “employee”, present in the 10 companies. This is largely expected that CSR express a balance concern between internal and external.

Nouns “management” and “business” are also widely used, although “management” more often, and always more than “business”. This is a first interesting sign to look into, why companies do not mention business, either as company business, or business model, or business development.

We assume that “year”, and “company”, used by 8 and 7 companies, are not carrying specific meaning. It could be confirmed by studying words used by the others company: reading in the texts with low usage of “company” if there refer more to corporation, group, or organisation.

In energy companies, words describing fuels for energy production could be the core of the report. It’s not the case. If the global corpus shows “power” as #9 “electricity” #12, and “emissions” #15, this is not many terms. Power can be ambiguous outside energy context. Why only 3 companies focus on “power” for example?

As concluding remark, having 7 nouns over 20 common to 6 to 10 companies, we would tend to conclude that vocabulary is relatively homogeneous. This largely common vocabulary can be explained by the format, with all CSR respecting content and forms. Alternatively, it can be explained by external pressure on electricity companies, with change in legislation, price evolution affecting them. But it could also be a deliberate answer by some companies to adopt

ideas from others, hence increasing the common vocabulary. We will test this in an evolutionary analysis.

**Specific or generic vocabulary.** Requests performed showed that vocabulary can be with very generic “electricity”, or very focus in the case of “coal”.

It leads to further comment on the specific vocabulary. Some companies follow specific paths that need to be further looked at. It can be a specific problem faced by a company for one or several years, or it could only be that other companies use these words slightly less so that they don’t show up in the top 20 occurrences but just after. Interestingly in both cases, statistical analysis triggers back a careful analysis of the corpus.

This is for example the case of “water” and “habitat” for AEP, USA. What is the reason that these terms are so important for an electricity company?

High ranking of “cost” for ESKOM, South Africa, raises also a question. Efficient and cheap electricity should be a concern for most companies, but only ESKOM presents “cost” as a priority.

Another source for specific vocabulary comes from cursive reading. Especially some coined terms like “bettercoal” “trilemma”, “clean-smarter” are used in a very limited number of times. They do not appear in the top-ranking methodology but could require studying how they link to the rest of the vocabulary.

Outcome of this section is the dual interest to study first what is common in the vocabulary. Hence how this common vocabulary has evolved over the 10 last years, how energy transition changes meaning, importance, and impact on strategy. Second, studying what is particular to one company or a few ones. It could be foregoers who will spread new ideas, operational issues that need fixing for instance.

### **3.5.3 Programme of research with TXM**

Our research question is to analyse change in strategy and adaptation to energy transition, as a challenge to their legitimacy. We study changes of each company in two main dimensions:

**The first dimension studied is longitudinal** to determine how each company defends its strategy, adapt to energy transition. This is at minimum 2008 – 2018, when earlier data is available it can be up to 2003 – 2018 (Pacific Gas and Electric USA, and RWE Germany in 2003)

It will consist in viewing historical pattern, showing how companies move along some axis (series of words, or association of words). Main statistical tool will be Correspondence Analysis

(hereafter CA) with some control measures, including specificities. Progression graphs will also be added. This section covers the apparition of concepts and their diffusion. (emergence of low carbon as opposed to asset optimisation). This is top users of some concepts vs those not using it (like energy transition vs other concepts).

**Different trajectories.** From the analysis of how each company changes, we will study variation among paths taken by companies.

According to different themes, in energy, which companies behave similarly, and which others move into completely different directions.

This dimension on variation between companies will bring different pattern according to vocabulary tested. We do not anticipate, nor strive for, a general rule explaining legitimacy of all companies in the sample. For example, we can focus on analysis of clean fuel vs fossil fuel via vocabulary used. Another example can be specific words and why they have such importance (like increasing importance on safety for Pacific Gas and Electric when wildfire spread in California).

The two dimensions can be also looked in the same view, with propagation of one concept by year and by company. This can take the form of a bar chart by year with additive values for companies; but it needs to go back to the text and extract the supporting verbatim, in order to complement numbers, with meaning of those.

### **3.6 CONCLUSION OF PART 3 METHODOLOGY: TEXTOMETRIC ANALYSIS OF 15 YEARS OF CSR REPORTS**

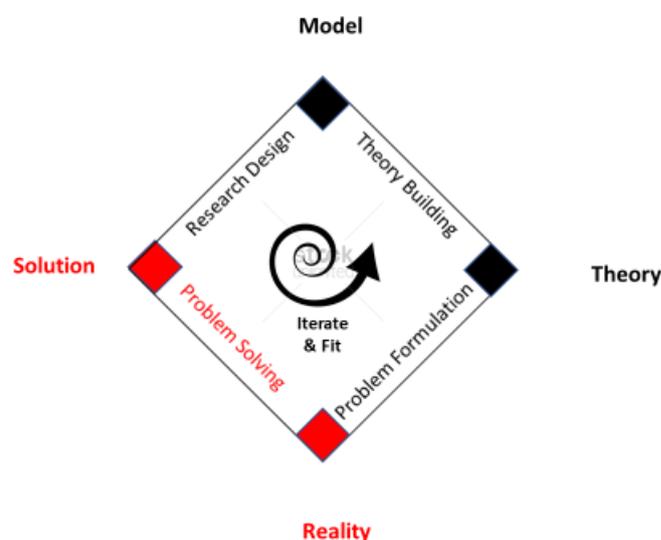
At the end of this part, we have explained the qualitative method of discourse analysis which we have selected. Using a statistical text analysis method allows several back and forth iterations between text content, statistics, and how patterns emerge. We have explained the choice of CSR reports as primary data, and the possibility given to test both evolution of vocabulary, and variation between companies. It sets the research program which will be structured in two dimensions, variation and evolution. We will now explore words emerging from the text, like nouns or adjectives, environment of “energy”, or “energy transition”. Then we will use vocabulary from legitimacy taken from academic literature and explore how it is used in the corpus.

## PART 4 RESULTS IN TEXTOMETRY: OBSERVING LEGITIMACY IN DISCOURSE ANALYSIS

This part covers data analysis with TXM software and interpretation of results, before key results findings and conclusion in part 5. Results are ordered in increasing complexity. We look at the corpus with successive angles:

- The starting point is an observation of how “energy” is represented in the corpus.
- A second section focuses on grammatical form in the corpus. This is especially occurrences of adjectives and nouns.
- The third series of results looks at concepts taken from energy that we screen throughout the text. First how carbon or CO<sub>2</sub> develop across the corpus. Then a study on how energy mix evolves in the discourse. And a development on the concept of stranded asset.
- Last section covers legitimacy vocabulary, built from literature, in the corpus. We look at how key values or mission statements present at the beginning of the period evolve. Then we study a representation of how each company aligns on pragmatic, moral, legal or cognitive legitimacy.

**Progression along the Van de Ven research process.** Present part of research process is highlighted in Figure 28. It may seem that the research journey is coming back to the initial point of looking bluntly at the reality. But the end of the problem solving is a different view of reality, graphically above or below in a 3D drawing. This makes possible a next iteration of the diamond model, which could take a different theoretical point of view, or different methodology, on a renewed research question. And the figure is also suiting textometric inquiry, with increasing level of analysis, individual words or lemma, then associations of words, then more sophisticated visualisations.



## Figure 28 Situating problem solving inside the research process (Van de Ven, 2007)

### 4.1 EXPLORING THE CONTEXT AROUND “ENERGY”

This section covers how the observation of the word “energy”, not isolated but in its environment, reveals a lot on the corpus content. For all coming sections, we start with the main findings, before detailing how they are achieved.

#### 4.1.1. Main findings around the word “energy”

Energy is a central concept in the corpus, and a good point to start from, as confirmed in the number of occurrences of the word itself, and of several word associations. This is especially the case of “clean energy, and “renewable energy” emerging progressively to become shared by most companies. On a different aspect, “energy transition” makes an entry around 2011. A general trend, though not true for all the 12 companies in the sample, shows a first point around 2007 centred on energy sources, trading, supply. Then a second period in 2008- 2011 is focusing on energy efficiency, while in the last period observed 2012 – 2018 energy transition is taking over.

#### 4.1.2. Exploring single word occurrence

**Energy appears as a central concept throughout the corpus.** Many aspects of the corpus will be screened, many results will be presented in this part on results and interpretations. Here the first concept studied is “energy”:

First, it is a good introductory concept to questions such as:

When did energy transition become a concern for most companies?

How is the energy mix in electricity production affected by global warming?

Is there one strategy for energy production and consumption or several?

“Energy” is also central in the corpus. A quick wordcloud representation of most frequent nouns in the 9.5 Mio word corpus shows in Figure 29:



understanding how energy is used in a context. Here we consider that “meaning is born in context” (Mayaffre, 2008).

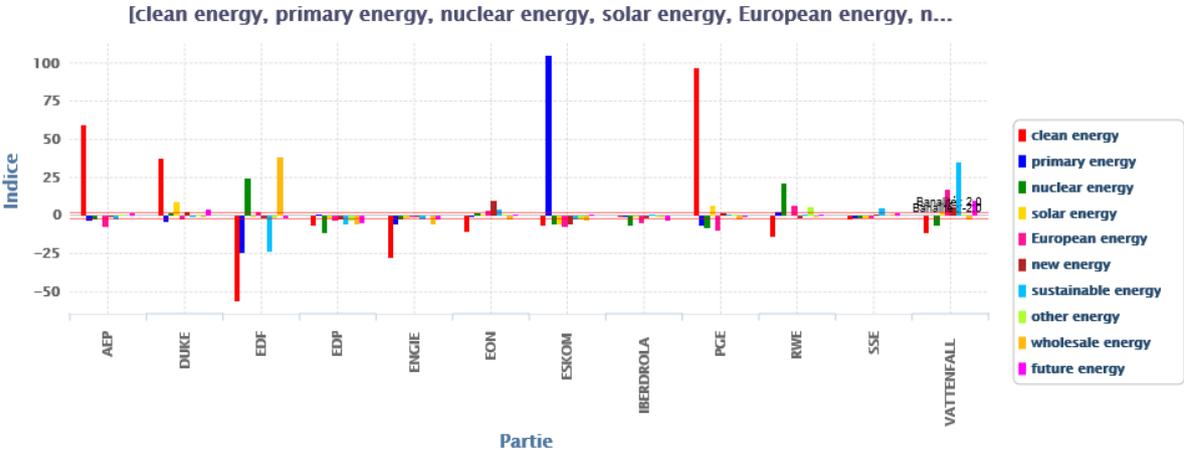
**4.1.3. Exploring association of words**

We then study **association of adjective and energy**. It shows that behind “renewable energy”, all types of energy are present. “renewable energy” is by far the most used association (3 688) but here we will be more interested by evolution than absolute number of renewable. Then there are “clean, nuclear, primary, solar...”, with a total of 841 various adjectives associated to energy. There is a high variation across companies in the ways they use different associations

|                    |                                   |                   |               |
|--------------------|-----------------------------------|-------------------|---------------|
| Adjective + energy | top three users, and % associated |                   |               |
| Clean energy       | PGE                               | 41%, then AEP 29% | then DUKE 11% |
| Nuclear energy     | EDF                               | 55% then RWE 19%  | then EON 10%  |

These two examples show that “clean energy” is a very US concept, where Europe tends to use other expressions. And for the second nuclear energy is claimed mostly from EDF associated with operations, and RWE and E.ON (Germany) with the question on discontinuation of operations.

Beyond simple occurrences and percentage, specificity calculation allows to determine with statistics occurrences observed compared to an even repartition over the corpus. Variation of size among corpus part are taken into account. Statistically this means that for small part of the corpus, same frequency ratio gets less salient specificity score. This shows, for a specific request, how use is specifically high, or used much more by other companies; and for negative specificities those who use it much lower that what would be expected for an even spread out distribution.



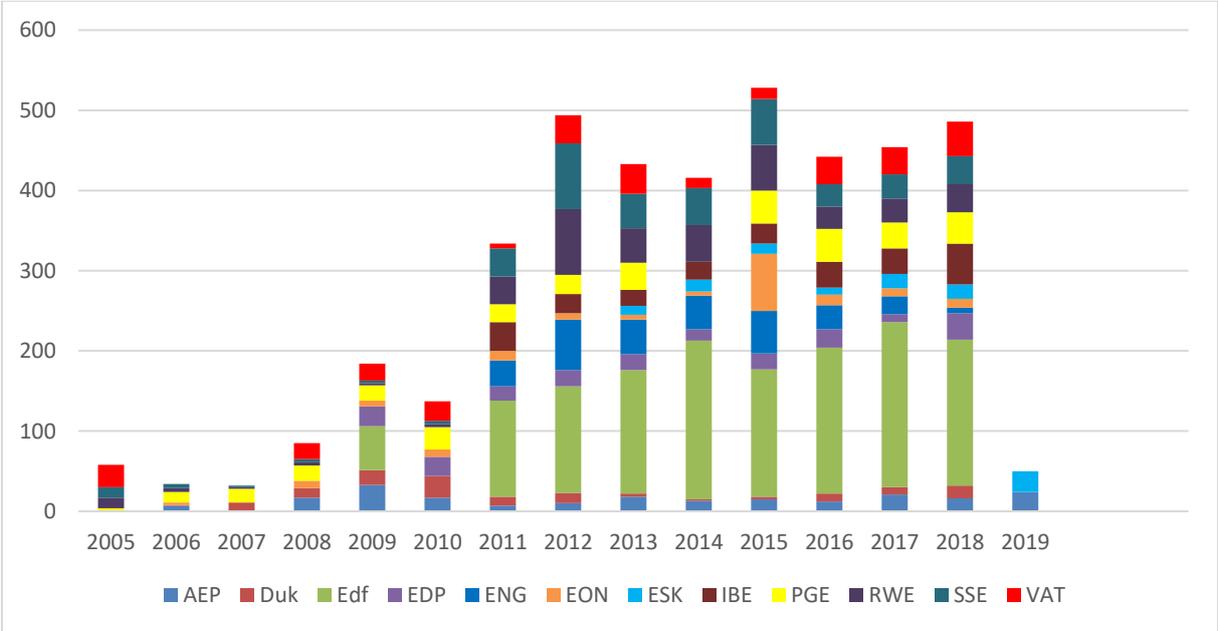
**Figure 30 Specificity calculation of top adjectives associated with energy, overall corpus**

Figure 30 shows for the top 10 associations of any adjective with energy how specific it is or not. (here we chose to leave out “renewable” to be able to interpret smaller numbers). First there is a great diversity of results. This show high variation of companies, and how they translate energy transition into different concepts.

Second, we see 4 dominant types. “clean energy” is very much used by all US companies, AEP, DUKE, PG&E. This makes an echo to official EPA program, “affordable clean energy”, and previous “clean power plan”. For these companies, “clean energy” is transition from a hypothetical dirty one, dominated by coal. “Primary energy” is a key focus for south Africa ESKOM. This could be related to issues of blackout and shortage in the network. Then “nuclear energy” is mostly used by EdF without surprise but also by RWE in Germany. Last point here, “sustainable energy” is used very often by VATTENFALL, Sweden. And very low number in EDF vs a normal calculation.

Third, some companies do not show up here, including ENGIE, IBERDROLA, SSE, EDP. This means this analysis is not discriminating for these companies. This is especially true for IBERDROLA, Spain with a very large corpus; it means some other dimensions are not highlighted here.

Figure 31 represents the propagation of Renewable energy over time:



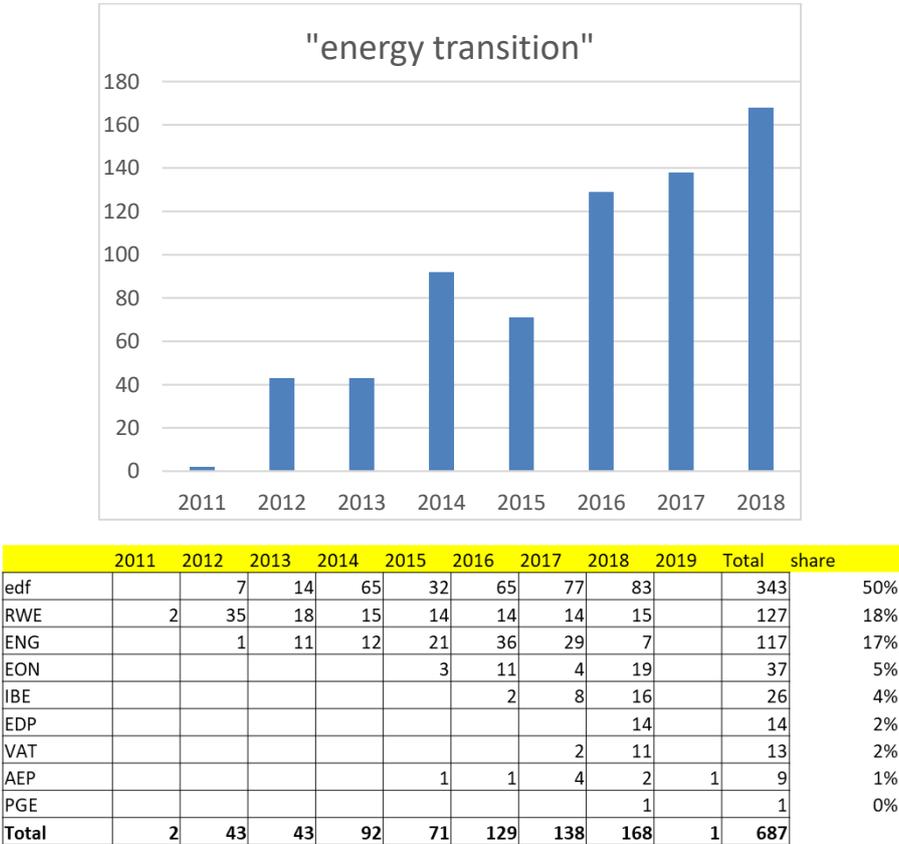
**Figure 31 Propagation of “renewable energy” by year and company**

General trends on this graph show that renewable energy is getting more and more attention in number of occurrences. As size of corpus increases with the year this view is not a specificity calculation, and does not show if energy transition is more present on specific years relative to size of this year in the overall corpus.

Among companies, some early adopters like VATTENFALL as early as 2005, then barely use before 2012; some companies put a heavy focus on renewable at a given date, mostly PG&E in 2013 and to some extent EDF in 2011 onwards.

**Energy transition makes an entry around 2011.** After adjectives we now look at association of energy and another noun, with first a focus on “energy transition” in relation to our research question. When did it become a subject, and for which company? As a risk, a challenge or maybe an opportunity?

First, we see that energy transition is relatively new concept in CSR reports studied. both chart and table in Figure 32 shows that first occurrence is 2 times by RWE in 2011, then a quick increase to 150 p year.



**Figure 32 Bar chart and table “energy transition” by year and by company**

In 2011 RWE introduces it. And this comes as first sentence of foreword of report “The energy transition is a big challenge for us all. RWE is playing a role in structuring the future of energy supply. And that did not begin only a year ago » (RWE, p1). But in 2011, no other player in our sample even mention energy transition in their reports.

During a first period 2011 – 2015, “energy transition” is only used by three companies. RWE is using the term a number of times in 2012 then drops to a much lower concern. EDF uses a lot the term in 2014, but much less in 2015. ENGIE is an early adopter between 2012 and 2015. In 2015 two more companies cite energy transition, E.ON and AEP.

Together with RWE in 2011 we can include ENGIE (2013 p2) “While the Group still intends to maintain its position as a key player in Europe and a leader of the energy transition, it is now a benchmark energy provider in the emerging world”. Here too, energy transition is at the heart of change and introduced in the very beginning of reports.

On the contrary for the two others companies, it comes as a side effect at the beginning. For E.ON it comes together with storage of electricity “key for secure power supply in the age of the energy transition” (E.ON 2015 p123). It is more a general context than concrete perspective.

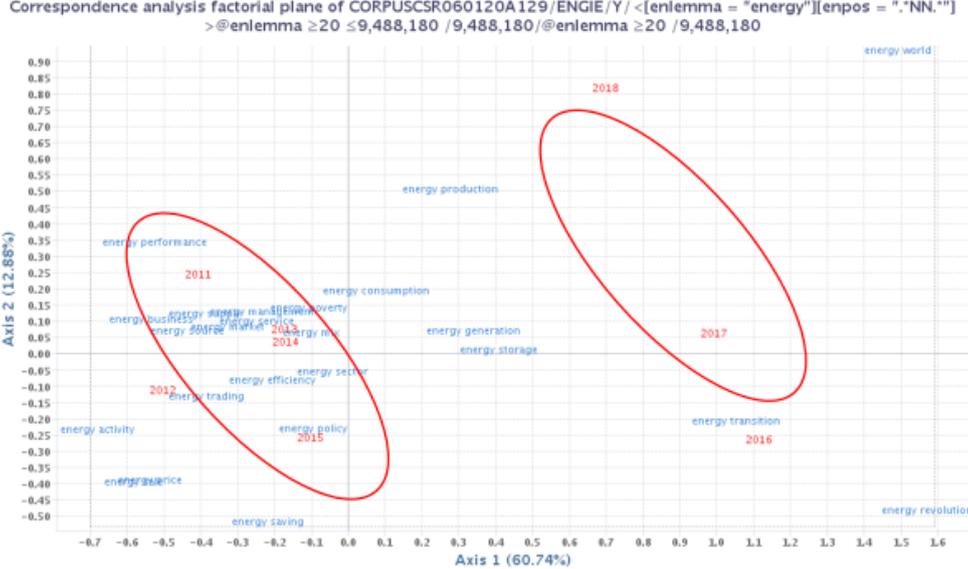
And for AEP:

“There is continuing dialogue and general agreement that technology, policy, timing and collaboration are all critical to a clean energy transition plan” (AEP 2015 p85); in fact, the text is about clean energy, and not energy transition. And clean energy is very typical of vocabulary for electricity companies in the USA.

Then in 2016 – 2018, the term becomes much more popular in number of occurrences and number of companies involved. This is up to 10 companies mentioning “energy transition”, for a total of 168 occurrences in 2018. This has two exceptions: ESKOM, DUKE ENERGY. For DUKE energy it links to the fact that clean energy is more central in US vocabulary. For ESKOM, the concern is more recent and not labelled energy transition. Instead ESKOM uses “transition” only; this is clearly marked in “The transition to a low-carbon, climate-resilient economy requires broader engagement to identify the social interventions needed” (ESKOM 2019, 52) In the report from March 2019 reflection is in very broad terms not into concrete actions.

**Energy associated to various nouns studied for ENGIE, RWE.** After association of energy and a defined noun that we choose, like energy transition, we now perform a wider search with what association come along the years. We take two examples, ENGIE (F) and RWE (D) and visualise in a correspondence analysis how the word environment evolves.

First for ENGIE all associations of energy and a noun with more than 20 occurrences are selected.



**Figure 33 Correspondence analysis for ENGIE energy and noun across time**

Figure 33 for ENGIE shows how energy is associated to different nouns in time. A first period from 2011 to 2015 shows how the group is opening up to different view of energies. 2011 is very near “energy performance, supply, business, market”. This is a traditional environment for utilities. 2015 appears closer to “energy sector, policy, generation or storage”. The second period on the figure covers 2016 to 2018. it is also the pivot year where the GDF SUEZ group rebrands itself into ENGIE with wider ambitions. We see this in the text clearly influenced by “energy transition” (36 and 29 occurrences over a total of 117, hence 55% of the 10years). 2018 appears further apart, with “energy production, consumption, and an energy world”. We view 2018 orientations as further step of transformation. Introduction of 2018 report is quite evocative “In a sector undergoing fundamental change, ENGIE has repositioned its activities to capture new opportunities and become a key player in the new energy world » (2018 P3). This sets then new scene, to be playing overall in the energy world, whatever form it may take.

This can be summarised in:

- 2011-2015 energy sector, performance, price, sale, supply dominate vocabulary, in a utility approach.
- 2016-2018 key importance of “energy world” associated to energy transition, energy production.

The same scheme is applied to RWE. Here the corpus starts much earlier in 2003, which gives wider observation of evolution. On one side there could be more transformation at stake, since RWE was pioneer in energy transition. But on the other side, the large share of coal power and issues around governance of the group could plead for a slow moving vocabulary

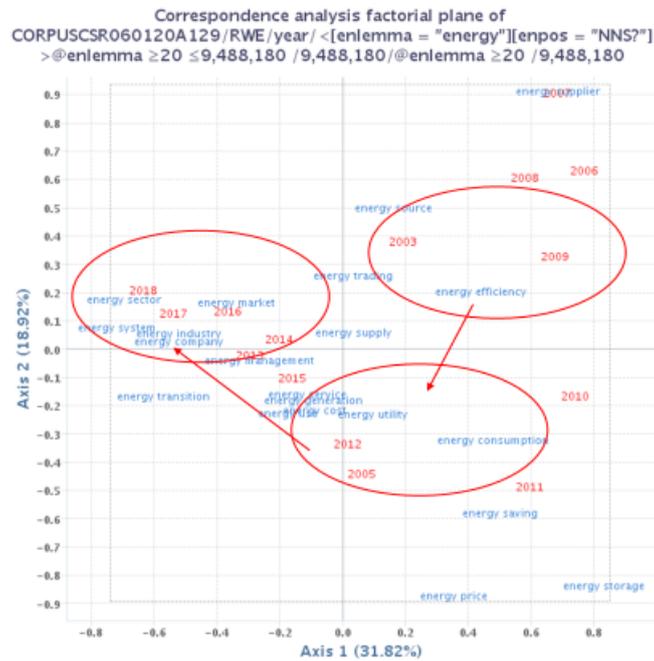
Most frequent associations overall are:

| energy + noun      | total |
|--------------------|-------|
| energy efficiency  | 187   |
| energy supply      | 131   |
| energy transition  | 127   |
| energy consumption | 94    |
| energy source      | 83    |
| energy industry    | 81    |
| energy utility     | 63    |
| energy market      | 55    |
| energy system      | 48    |
| energy management  | 44    |

**Table 10 RWE most frequent associations of energy followed by a noun**

Regardless of evolution in time, Table 10 show the relative strength of traditional utility role (represented by efficiency, supply and consumption) compared to transformation (here only transition). That RWE was and remain a strong utility focused on core mission is an expected result. Next analysis will be how it moves in time.

Performing the same analysis done for ENGIE, all associations of energy and a noun with significant occurrences are plotted on a correspondence analysis table.



**Figure 34 Correspondence analysis for RWE energy and noun across time**

Figure 34 is a representation for RWE (Germany) of how the association of energy and a noun is used over time. A clear time related element, or Guttman effect, can be traced in the visualisation.

Evolution of the vocabulary shows three different periods. At the beginning 2003 – 2009, RWE focuses on “energy efficiency, trading, source”, all very traditional role of utility. Energy efficiency is linked to the target of cheap and reliable supply, when energy source covers independence, regularity of supply. Though it is more progressive than clear cut, a second period 2010 - 2012 around “energy consumption, price, efficiency”. This is not radically different from the period before, but nevertheless changes priority towards customers and energy saving. This is illustrated in numbers by “customer” used less than 50 times per year in the initial years, then more than 200 on average for the next period, for only twice a size of corpus.

The period, 2013 – 2018 is dominated by apparition of “energy transition”. The move is away from utility into “energy systems, market, and energy transition”. A statistical limit in this graph is that the percent of variation represented is relatively low (statistics on axes 1 and 2 Q12 = 20%). This explains why the period 2012 – 2015, as well as 2005 are not clearly represented.

This results in three different periods:

- 1<sup>st</sup> 2003 – 2009 energy source, trading, supply dominate vocabulary
- 2<sup>nd</sup> 2010 - 2012 energy efficiency

- 3<sup>rd</sup> 2013 – 2018 into energy transition

**This first series of results shows how exploration of one single word -energy- can lead to many paths** on evolution across time and variation across companies. It is an entry door into exploration of how legitimacy changes through discourse analysis of energy companies.

In the very large amount of words of the corpus, some explorations will guide us into legitimacy expressed as in 2008 or before, then into how it becomes in 2018.

Some other exploration will be grounded on grammatical forms, like noun used in this present section, but also adjectives or verbs. This will be an open code entry to retrieve pattern without choosing any term beforehand.

And some exploration will screen how energy concepts, like energy transition vs clean power, or stranded asset, can be found in the corpus and what they express on legitimacy of utilities.

## **4.2 THEMES EMERGING FROM THE GRAMMATICAL STRUCTURE OF CORPUS**

This section starts amidst the corpus. By fishing for most frequent nouns, adjectives, and to some extent verbs, it discloses some patterns in the text. It could be described as “moving from format to content”, “from structure to content”; we study grammatical forms and elaborate how common or specific vocabulary can tell some lessons on energy. We expand the analysis from individual word to words, along the idea that “meaning is born in context”, where one word can only carry meaning within a given context (Mayaffre, 2008).

### **4.2.1 Observing nouns used in the corpus**

#### **4.2.1.1 Why start from grammatical categories?**

Here we start from the text, with grammatical forms of adjectives, nouns, verbs. From occurrences, ranking of who uses what vocabulary, we infer common and specific vocabulary. In a CSR communication, it is expected to read social, environment and responsibility at every page; is it really so? Are there some companies in our sample which have a totally different emphasis?

The purpose of studying grammatical forms is to see categories emerging from each form. These specific words will then allow to study words in associations: what are the verbs mostly used with energy? Is it produce energy, minimise energy, and how it differs across companies?

Nouns are studied first because they correspond both to types of fuels and products (for example coal, gas, or electricity, product and services). Hence, they are expected to be at heart of company strategy. Then adjectives have been found very meaningful, especially in association (for example renewable energy is much more precise than just one of the two). Verbs were left out after careful analysis since it turned out they are very formalised in CSR report, and less relevant for interpretation. Each section starts with a global overview of common vocabulary across companies. This is the landscape where discourse takes place. Then we study the vocabulary specific to one or a few companies. This can be a real hapax, with single use over the corpus, or just a very marked use by one company compared to others. Since each company weighs very differently in the corpus, this is done in ranking of nouns use, rather than number of occurrences. When the largest corpus for EDF accounts for close 25%, SSE, only represents some 1.2%. This does not mean a difference in importance between them. But rather than counting words cannot be meaningful without preparation of how and what to count.

**To overcome heterogeneity, we look preferably at ranking of occurrences of terms used rather than number of occurrences.** A preamble to look at most used nouns is to revisit heterogeneity of corpus. When company A uses three times more “energy” than company B, it cannot be concluded that energy is three times more important for A than B. Hence the number of occurrences cannot be the measure of importance; second, reports change in size across companies, and for one given company size and structure of reports evolve significantly over years. This is not a final remark, but rather a precautionary step to analyse corpus with this heterogeneity always in mind (Pincemin, 2012).

#### **4.2.1.2 Main findings from exploration of nouns**

First result of observation of all nouns in the corpus is that vocabulary is relatively homogeneous. This largely common vocabulary can be explained by the typical format of CSR reports, which respect some content and forms. In addition, it can be explained by the same external pressure on all electricity companies, with change in legislation and price evolution affecting them. But it could also be a deliberate answer by some companies to adopt ideas from others, favouring a common vocabulary.

The vocabulary is studied through its common and its specific parts. This consists in observing how this common vocabulary has evolved over the 10 last years, how energy transition changes meaning, importance, and impact on strategy. Alternatively, we observe what is particular to one or a few companies. It could be operational issues that need fixing, like the focus on “safety, water” in conjunction with wildfire in California for PG&E.

### 4.2.1.3 Frequency tables by decreasing ranking

Table 11 shows a global view of nouns with the top 20 occurrences overall in line and each company in column, with the total.

| enle | total       | AEP          | DUKE          | EDF         | EDP         | ENGIE       | EON           | ESKOM       | IBERDROLA   | PGE       | RWE           | SSE           | VATTENFALL  |
|------|-------------|--------------|---------------|-------------|-------------|-------------|---------------|-------------|-------------|-----------|---------------|---------------|-------------|
|      | B           | C            | D             | E           | F           | G           | H             | I           | J           | K         | L             | M             | N           |
| 1    | energy      | customer     | energy        | energy      | company     | gas         | energy        | year        | company     | energy    | energy        | energy        | power       |
| 2    | company     | energy       | customer      | electricity | member      | share       | employee      | performance | year        | customer  | power         | employee      | energy      |
| 3    | year        | employee     | company       | power       | risk        | energy      | customer      | power       | activity    | program   | plant         | business      | company     |
| 4    | customer    | power        | employee      | year        | energy      | business    | power         | cost        | energy      | employee  | company       | customer      | asset       |
| 5    | power       | business     | power         | company     | market      | company     | business      | electricity | managemen   | gas       | electricity   | year          | electricity |
| 6    | employee    | technology   | year          | risk        | year        | year        | company       | energy      | area        | year      | managemen     | electricity   | plant       |
| 7    | business    | company      | plant         | plant       | managemen   | risk        | managemen     | managemen   | information | community | employee      | generation    | value       |
| 8    | electricity | system       | percent       | generation  | business    | asset       | sustainabilit | risk        | report      | safety    | customer      | service       | operation   |
| 9    | plant       | program      | business      | market      | share       | activity    | unit          | station     | emission    | area      | impact        | year          | year        |
| 10   | risk        | service      | program       | managemen   | employee    | market      | year          | coal        | country     | business  | gas           | carbon        | risk        |
| 11   | managemen   | year         | community     | project     | information | line        | responsibilit | capacity    | employee    | percent   | year          | company       | liability   |
| 12   | gas         | grid         | generation    | activity    | service     | plant       | emission      | report      | group       | service   | station       | sustainabilit | customer    |
| 13   | project     | transmission | gas           | section     | activity    | plan        | process       | programme   | business    | system    | emission      | project       | employee    |
| 14   | service     | plant        | service       | service     | electricity | employee    | project       | customer    | supplier    | water     | business      | value         | cost        |
| 15   | activity    | percent      | sustainabilit | facility    | project     | managemen   | plant         | business    | risk        | company   | project       | network       | business    |
| 16   | market      | cost         | project       | customer    | customer    | power       | supplier      | employee    | plant       | facility  | supply        | investment    | emission    |
| 17   | generation  | coal         | technology    | developmen  | area        | income      | percent       | system      | project     | project   | report        | community     | market      |
| 18   | system      | project      | emission      | group       | power       | contract    | system        | unit        | impact      | power     | responsibilit | emission      | investment  |
| 19   | emission    | resource     | cost          | network     | policy      | agreement   | risk          | plant       | facility    | supplier  | system        | change        | account     |
| 20   | development | risk         | coal          | gas         | shareholder | electricity | market        | supply      | service     | area      | grid          | people        | loss        |

**Table 11 Top nouns used, by company, common or specific**

Legend: selection of common values in blue, unique values across the sample in yellow

**When the most frequent nouns used** over the whole corpus are “energy, company, year, customer, power...”, for each column representing the 12 companies in the corpus the most frequent nouns are indicated.

The three most frequent nouns in the global corpus “energy”, “customer”, “employee”, are present not only in almost all companies but most of the time in the top three ranking. We leave intentionally “year” and “company” out of any discussion, considering that in a corporate yearly report they have low power of explanation. These words confirm that our corpus is relevant for what we study (energy in 9 companies, and among the top three for 6).

Then there are words referring to external stakeholders, including again “customer”, present in 7 companies; internal stakeholders “employee”, present in the 10 companies. This is largely expected that CSR express a balance concern between internal and external.

Nouns “management” and “business” are also widely used, although “management” more often, and always more than “business”. This is a first interesting sign to look into, why companies do not mention business, either as company business, or business model, or business development.

In energy companies, words describing fuels for energy production could be the core of the report. It’s not the case. If the global corpus shows “power” as #9 “electricity” #12, and

“emissions” #15, this is not many terms. Power can be ambiguous outside energy context. Why only 3 companies focus on “power” for example?

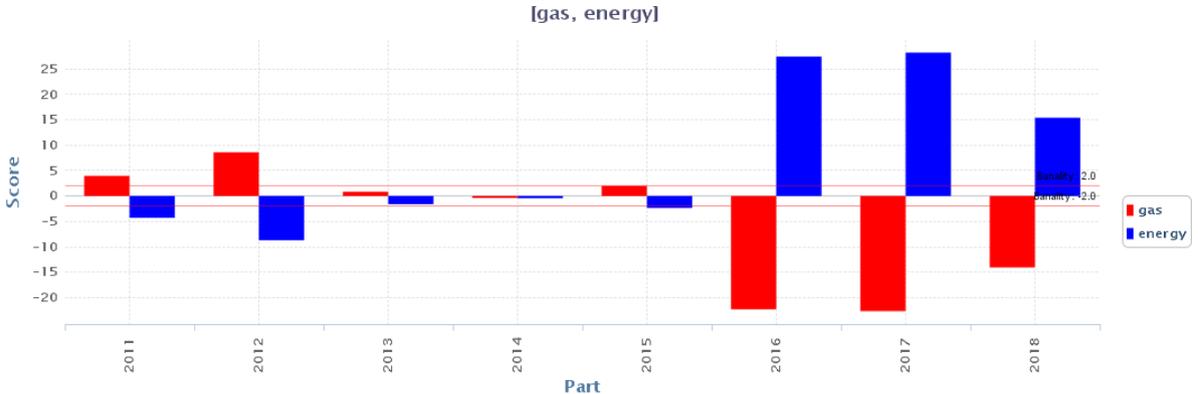
**An example with the most frequent one “energy”** number in total, with 33 157 occurrences; and “energy” ranking first for 6 companies out of 12. This shows how centred all CSR reports are on the specific sector.

In complement of ranking, we show the numbers of occurrences that created this view, for “energy”:

| AEP  | DUKE | EDF  | EDP  | ENGIE | EON  | ESKOM | IBERDROLA | PGE  | RWE  | SSE | VATTENFALL |
|------|------|------|------|-------|------|-------|-----------|------|------|-----|------------|
| 2347 | 1396 | 8839 | 2205 | 2529  | 2599 | 1203  | 2158      | 3964 | 2548 | 623 | 2746       |

These numbers show an order of magnitude, between 600 and 9000 occurrences, for very different corpus size, as SSE weighs only 1.3% and EDF 25% of the corpus. It then shows that EDF uses “energy” much more than others, but their reports are much longer also. We will use specificity calculation to show how particular or not it is for each company.

Colour used in Table 11 represent for the blue ones the **common vocabulary**, where we visualise how the most frequent words overall in column are represented for each company. In ranking its shows for example that if “energy” and “company” are the two most frequent terms overall, which is a simple definition of a utility; all companies use them in the 5 or 6 highest ranking nouns. But two companies are using nouns even more often, EDP (Portugal) with “member, and risk”, and ENGIE with “gas, share”. This is due for EDP to a choice of very literary style, and also a very high focus on risk, which will need further inquiry. And for ENGIE the historical business of gas seems to be a more important definition that energy. This has evolved significantly over the years for ENGIE.



**Figure 35 Specificity calculation for ENGIE 2011 – 2018 on “gas, energy”**

(here specificities measure the frequency balance between gas and energy, hence symmetric by construction)

This is well demonstrated in Figure 35: in this specificity graph where only the frequencies of both terms are considered excluding the rest of the text, “gas” is overrepresented in 2011 -2012, when the company was called GDF Suez, in comparison with “energy” distribution over the years; where as in 2016 – 2018 it becomes very underrepresented, in comparison with “energy distribution over the years”. And the shift taken by the company to a wide energy group is shown in underrepresentation of “energy”, which becomes very overrepresented in 2016 – 2017. This graph shows the transformation of the group, turning point in 2016 and intensity of the change.

**Focusing on how company communicate of type of energy.** We perform the same analysis, this time with focus on fuel types used. The source table is identical but with different wording highlighted.

| enle | total       | AEP          | DUKE          | EDF         | EDP         | ENGIE       | EON           | ESKOM       | IBERDROLA   | PGE       | RWE           | SSE           | VATTENFALL  |
|------|-------------|--------------|---------------|-------------|-------------|-------------|---------------|-------------|-------------|-----------|---------------|---------------|-------------|
| B    | C           | D            | E             | F           | G           | H           | I             | J           | K           | L         | M             | N             |             |
| 1    | energy      | customer     | energy        | energy      | company     | gas         | energy        | year        | company     | energy    | energy        | energy        | power       |
| 2    | company     | energy       | customer      | electricity | n           | share       | employee      | performance | year        | customer  | power         | employee      | energy      |
| 3    | year        | employee     | company       | power       | member      | energy      | customer      | power       | activity    | program   | plant         | business      | company     |
| 4    | customer    | power        | employee      | year        | risk        | business    | power         | cost        | energy      | employee  | company       | customer      | asset       |
| 5    | power       | business     | power         | company     | energy      | company     | business      | electricity | managemen   | gas       | electricity   | year          | electricity |
| 6    | employee    | technology   | year          | risk        | market      | year        | company       | energy      | area        | year      | managemen     | electricity   | plant       |
| 7    | business    | company      | plant         | plant       | year        | risk        | managemen     | managemen   | information | community | employee      | generation    | value       |
| 8    | electricity | system       | percent       | generation  | managemen   | asset       | sustainabilit | risk        | report      | safety    | customer      | service       | operation   |
| 9    | plant       | program      | business      | market      | business    | activity    | unit          | station     | emission    | emission  | area          | impact        | year        |
| 10   | risk        | service      | program       | managemen   | share       | market      | year          | coal        | country     | business  | gas           | carbon        | risk        |
| 11   | managemen   | year         | community     | project     | employee    | line        | responsibilit | capacity    | employee    | percent   | year          | company       | liability   |
| 12   | gas         | grid         | generation    | activity    | S           | plant       | emission      | report      | group       | service   | station       | sustainabilit | customer    |
| 13   | project     | transmission | gas           | section     | information | plan        | process       | programme   | business    | system    | emission      | project       | employee    |
| 14   | service     | plant        | service       | service     | service     | employee    | project       | customer    | supplier    | water     | business      | value         | cost        |
| 15   | activity    | percent      | sustainabilit | facility    | activity    | managemen   | plant         | business    | risk        | company   | project       | network       | business    |
| 16   | market      | cost         | project       | customer    | electricity | power       | supplier      | employee    | plant       | facility  | supply        | investment    | emission    |
| 17   | generation  | coal         | technology    | developmen  | project     | income      | percent       | system      | project     | project   | report        | community     | market      |
| 18   | system      | project      | emission      | group       | customer    | contract    | system        | unit        | impact      | power     | responsibilit | emission      | investment  |
| 19   | emission    | resource     | cost          | network     | area        | agreement   | risk          | plant       | facility    | supplier  | system        | change        | account     |
| 20   | developmen  | risk         | coal          | gas         | power       | electricity | market        | supply      | service     | area      | grid          | people        | loss        |

**Table 12 Top nouns used by company on type of energies**

One introductory remark to Table 12 that top 20 occurrences nouns exclude wind, solar, hydroelectric, nuclear so they do not offer a clean energy mix, but only an arbitrary view of energy types which are nouns. In a different section, energy mix, will be analysed differently, without grammatical categories.

Total occurrences are following, with wind not appearing here because only #67 in total.

|             |        |
|-------------|--------|
| Electricity | 17 200 |
| Gas         | 14 170 |

|      |       |
|------|-------|
| Wind | 5 958 |
| Coal | 4 888 |

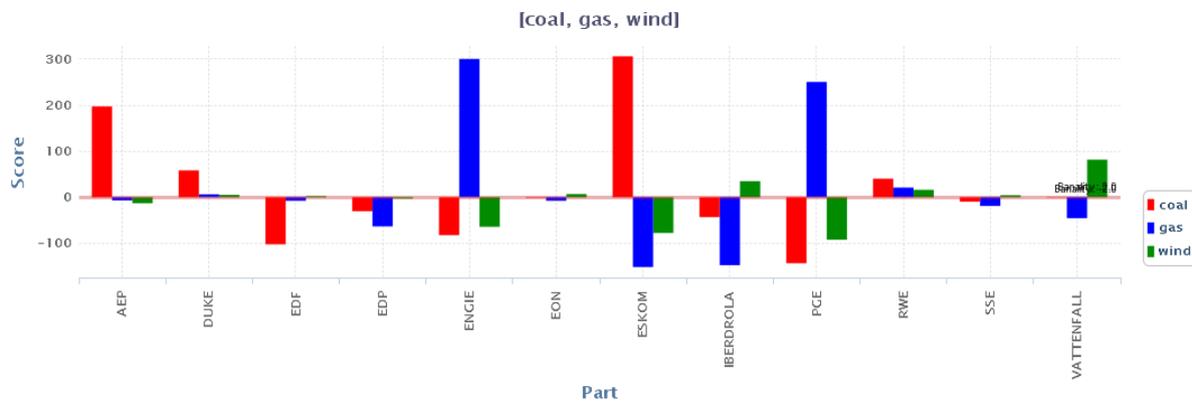
We can group the 12 companies in regard to this request in 3 groups:

Those who rank coal as most referred fuel AEP, ESKOM.

Those who rank gas as most referred fuel DUKE, EDF, ENGIE, PGE, RWE,

And focus on electricity overall without specific fuel.

A more relevant comparison of the use of these fuels would be a specificity analysis, this time we include wind. Calculation is done with specific terms of coal, gas and wind within global corpus, not as a comparison between them.



**Figure 36 Specificity calculation coal, gas, wind for all companies**

This is performed on Figure 36 with specificity calculation on coal, gas and wind. It shows that coal is overrepresented for AEP (USA) and ESKOM (South Africa), this is quite logical since they both operate a lot of coal power plant. But it means it is also overrepresented compared to the size of their report and in the corpus. Underrepresentation is particularly marked for PG&E (USA), ENGIE and EDF. This is a surprise for the last two, since they operate significant coal power plant, and face regular criticism to do so. It means they minimize in CSR report importance of coal operation, to a much larger extent than the normal size of the report should reflect.

Wind was added here first to have a renewable source, and because total occurrences 5958 is in fact higher than coal; if “wind” does not appear on the top 20 occurrences of nouns, but only #69 it is more frequent for several companies than coal. Wind is overrepresented for VATTENFALL (Sweden) and IBERDROLA (Spain) who both were very early movers on wind energy. Most other are less specific, with a large scale of +/- 100. But specificity for wind is significant for RWE at 10 and EON at 8 compared size of their CSR reports where a 0 to 3

would be unspecific. ENGIE, ESKOM and PG&E are underrepresenting “wind”; this represents a later choice for wind energy, particularly ESKOM, or a preference for other technologies, PG&E in California stronger on solar energy.

It is noticeable that E.ON and RWE (Germany) both very challenged for their coal power plant do not show up here as overrepresented in coal. This shows a choice to communicate on other subjects, and minimize coal. Nevertheless, they mention coal significantly, for a total of 17% in the whole corpus. E.ON number of occurrences is 400 for coal, and RWE 651 times.

#### **4.2.1.4 Looking at specific vocabulary**

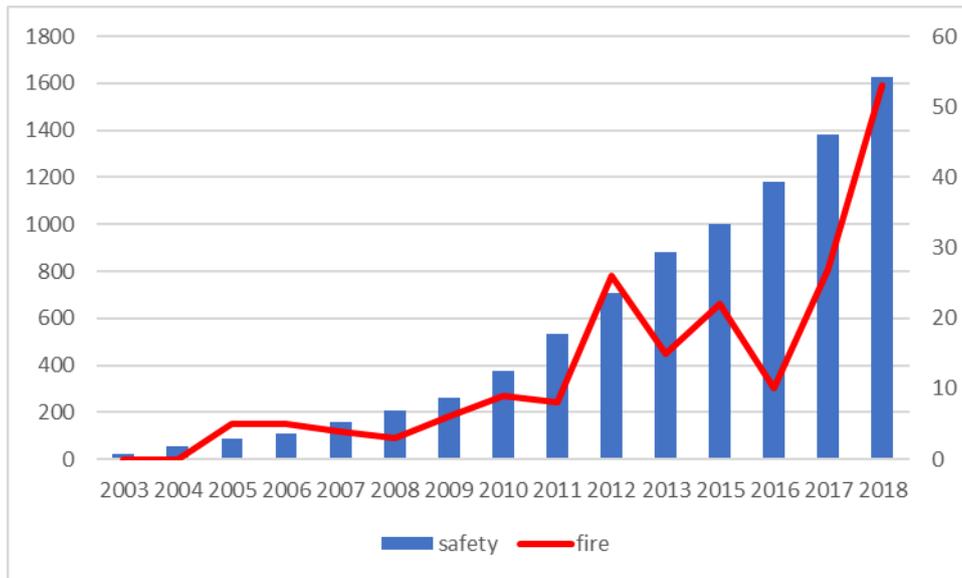
The second colour used in Table 11 is yellow for single occurrences in the top 20 nouns table. When blue cells focus on the common part, yellow ones are the specific use by companies. A focus for each company specific vocabulary shows:

AEP focuses on “transmission, resource” much stronger than others. AEP uses “transmission” 1039 times out of 3937 while AEP represents only 6% of the corpus.

ENGIE focuses on « line, plan, income, contract, agreement”. It is a very specific vocabulary, with also the focus on gas in first ranking noun. The importance of contract and agreement could be expected true for all companies. In fact, it is mostly specific to ENGIE and EDF.

ESKOM (South Africa) focuses on “« performance, capacity, programme”. It comes as a surprise that they are the only one to stress performance (1592 occurrences out of a total 9534, when ESKOM weighs 6% of the total corpus). On the contrary capacity is not a wonder with weaknesses of the grid. “Performance” is associated as a cooccurrence to key, indicator, plant, target, or compact. This concern on performance is mostly concern at power plant level and distribution lines, as shown by two verbatim: “Eskom’s distribution performance is greatly affected by the performance of long rural lines with limited redundancy and feedback capabilities” (ESKOM 2013 p35). And a few years later, “Medupi Unit 6 performance is still being excluded from the performance above” (ESKOM, 2016, P48).

In the case of PG&E, we see that this Californian company **insists on “safety”**. This can be read be in relation to difficult situation for California with wildfires.



**Figure 37 Bar chart of frequencies of “safety” in PG&E reports (right scale) in regard of occurrences of “fire” (left scale)**

Figure 37 shows how much the concern has grown for California. And when linked to occurrences of “fire, wildfire”, as shown in fig with a red line it is even more striking. “safety” is steadily growing as one of core values of Pacific Gas & Electric. This shows emergence of wildfire theme, which contributed to PG&E filing for bankruptcy in 2019.

These single occurrences are only defined **within top ranking words, there are not real hapax** (defined as terms that would be absolutely specific in the corpus). To capture these, as they are often new terms like “bettercoal” “trilemma”, “clean-smarter”, we use other methods. It is via indirect search that such hapax appears.

“bettercoal” could be a good candidate, since this term appears 10 times overall, for 5 companies in total, mostly in 2015-2016. Coining a concept of “bettercoal” on top of coal is an interesting way to associate positive and improving elements to coal which gets increasingly vilified.

But in fact, the main reference is the Bettercoal initiative with a capital B. with this time close to 300 occurrences it is more a candidate for emergence of new potential for coal than just a curiosity in the text.

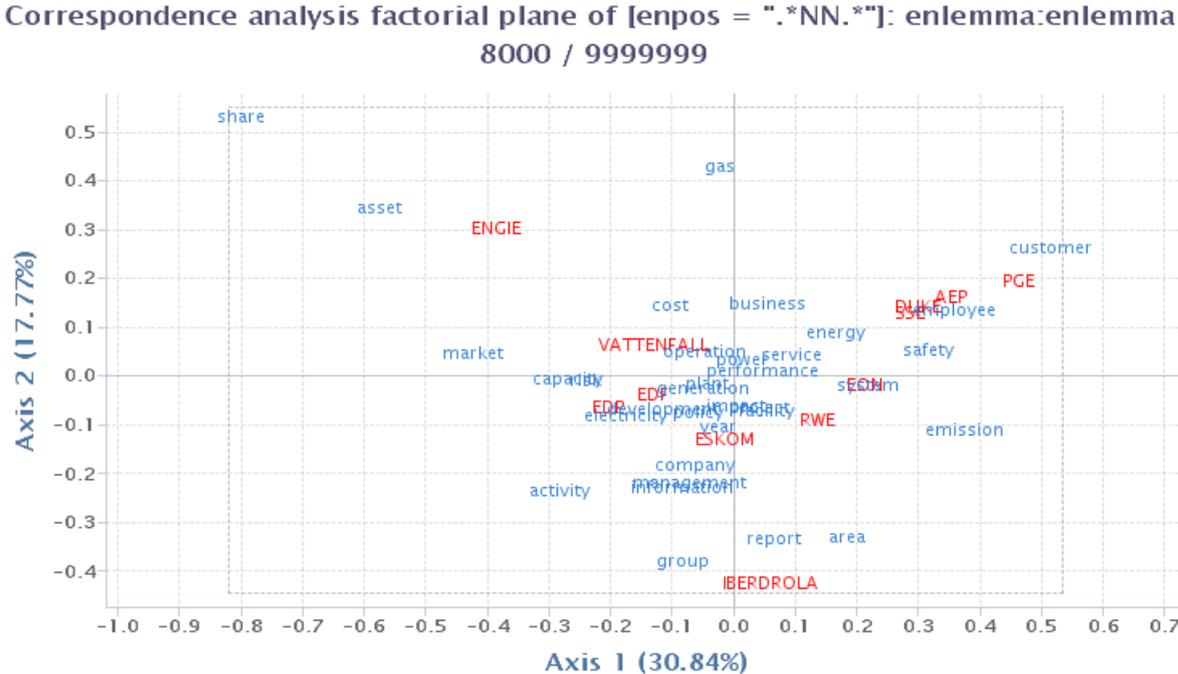
A good introduction to this “bettercoal initiative” can be read “Cooperating with other energy companies is absolutely essential in order to be in a position to exert more pressure and achieve sustainable production and transport conditions in the supply chain for hard coal. In 2012, we joined forces with other large purchasers of hard coal to launch the Bettercoal initiative. By the

end of 2016, 13 of the big European energy companies were already members of Bettercoal” (RWE 2016 p7).

When expanding to all spelling used (typically BetterCoal, or bettercoal), this initiative appears very limited to German companies, representing around 80% of occurrences; maybe many companies are member of this initiative as described in RWE 2016 report, but only 2 in our sample seem to express it.

**4.2.1.4 Graphical representation in correspondence analysis**

Most frequent nouns (here more than 8000 occurrences, which makes 34 nouns) are then visualised on a vector representation; this correspondence analysis in Figure 38 shows how close each company are to the nouns selected. Rather than having list of nouns, here it is a projection of corpus of each company within the space of these most frequent nouns.



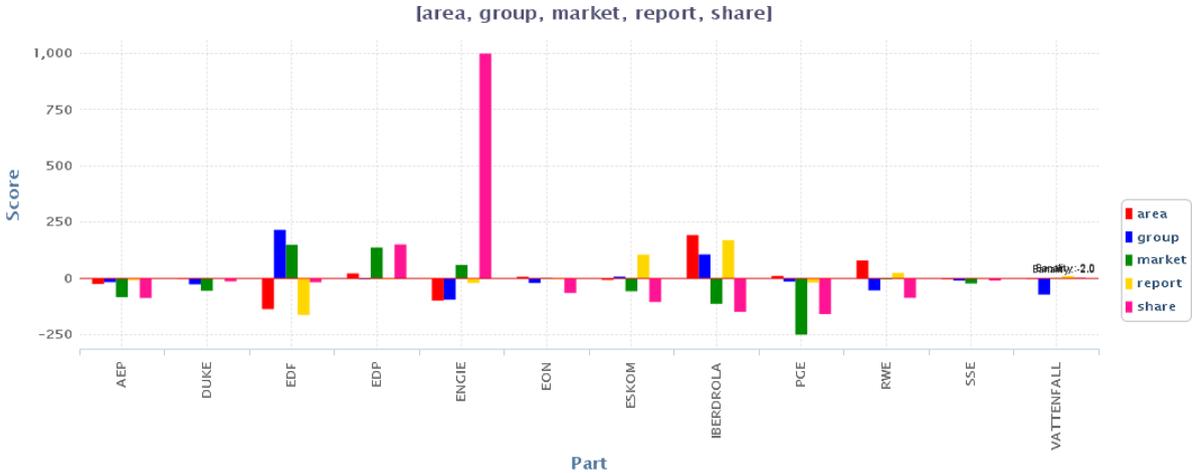
**Figure 38 Correspondence analysis of top nouns across the company**

On this vector representation companies appear very scattered, especially the largest corpus of EDF, EDP and ENGIE are not in the middle, when they represent 45% of the total corpus. In particular ENGIE seems very specific around “share, asset, gas”. This is very logical for “gas” due to the historic gas business in the group. PG&E seems very specific around “customer”, while all three US company use consistently “employee, safety”. On the bottom of

the figure, IBERDROLA seems very exposed to “group, report, area, management, information”.

On the contrary, most undifferentiated terms in the middle of this first factorial plane include “plant, generation, performance, power, operations, service”. This centre is very consistent with the kind of companies we look at, and just confirming that the vocabulary is focused on electricity business.

To determine how the apparent specific terms in the graph are really statistically different, we perform a specificity calculation on the terms on the outer ring. On “group, report, area, share, asset, market” this shows on Figure 39.



**Figure 39 Specificity calculation of nouns by company**

Here specific use of any noun is compared to all nouns. “Share” is very specific to ENGIE, as was seen in the correspondence analysis figure. Probably importance of subsidiaries and ownership is much more developed for ENGIE. In number of occurrences ENGIE uses 3000 times “share” out of a total of 8000, where the corpus of Engie weighs only 11%.

Other terms here, “area, group, market, report” are less specific, as drawn on Figure 39. This is partly due to the conventional specificity of 1000 for ENGIE, which means the highest value the software returns. If we were to exclude the term “share”, all other would more specific to some companies. This is not the purpose here to ponder on distribution of “area, group, market or report” that are not considered here as key into comprehension of changes.

## 4.2.2 Observing adjectives used in the corpus

### 4.2.2.1 Main findings from exploration of adjectives

This result section explores adjectives used (and first of all renewable), which company uses them, and what variation can be observed. The study of some specific adjectives like: “smart”, “fair” is particularly relevant. From the most frequent adjectives 2 interesting oppositions are identified:

- Opposition between financial and environmental which shows marked differences. On one side “environmental” is associated to PGE and IBERDROLA. And on the other direction “financial” is very marked for ENGIE, ESKOM and VATTENFALL. It turns out that those who use one do not use the other one.
- Opposition local to corporate reveals the accent put by companies on one dimension. Sometimes there is an opposition between priority at corporate level or at local one. For others the use of “local, corporate” is more associated to other concerns, like business model for EDP, or reputation for IBERDROLA.

These oppositions in adjectives create some rhetoric opposition. But they are not used systematically one over the other, as they can also be associated to other dimensions.

### 4.2.2.2 Frequency tables by decreasing ranking of adjectives used

**Analysis of adjectives is particularly relevant to our research question.** First because of the link to our research question: how does legitimacy change from “efficient, thermal, cheap, energy” to different leading qualifiers “new, renewable, sustainable energy”. We aim to observe these shifts and speed of evolution in each company’s vocabulary. And second because our corpus contains a high variety, with 705 000 number of adjectives just below 714 000 number of verbs. This shows how reports are more oriented to qualify actions taken than explaining what companies do, otherwise it would be expected in English language that verbs be overwhelming form of expression. In the top 10 most frequent adjectives we find key dimensions which could be read more or less as potential opposition: “financial” more or less vs “environmental”, “nuclear” opposed or complementary to “renewable”, “corporate or local” decisions.

| en | total       | AEP         | DUKE       | EDF        | EDP         | ENGIE        | EON         | ESKOM       | IBERDROLA   | PGE         | RWE          | SSE         | VATTENFALL   |
|----|-------------|-------------|------------|------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|-------------|--------------|
| B  | C           | D           | E          | F          | G           | H            | I           | J           | K           | L           | M            | N           |              |
| 1  | other       | new         | new        | nuclear    | corporate   | financial    | new         | financial   | environmen  | other       | new          | new         | other        |
| 2  | new         | other       | other      | French     | other       | other        | environmen  | new         | such        | new         | environmen   | total       | financial    |
| 3  | financial   | environmen  | natural    | new        | new         | net          | other       | other       | other       | environmen  | other        | renewable   | nuclear      |
| 4  | environmen  | such        | electric   | financial  | financial   | new          | such        | due         | financial   | local       | renewable    | responsible | total        |
| 5  | nuclear     | electric    | economic   | other      | annual      | natural      | corporate   | total       | various     | electric    | important    | sustainable | new          |
| 6  | such        | many        | solar      | public     | environmen  | French       | key         | environmen  | social      | natural     | German       | environmen  | net          |
| 7  | total       | significant | environmen | industrial | total       | corporate    | important   | key         | corporate   | such        | CO2          | local       | environment  |
| 8  | corporate   | financial   | nuclear    | such       | internal    | total        | German      | integrated  | significant | solar       | nuclear      | financial   | such         |
| 9  | local       | important   | renewable  | environmen | strategic   | environmen   | global      | strategic   | total       | total       | local        | key         | consolidated |
| 10 | renewable   | regulatory  | total      | local      | social      | internal     | social      | net         | specific    | renewable   | own          | economic    | future       |
| 11 | natural     | natural     | financial  | renewable  | main        | industrial   | regional    | annual      | new         | corporate   | corporate    | social      | Swedish      |
| 12 | social      | economic    | such       | particular | such        | nuclear      | responsible | future      | available   | annual      | such         | first       | fair         |
| 13 | annual      | local       | regulatory | major      | general     | long-term    | human       | such        | economic    | diverse     | key          | such        | annual       |
| 14 | public      | renewable   | commercial | certain    | different   | such         | nuclear     | significant | human       | public      | occupational | significant | important    |
| 15 | French      | federal     | important  | European   | economic    | social       | smart       | current     | old         | first       | social       | important   | current      |
| 16 | significant | public      | additional | applicable | renewable   | current      | relevant    | operational | global      | significant | same         | other       | renewable    |
| 17 | net         | additional  | future     | total      | responsible | main         | Group-wide  | available   | local       | federal     | first        | potential   | sustainable  |
| 18 | economic    | several     | federal    | social     | due         | consolidated | first       | nuclear     | sustainable | last        | available    | long-term   | local        |
| 19 | internal    | first       | many       | natural    | regulatory  | renewable    | sustainable | corporate   | due         | additional  | relevant     | major       | hydro        |
| 20 | due         | corporate   | reliable   | main       | net         | local        | own         | average     | internal    | important   | high         | annual      | internal     |

**Table 13 Top occurrences of adjectives overall in the corpus**

**(in blue common vocabulary to most companies, in yellow singular use in the table)**

Table 13 shows the 20 most frequent adjectives used overall and by company. Colour code states in blue the most frequent used adjectives overall when they are used by most companies; and unique values in this table shown in yellow.

On the total vocabulary, the most frequent adjectives are other (16100), new (15300), financial (11900), environmental (11100), nuclear (10900). In this exercise cardinal adjectives were discarded to get only words. We see also the relative importance of country adjectives like French, Swedish, but they will not be studied here. If French comes at #5, it is mostly due to the corpus size of EDF (4189 occurrences for a total of 4244), same for Swedish with VATTENFALL.

In this list of 20 most frequent adjectives, there are some groups:

One group is around dimensions of CSR report and strategy, with financial or environmental

A second group suggests potential oppositions with “local, corporate“.

A third group is focusing on types of fuels, including nuclear, or wider category of renewables.

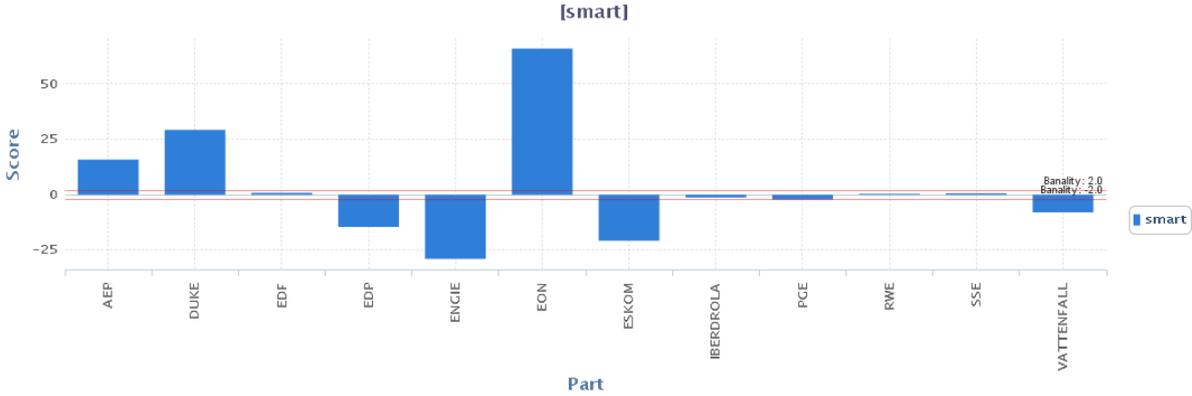
Before moving to each of them, we examine singular occurrences in the table. These values are not real hapax, since they can appear below the line of top 20 occurrences, but nevertheless in the top vocabulary of one single company.

There are relatively few unique adjectives in the table, once removing those like “several, certain, various, same...”, which are considered not relevant for our research.

Three adjectives retain attention here:

For DUKE, “commercial” is a very specific term used, as well as “reliable”. If most company use the term (out of the 2225, used by EDF 425 times or ENGIE 423), for DUKE it is a specific use with 158 occurrences, ENGIE having also a high score here.

For E.ON, on single term is outstanding, “smart”. And the specificity calculation shows in Figure 40 statistically confirms how the company puts an unusual focus on this.



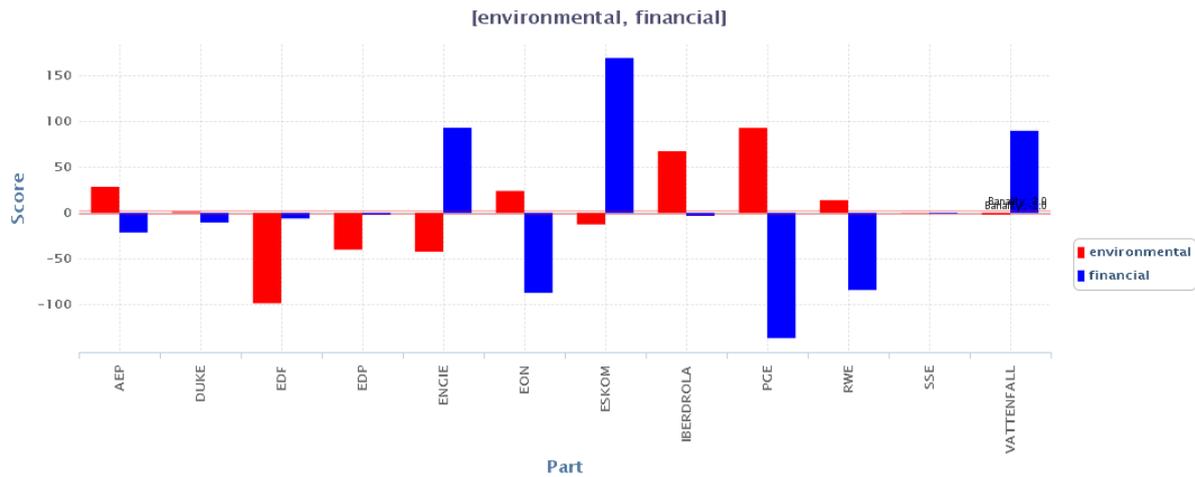
**Figure 40 Specificity calculation of “smart” across companies**

This is a growing concern, appearing in 2012 in the vocabulary and increasing ever since. Like for “commercial” for DUKE, E.ON is not the first user in absolute numbers (374 occurrences, second after EDF 579, out of a total of 2214) but high specificity score for its corpus size. And for E.ON it is associated with smart “meter, grid, home, energy...”

Last specific term studied her is “fair”, for Vattenfall. It is mostly associated to fair value, fair return for the total corpus, but for VATTENFALL, next to the largest fair value, there are to a lesser extent “fair presentation and fair competition”.

**4.2.2.3 Using specificity diagram to highlight opposition of terms**

Based on the frequency identified, we look at couple of terms that appear in rhetorical opposition between companies. It consists in financial over environmental, then local over corporate. This is not an exclusive choice of one side, but rather an exploration of how each company insists on one side vs the other.



**Figure 41 Specificity calculation “financial vs environmental” by company**

Figure 41 shows a simple specificity calculation of financial and environmental within the overall corpus. Simple, because the two not necessary opposed each other, and CSR purpose would rather be to reconcile both. Simple also because other adjectives can participate here and we will add them in a further section.

There is a first group of companies which do not use both very differently. This could confirm a balanced on two legs approach, both finance and environment. Here this is only the case for DUKE, SSE, and with opposite use for AEP.

Companies which put environment first are IBERDROLA and PGE. On the contrary environmental is extremely low within EDF. It should not be read that EDF does not care about environment, but that it is not apparent with this scale. For IBERDROLA associations below are very interesting showing positive and negatives sides presented in the reports.

| association adj + nouns   | total occ. |
|---------------------------|------------|
| environmental impact      | 230        |
| environmental management  | 131        |
| environmental risks       | 58         |
| environmental performance | 53         |

Companies which most put emphasis on financial are ENGIE, ESKOM and VATTENFALL. On the contrary financial is very scarce in corpus by E.ON, PG&E and RWE. Financial difficulties in ESKOM explain such a focus;

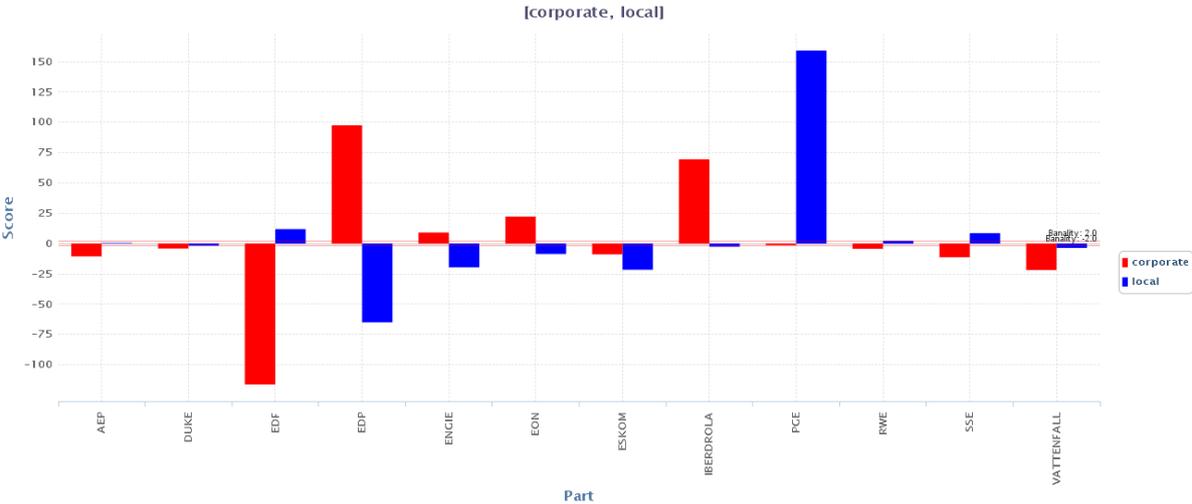
As for ENGIE this is very contrasted in time, when financial appears 1984 times overall; at the beginning of the period it is a crucial topic (210 times in 2011, 671 in 2012 when the report was the longest, but only 60 occurrences in total in 2016 to 2018). Financials have stopped to be a

topic in CSR report for ENGIE, they were overrepresented in 2012 and 2015. It can be a shift in attention, or the new report design when the group becomes ENGIE but both point to the same direction, that the group is less driven by financials than before.

For E.ON there is an editorial choice that CSR reports excludes all currency related matter, this is why financials are particularly absent.

**A second group suggests potential oppositions with “local, corporate“.** Another apparent opposition appearing in Table 13 was between local and corporate. We test here whether local, #8 with 6726 occurrences and corporate #9 with 6196 occurrences are commonly shared across company sample.

Specificity calculation evaluates how much the two terms are used in comparison to the overall corpus. Following Figure 42 gives the specificity of both terms, with the rest of the corpus in the background.



**Figure 42 Specificity calculation of corporate vs local by company**

**Two companies focus on the corporate side,** EDP heavily and IBERDROLA. EDP is using far less “local” than its size of corpus, (+97 and -55), when IBERDROLA uses local in same proportion than its corpus size (scores of +69 and -3). This can be interpreted as for IBERDROLA it is likely to be an emphasis of the corporate side; and for EDP rather a question of vocabulary, and use of another term instead of local.

| IBERDROLA "Corporate" # occurrences 839 |      |        |       |          | IBERDROLA "Local" # occurrences 455 |      |        |       |          |
|---|------|--------|-------|----------|-------------------------------------|------|--------|-------|----------|
| Occ                                     | Freq | CoFreq | Score | MeanDist | Occ                                 | Freq | CoFreq | Score | MeanDist |
| governance                              | 446  | 143    | 128   | .8       | communities                         | 346  | 106    | 119   | .9       |
| policies                                | 580  | 105    | 66    | 2.2      | wage                                | 31   | 25     | 43    | 1.4      |
| responsibility                          | 429  | 90     | 63    | 2.4      | authorities                         | 160  | 27     | 23    | .1       |
| social                                  | 1236 | 129    | 52    | 2.6      | level                               | 429  | 38     | 22    | 2.0      |
| functions                               | 54   | 33     | 42    | 1.3      | programmes                          | 537  | 38     | 18    | 3.7      |
| reputation                              | 42   | 21     | 24    | 1.3      | governments                         | 89   | 19     | 18    | .8       |
| businesses                              | 383  | 48     | 23    | 2.8      | impact                              | 616  | 40     | 18    | 4.5      |

**Table 14 Corporate vs local for IBERDROLA main cooccurrences**

Table 14 shows that if “corporate” is about twice as much represented in the IBERDROLA subcorpus, it is also in different context. Corporate side is associated mostly with governance, and global policies, when “local” is referring rather to a decision level “local communities, authorities, level”.

A first group of associated terms shows that “corporate” and “local” are not in opposition. The first one refers to governance of the company (“governance, responsibility, function”), when the second covers more relationships with stakeholders (“communities, authorities, government”).

But a second group appears with more opposed priorities; on one side there is “corporate reputation, business”; echoing “local level, local impact”. We are in a -think global, act local- perspective, corresponding to the high number of countries where IBERDROLA operates.

We compare these elements with EDP, the second highest ranking company on “corporate dimension”.

| EDP "Corporate" # occurrences 1041 |      |        |       |          | EDP "Local" # occurrences 257 |      |        |       |          |
|------------------------------------|------|--------|-------|----------|-------------------------------|------|--------|-------|----------|
| Occ                                | Freq | CoFreq | Score | MeanDist | Occ                           | Freq | CoFreq | Score | MeanDist |
| bodies                             | 454  | 256    | 304   | .4       | communities                   | 154  | 46     | 66    | .5       |
| governance                         | 544  | 356    | 127   | .5       | authorities                   | 80   | 27     | 41    | .1       |
| members                            | 1222 | 164    | 80    | 3.3      | community                     | 170  | 28     | 32    | 1.6      |
| model                              | 485  | 105    | 73    | 1.9      | engagement                    | 63   | 13     | 17    | 2.6      |
| recommendatio                      | 134  | 37     | 30    | 6.1      | populations                   | 23   | 10     | 16    | .9       |
| exception                          | 52   | 26     | 29    | 4.3      | development                   | 722  | 24     | 12    | 2.0      |
| body                               | 311  | 46     | 25    | 1.7      | relations                     | 314  | 15     | 9     | 3.3      |

**Table 15 Corporate vs local for EDP main cooccurrences**

For EDP the difference in occurrence is more marked, with “corporate” used four times more than “local”.

In Table 15 like for IBERDROLA “local” is very much associated to acting with “communities, populations”, but with a stronger focus on engagement of the company.

But on the other side, “corporate” is not used partly for governance matters, like IBERDROLA but also for description of business model “members, model, recommendation”.

Beyond these two companies, to a lesser extent, E.ON with a specificity score of 22 for corporate, and ENGIE with a score of 9 also put more emphasis on the corporate side.

This analysis shows how the comparison corporate / local reveals accent put by companies on one dimension; it shows what dimension can be in opposition between priority at corporate level or at local one. And it shows some different concerns for companies, like business model for EDP, or reputation for IBERDROLA.

**On the other side only PG&E puts a very strong emphasis on local aspect**, with specificity score of 129; EDF has a score of 20 with also some overrepresentation of local compared to size of its corpus.

PG&E is using “local” 1151 times, with a focus on: “community (128), government (93), then level, business, and economy”. There is a dual orientation, towards stakeholders with local community and local government; and a concern to focus on an activity at local level and local business.

As PG&E is mostly serving California and USA it is understandable to find this focus on local content as very specific compared to most other companies.

This accent on “local” does not mean that PG&E is minimizing the corporate side. With 639 occurrences, on “corporate governance, sustainability, responsibility”, the specificity score shows a use slightly above expectation in comparison to the size of the corpus.

#### **4.2.2.4 Frequency and specificity of adjectives qualifying energy sources**

From the main table of adjectives, we saw that adjectives related to energy sources were coming high in the occurrences, especially “nuclear, renewable”. One limit here is that some energy sources are associated to adjectives (hydro-electric, nuclear, renewable) but other are solely associated to nouns (coal, gas) so that the analysis has a limited scope. We use the same frequency table of adjective, Table 16, but with only fuel related adjectives highlighted.

| en | total       | AEP         | DUKE       | EDF        | EDP         | ENGIE        | EON         | ESKOM       | IBERDROLA   | PGE         | RWE          | SSE         | VATTENFALL   |
|----|-------------|-------------|------------|------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|-------------|--------------|
| B  | C           | D           | E          | F          | G           | H            | I           | J           | K           | L           | M            | N           |              |
| 1  | other       | new         | new        | nuclear    | corporate   | financial    | new         | financial   | environmen  | other       | new          | new         | other        |
| 2  | new         | other       | other      | French     | other       | other        | environmen  | new         | such        | new         | environmen   | total       | financial    |
| 3  | financial   | environmen  | natural    | new        | new         | net          | other       | other       | other       | environmen  | other        | renewable   | nuclear      |
| 4  | environmen  | such        | electric   | financial  | financial   | new          | such        | due         | financial   | local       | renewable    | responsible | total        |
| 5  | nuclear     | electric    | economic   | other      | annual      | natural      | corporate   | total       | various     | electric    | important    | sustainable | new          |
| 6  | such        | many        | solar      | public     | environmen  | French       | key         | environmen  | social      | natural     | German       | environmen  | net          |
| 7  | total       | significant | environmen | industrial | total       | corporate    | important   | key         | corporate   | such        | CO2          | local       | environment  |
| 8  | corporate   | financial   | nuclear    | such       | internal    | total        | German      | integrated  | significant | solar       | nuclear      | financial   | such         |
| 9  | local       | important   | renewable  | environmen | strategic   | environmen   | global      | strategic   | total       | total       | local        | key         | consolidated |
| 10 | renewable   | regulatory  | total      | local      | social      | internal     | social      | net         | specific    | renewable   | own          | economic    | future       |
| 11 | natural     | natural     | financial  | renewable  | main        | industrial   | regional    | annual      | new         | corporate   | corporate    | social      | Swedish      |
| 12 | social      | economic    | such       | particular | such        | nuclear      | responsible | future      | available   | annual      | such         | first       | fair         |
| 13 | annual      | local       | regulatory | major      | general     | long-term    | human       | such        | economic    | diverse     | key          | such        | annual       |
| 14 | public      | renewable   | commercial | certain    | different   | such         | nuclear     | significant | human       | public      | occupational | significant | important    |
| 15 | French      | federal     | important  | European   | economic    | social       | smart       | current     | old         | first       | social       | important   | current      |
| 16 | significant | public      | additional | applicable | renewable   | current      | relevant    | operational | global      | significant | same         | other       | renewable    |
| 17 | net         | additional  | future     | total      | responsible | main         | Group-wide  | available   | local       | federal     | first        | potential   | sustainable  |
| 18 | economic    | several     | federal    | social     | due         | consolidated | first       | nuclear     | sustainable | last        | available    | long-term   | local        |
| 19 | internal    | first       | many       | natural    | regulatory  | renewable    | sustainable | corporate   | due         | additional  | relevant     | major       | hydro        |
| 20 | due         | corporate   | reliable   | main       | net         | local        | own         | average     | internal    | important   | high         | annual      | internal     |

**Table 16 Top adjectives used by company, focus on fuel related adjectives**

**There is a high variation across companies**, some put fuels related as most used terms, at the heart of their discourse (EDF and VATTENFALL with nuclear, or RWE and SSE with renewable) while other do not put it as highly used:

nuclear comes first for EDF, ENGIE, E.ON, VATTENFALL, ESKOM.

renewable comes first for AEP, EDP, RWE, SSE

solar for DUKE, PG&E

The more one company uses a term is not a demonstration of how important it is. Since we compare adjectives to adjectives, it cannot be interpreted wider. For ESKOM (South Africa) coal is about 10 times more important than nuclear in the production mix; but on this table only adjectives and not nouns are selected. We will build more fine-tuned requests in a dedicated section on energy mix to look at it. In this result part, we extract primary material from the corpus without elaborating a series of concepts that we search into the text.

Next step is to see why each company has nuclear, or renewable or solar as most used adjective. We extend the list in order to get only fuel related adjectives, this lowers the number of occurrences, but increases the relevance on how each company focuses on the various fuels, as per Table 17.

| en | total         | AEP           | DUKE          | EDF           | EDP           | ENGIE         | EON           | ESKOM         | IBERDROLA     | PGE           | RWE           | SSE           | VATTENFALL   |
|----|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|
| B  | C             | D             | E             | F             | G             | H             | I             | J             | K             | L             | M             | N             |              |
| 1  | nuclear       | electric      | electric      | nuclear       | renewable     | nuclear       | nuclear       | nuclear       | thermal       | electric      | renewable     | renewable     | nuclear      |
| 2  | renewable     | renewable     | solar         | renewable     | electric      | renewable     | renewable     | renewable     | renewable     | solar         | CO2           | thermal       | renewable    |
| 3  | electric      | solar         | nuclear       | radioactive   | hydro         | thermal       | solar         | coal-fired    | electric      | renewable     | nuclear       | electric      | hydro        |
| 4  | solar         | nuclear       | renewable     | thermal       | hydroelectric | solar         | conventional  | solar         | nuclear       | hydroelectric | conventional  | hydro         | CO2          |
| 5  | thermal       | electrical    | coal-fired    | solar         | thermal       | CO2           | radioactive   | electrical    | hydroelectric | nuclear       | coal-fired    | coal-fired    | solar        |
| 6  | CO2           | coal-fired    | CO2           | photovoltaic  | solar         | radioactive   | CO2           | electric      | CO2           | conventional  | solar         | solar         | fossil       |
| 7  | radioactive   | CO2           | fossil        | electric      | electrical    | hydroelectric | coal-fired    | hydro         | electrical    | electrical    | thermal       | electrical    | radioactive  |
| 8  | hydroelectric | hydroelectric | hydroelectric | CO2           | photovoltaic  | photovoltaic  | electric      | conventional  | conventional  | photovoltaic  | radioactive   | nuclear       | electric     |
| 9  | coal-fired    | fossil        | hydro         | electrical    | CO2           | coal-fired    | photovoltaic  | radioactive   | solar         | CO2           | electric      | fossil        | coal-fired   |
| 10 | electrical    | hydro         | photovoltaic  | fossil        | nuclear       | electric      | fossil        | hydroelectric | photovoltaic  | hydro         | photovoltaic  | other         | electrical   |
| 11 | hydro         | photovoltaic  | conventional  | coal-fired    | conventional  | electrical    | thermal       | photovoltaic  | radioactive   | fossil        | hydroelectric | new           | thermal      |
| 12 | photovoltaic  | conventional  | electrical    | hydroelectric | fossil        | hydro         | electrical    | thermal       | fossil        | thermal       | fossil        | financial     | conventional |
| 13 | conventional  | thermal       | radioactive   | conventional  | coal-fired    | fossil        | hydroelectric | CO2           | coal-fired    | radioactive   | electrical    | environmental | photovoltaic |
| 14 | fossil        | radioactive   | thermal       | hydro         | other         | conventional  | hydro         | fossil        | hydro         | coal-fired    | hydro         | such          | other        |

**Table 17 Occurrences of adjectives related to energy sources**

The analysis is conducted in four steps: a) ranking of fuel related adjectives shows which company uses some adjectives more b) numbers associated, with the top occurrences, c) correspondence analysis of proximity of each company to specific adjectives and d) specificity in use for each company.

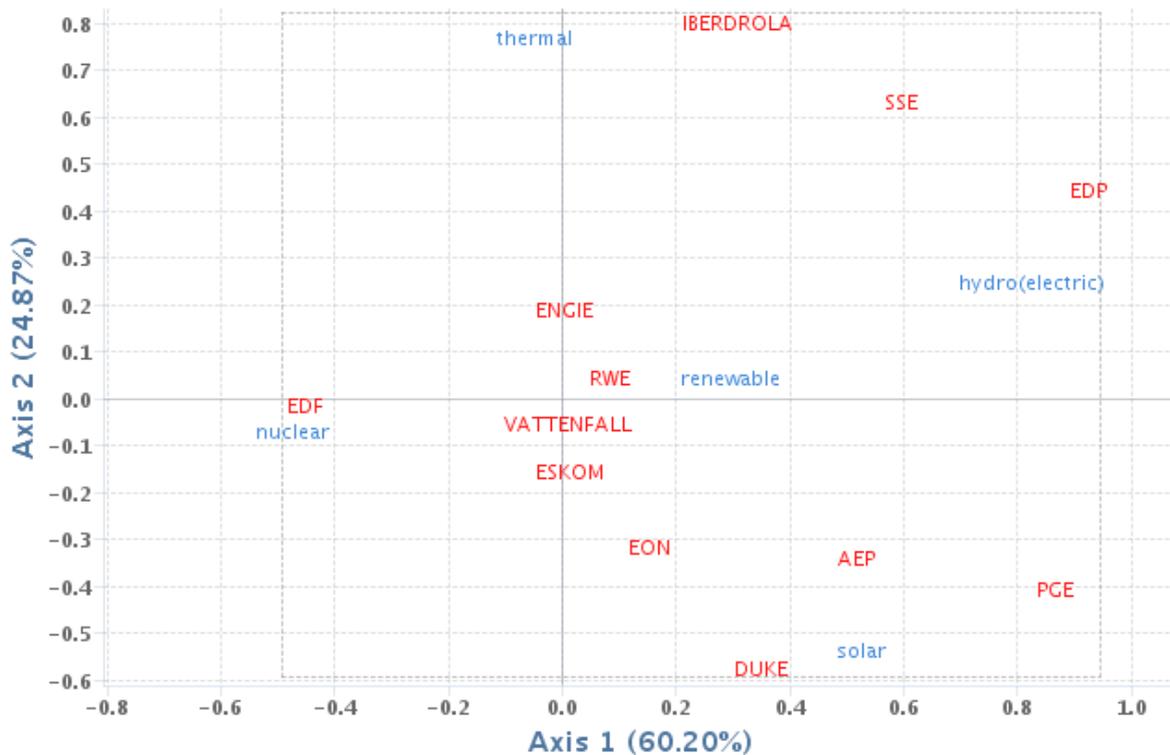
Number of occurrences show that they are **not related to their relative importance**. In Table 18 below, nuclear comes first because of large size in the corpus of EDF (25%) and citing 62% of total occurrences. Then renewable comes at a high score, and all companies use it;

|               |       |
|---------------|-------|
| nuclear       | 10884 |
| renewable     | 5985  |
| solar         | 2986  |
| thermal       | 1925  |
| hydroelectric | 1246  |
| hydro         | 1056  |

**Table 18 Number of occurrences of adjectives related to fuels**

Order of magnitude is interesting, with nuclear cited 10 times more than hydro; but they are not comparable one to one: renewable could cover several of the other fuels including hydro.

Correspondence analysis factorial plane of CORPUSCSR060120A129/parCY / < [enlemma = "nuclear|renewable|solar|thermal|hydro(electric)?"]>@enlemma ≤9,488,180 /9,488,180/@enlemma /9,488,180



**Figure 43 Correspondence analysis of energy sources adjectives across company**

Figure 43 show the correspondence analysis of the 12 companies on a bi dimension scale where fuel related adjectives are plotted. The farther right the more correlated to hydroelectric, the farther left, the more nuclear.

**Close to the centre is “renewable”, main topic but not evenly spread.** Renewable is the term most frequently used among energy sources. But if it is used massively by AEP, EDP, PGE, RWE, SSE it is not the case for others. In the direction towards “solar” there is a series of companies with AEP, DUKE and PGE the three American companies in the sample. We could say that for these three, the usual expression for renewable energy is limited to “solar”.

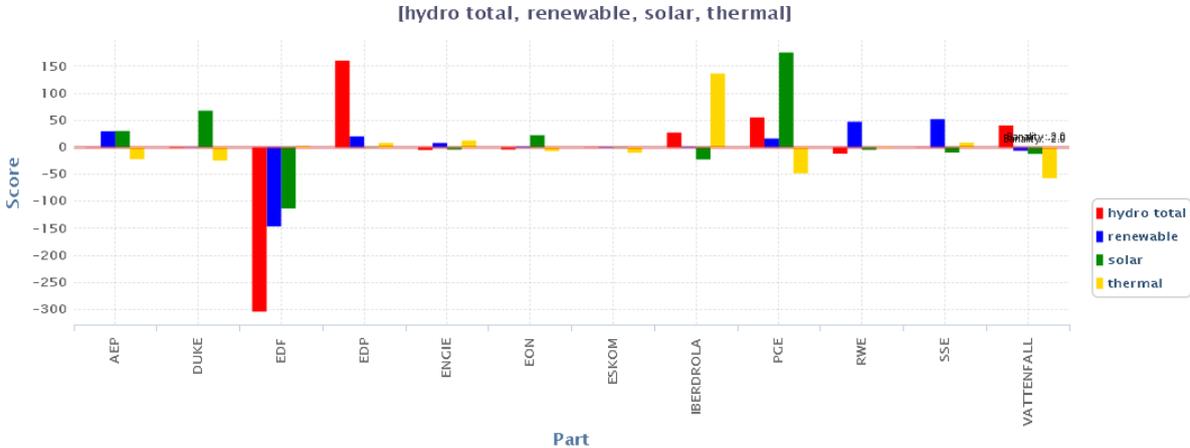
On the contrary, there is EDF very close to “nuclear”, due to the fact that it represents 6763 occurrences (62%), followed by VATTENFALL with 1408 occurrences (13%). Both of them account for 75% of all references to nuclear in the corpus.

Hydroelectric appears mostly associated to PG&E and EDP. Both group use “hydro” to a higher extent than other companies, accounting for 38% of all occurrences.

Last here “thermal” appears very near IBERDROLA 427 occurrences out of 1925. There is very limited explanation potential here due to all synonyms to thermal, it could just mean that other companies use “conventional energy” for example.

Looking into IBERDROLA uses, the most frequent associations are: “the thermal generation” (42 occurrences); “conventional thermal” (38); “the thermal plant” (43); “the thermal power” (19); “in thermal generation” (18); “conventional thermal” (15). This is around twice higher without the determinant. The equivalent numbers of conventional and thermal in each case can be interpreted as a choice to be very generic, not opposing one to the other.

Last view takes the same values of correspondence analysis, but within a specificity calculation.



**Figure 44 Specificity diagram for adjectives “hydro/hydroelectric, renewable, solar, thermal” by companies**

Figure 44 shows the specificity calculation, for the same values of correspondence analysis except “nuclear” discarded here; “nuclear” is so strong in the vocabulary that the rest is not appearing. This shows that hydro-electricity is underemployed by EDF relative to its use of the five adjectives (hydro, hydroelectric, renewable, solar, thermal) and over employed by EDP, and to a lesser extent PG&E and VATTENFALL. This comes as a surprise for EDF large actor in hydro. The interpretation is that EDF reports are very long, but hydro covering a limited part of these reports, which shows a lower importance than nuclear in computations.

Solar appears very specific to PG&E, then DUKE, with the same remark of underrepresentation for EDF.

**The explanatory potential of adjectives is reaching some limits.** The apparent opposition between financial / environmental shows some companies who strictly separate CSR report

with environmental, and annual report focusing on financial; and other trying to bridge the two together.

On an axis local / corporate, it turned out that they do not belong to the same priorities, corporate associated often to governance, and local more associated with action and decision.

And on the last dimension, adjectives related to energy types, like renewable, nuclear, solar... different patterns have emerged. On this analysis “renewable” tends to be in an opposition to nuclear, thermal and even hydroelectric in the discourse. But the explanation potential of these adjectives is limited because of dual use of nouns and adjectives for energies (wind energy vs solar energy). So that this serves as preparation work of more complex requests on all fuels.

### **4.3 RESULTS BY THEME AROUND ENERGY**

This section covers themes in energy in conjunction to energy transition literature. It is structured along four issues:

- In 4.3.1 Emergence of energy transition and how it complements use of clean power.
- In 4.3.2 Use of carbon and CO<sub>2</sub> and emergence of carbon footprint.
- In 4.3.3 Study of how the energy production mix moves into renewable.
- In 4.3.4 Observation of how risk of stranding assets is getting perceived as a threat.

Results produced are in three directions: **how overall vocabulary changes, how companies use different or same vocabulary, and how each company changes over time.** These are indications of how companies change, observed through the way they declare it in CSR reports. Change in CSR content are partly comparable to change in strategy; this is the proxy used in this research. We have analysed the discourse along guiding principles: if company A is citing less and less coal, and is moving its vocabulary from “developing coal” into “avoiding coal”, then there is a clear shift in strategy, asset selection, production mode. Taking another example of trajectory in the discourse: if company B was silent at the beginning about transformation and change, and start using these words at length, there is reasonable proof that a change of strategy is happening or at least claimed.

### **4.3.1 Apparition and diffusion of “energy transition”**

#### **4.3.1.1 Main findings around “energy transition”**

We observe “energy transition” in the corpus, its emergence when and for which companies and how the use evolves. The expression was not employed until 2011; it started to be part of CSR vocabulary, up to a tipping point around 2016 when it became broadly used. This convergence, just after the Paris Agreement in 2015 is marked in Europe. In the same time, it is not a shared concept for all companies represented. In America “clean power” is much more appropriate.

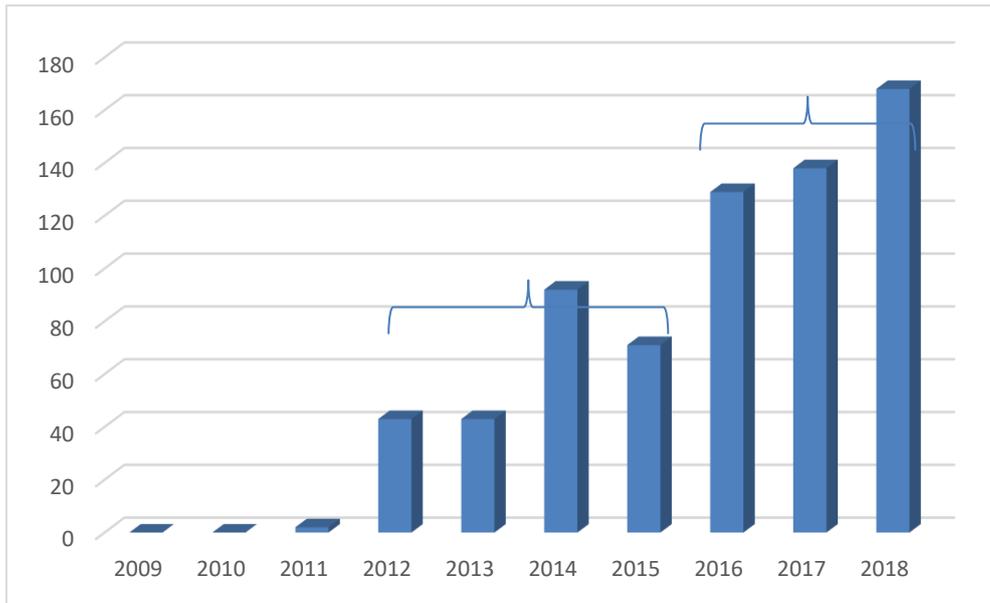
We show that nobody can stay out of the way of this transition. But each company “translates” it into its own language. Sometimes it is with home-made concept (typically “fossil-free” for VATTENFALL), or by using external references, like legislation. Together with other constructed concepts, it shows that companies defend their legitimacy by advertising tailor made production mix, or product service mix which shows the best picture.

Through choice of words some companies appear to be more in a minimal adaptation approach, or late converted, when other embrace a larger transformation.

#### **4.3.1.2 Using bar chart to characterise emergence of energy transition**

In this section, we study emergence and diffusion of the concept of energy transition. Even if the literature made it popular many years ago, it is not widely used by all companies of the sample. And some prefer other concepts closer to their legal or social environment. “Energy transition” is pointing at shifting, changing direction; whereas “clean power” which is more frequent in the USA refers to clean opposed to dirty.

**Emergence of energy transition by 2011.** On the whole corpus, the expression “energy transition” appears on 687 occurrences. This absolute number is studied by year, by company and how it unfurls across the corpus. Up to 2010 energy transition was not part of CSR vocabulary, at least for our company sample, as show on bar chart Figure 45 below. Then it appeared in 2011, then with an apparent regular progression (this statement is also based on total size within +/-10% of yearly corpus 2011-2018, presented on Figure 25). But comparing to the Paris Agreement in 2015, it shows a marked difference, with 62 times on average up to 2015 and 145 after, during the period 2016 – 2018.



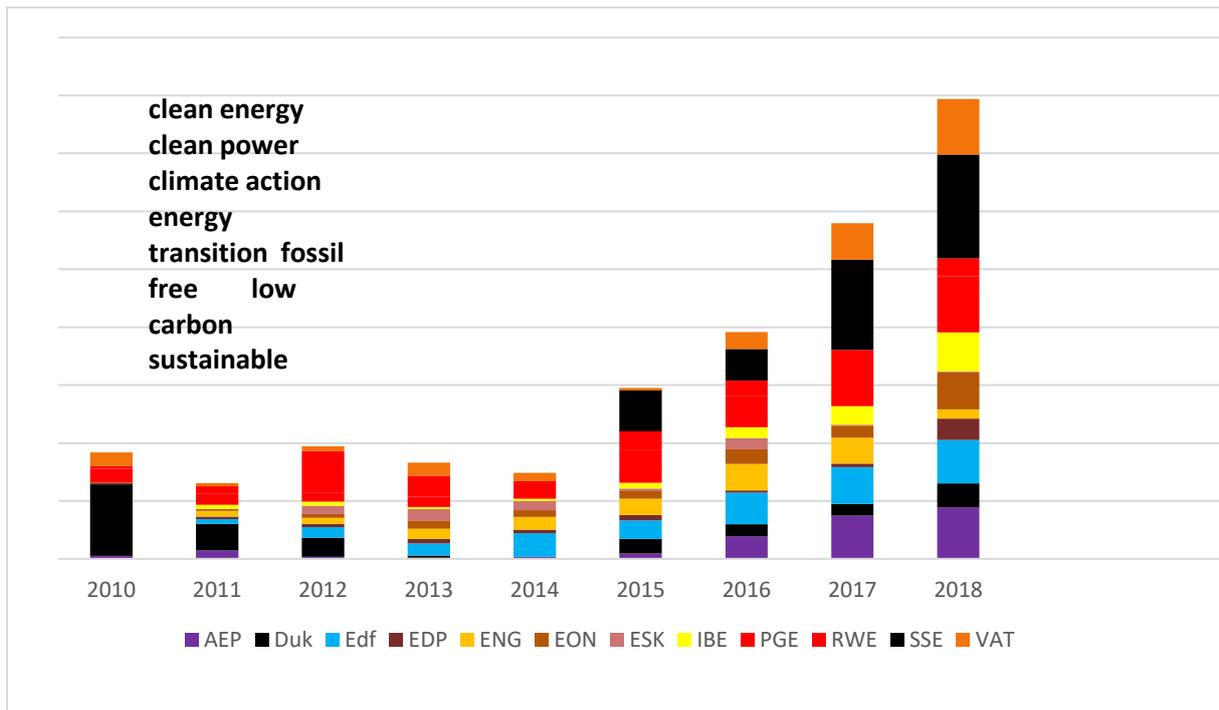
**Figure 45 Bar chart emergence of “energy transition”**

RWE started in 2011 using this expression and kept developing it into their communication. And the way the company uses it shows the evolution, from a big challenge ahead, to a normal business environment:

“The energy transition is a big challenge for us all. RWE is playing a role in structuring the future of energy supply. And that did not begin only a year ago” (RWE, 2011 p1).

“This approach means that we also believe part of our role is to act as advisors for a successful energy transition which achieves a balance between climate protection, competitiveness and certainty of supply » (RWE, 2018 p97).

**Those who use it and those who do not.** Previous analysis leads to look into which companies started using “energy transition” and in which context.



**Figure 46 Bar chart of energy transition concepts by company and by year**

Figure 46 is a bar chart on use of concepts around energy transition, as listed on the graph, along the years, but this time by company shows different elements. First it shows a very progressive use by companies. Up to 2015 only 3 companies are addressing energy transition per se: RWE (Germany) as pioneer but then less until 2015. Then EdF, ENGIE, and SSE.

Then number of companies increases from 5 in 2016 to 9 companies in 2018. This means ESKOM (RSA), SSE (UK) and Duke Energy (USA) do not use it at all. This raises the question of how these companies take global warming in consideration, which is studied here-below.

The second observation is that some companies use it increasingly with the years, while other tend to use it less. There is no steady trend upwards but rather a focus in time which is then less developed in the corpus.

| table | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | total |
|-------|------|------|------|------|------|------|------|------|-------|
| RWE   | 2    | 35   | 18   | 15   | 14   | 14   | 14   | 15   | 127   |
| EDF   | 0    | 7    | 14   | 65   | 32   | 65   | 77   | 83   | 343   |
| ENG   | 0    | 1    | 11   | 12   | 21   | 36   | 29   | 7    | 117   |
| EON   | 0    | 0    | 0    | 0    | 3    | 11   | 4    | 19   | 37    |
| AEP   | 0    | 0    | 0    | 0    | 1    | 1    | 4    | 2    | 8     |
| IBE   | 0    | 0    | 0    | 0    | 0    | 2    | 8    | 16   | 26    |
| VAT   | 0    | 0    | 0    | 0    | 0    | 0    | 2    | 11   | 13    |
| EDP   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 14   | 14    |
| PGE   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1     |
| total | 2    | 43   | 43   | 92   | 71   | 129  | 138  | 168  |       |

Table 19 shows the adoption of “energy transition” in CSR reports year after year company after company. It shows the global adoption move year by year. But it also shows (number of occurrences in blue) that “energy transition” gets less cited after some years.

| table | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | total |
|-------|------|------|------|------|------|------|------|------|-------|
| RWE   | 2    | 35   | 18   | 15   | 14   | 14   | 14   | 15   | 127   |
| EDF   | 0    | 7    | 14   | 65   | 32   | 65   | 77   | 83   | 343   |
| ENG   | 0    | 1    | 11   | 12   | 21   | 36   | 29   | 7    | 117   |
| EON   | 0    | 0    | 0    | 0    | 3    | 11   | 4    | 19   | 37    |
| AEP   | 0    | 0    | 0    | 0    | 1    | 1    | 4    | 2    | 8     |
| IBE   | 0    | 0    | 0    | 0    | 0    | 2    | 8    | 16   | 26    |
| VAT   | 0    | 0    | 0    | 0    | 0    | 0    | 2    | 11   | 13    |
| EDP   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 14   | 14    |
| PGE   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1     |
| total | 2    | 43   | 43   | 92   | 71   | 129  | 138  | 168  |       |

**Table 19 Number of occurrences of “energy transition” by year, by company (no values for DUKE, ESKOM, SSE)**

For RWE It is explained by a sudden change in 2011-2012. “The challenge of the energy transition.

In 2011, Germany launched a fundamental directional change in relation to the supply of electricity RWE” 2012 p 3). After this shift, the company is moving into implementation. This can be read in “of the energy transition (RWE 2013 p6). And is still the case up to 2018, with energy transition part of the landscape. “we engage in discussions with our stakeholders in particular on the following issues: our contribution to the energy transition and climate protection” (RWE 2018 p21)”.

Looking at EDF second adopter of “energy transition” in 2012. If the numbers are much higher it is due to difference in report size. RWE weighs 5% and EDF 25%, meaning that when RWE employs “energy transition” 127# it would be equivalent to 635# or twice as much as actual use by EDF 343 #.

For EDF the change in tone is quite perceptible. In 2012, first use by the company, energy transition is a debate “the new amounts to be applied may be reviewed by the Parliament in the second half of 2013 upon conclusion of the energy transition debate” (EDF 2012 p 59). Whereas in 2018 it has moved to the front line and main role of the company. “A key player in the energy transition, EDF group is an integrated energy company” (EDF 2018 p2).

**4.3.1.3 Specificity diagram to find alternative formulation to “energy transition”**

If “energy transition” has proven to be a fruitful concept across our corpus, it is not shared by all companies. Does it mean the other in our sample do not care about consequences of global

warming? or does it mean they use other words? Some other concepts have emerged from introductory statement of CSR in 2018, including low carbon, and climate action.

In order to expand the concept to how it is used by other companies, we test for all companies what frequent association appear with carbon, energy, power which would match. This brings additional concepts such as:

| <b>Word association</b> | <b>occurrences</b> | <b>used by</b>              |
|-------------------------|--------------------|-----------------------------|
| Low carbon              | 813                | large use by SSE, EDF       |
| Clean energy            | 621                | large use by AEP, DUKE, PGE |
| Sustainable energy      | 262                | large use by VATTENFALL     |
| fossil free             | 116                | large use by VATTENFALL     |
| climate action          | 68                 | large use by IBERDROLA, PGE |

This expansion of vocabulary takes into account differences in spelling (like low carbon and low-carbon), and discarded association which were not significantly used (like clean power only 18 use). When representing these association in a specificity diagram, as shown on Figure 47 vocabulary used outside “energy transition” appears clearly.

**“Clean energy” is very characteristic of all US companies**, AEP, DUKE, PG&E, with a higher focus for PG&E. This is in line with US legislation stressing Clean power, and affordable clean. Companies change, but under the umbrella of legislation. In opposition to this, both French company EDF and ENGIE are barely taking this concept into account, with very negative specificity numbers.

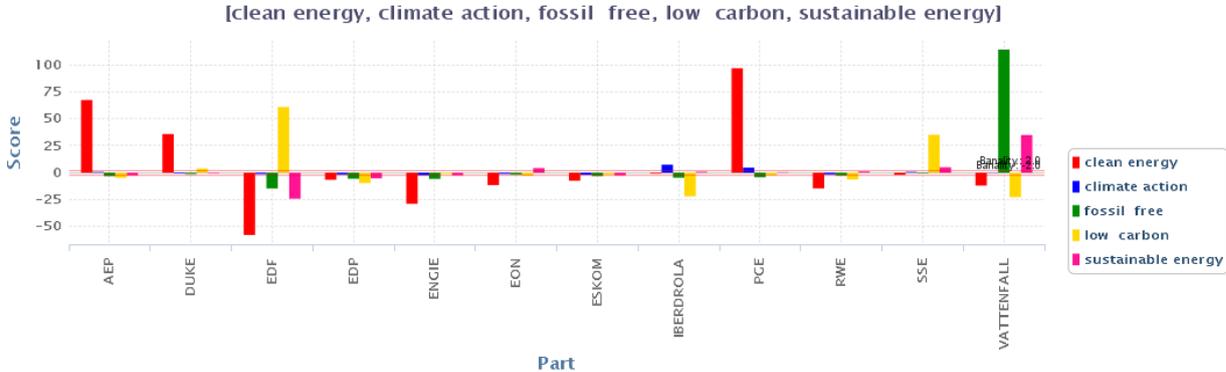
**“Low carbon”** was picked up because it is the main concept for SSE, UK (specificity score 35) but it is also very much used by EDF (score 60). **This concept is used by most in a very average way.** For SSE, it is the main concept used “Its vision is to be a leading provider of energy and related services in a low-carbon world” (SSE 2018 p1). But this is also a conversion compared to a very precautionary statement in 2015 “to engage with key policy makers on the legal and regulatory frameworks that influence the move towards a low carbon energy system”; (SSE 2015, p 34). And for EDF it is even more used than “energy transition” and consistently across the years, associated to “electricity, energy, generation”. It more a description of activities than a change of direction.

**“Fossil free” is a very specific VATTENFALL** (Sweden) association. In 2018 it has turned into a motto “fossil-free within one generation”, which sounds like a vision. But it started in 2016 only. This is a specific way to put nuclear power and offshore wind into a forged concept of fossil free.

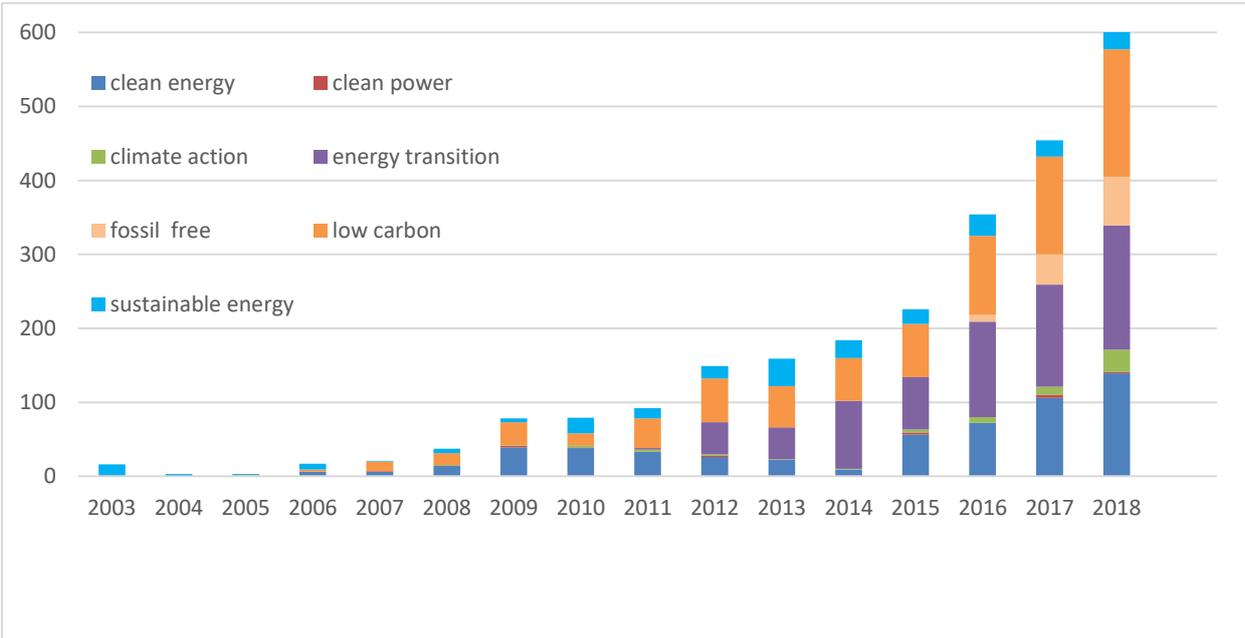
Other less frequent concept includes “climate action” very specific to IBERDROLA (score 7, and “sustainable energy” specific to VATTENFALL (score of 35). And for ESKOM no significant concept emerged, which can be read like all other priorities in South Africa, before transformation into energy transition. In its last CSR report, from March 2019 ESKOM was claiming “We aimed to clean up governance issues, stop the bleeding and re-energise the business” (ESKOM 2019 p24).

**4.3.1.4 Comparison of progression by year, by concept and by company**

Next, we study how various concepts are used compared one to the other. This is mainly use of clean energy compared in Figure 47 to climate action, fossil free, low carbon, sustainable energy... these concepts are taken from a cursive reading of reports.



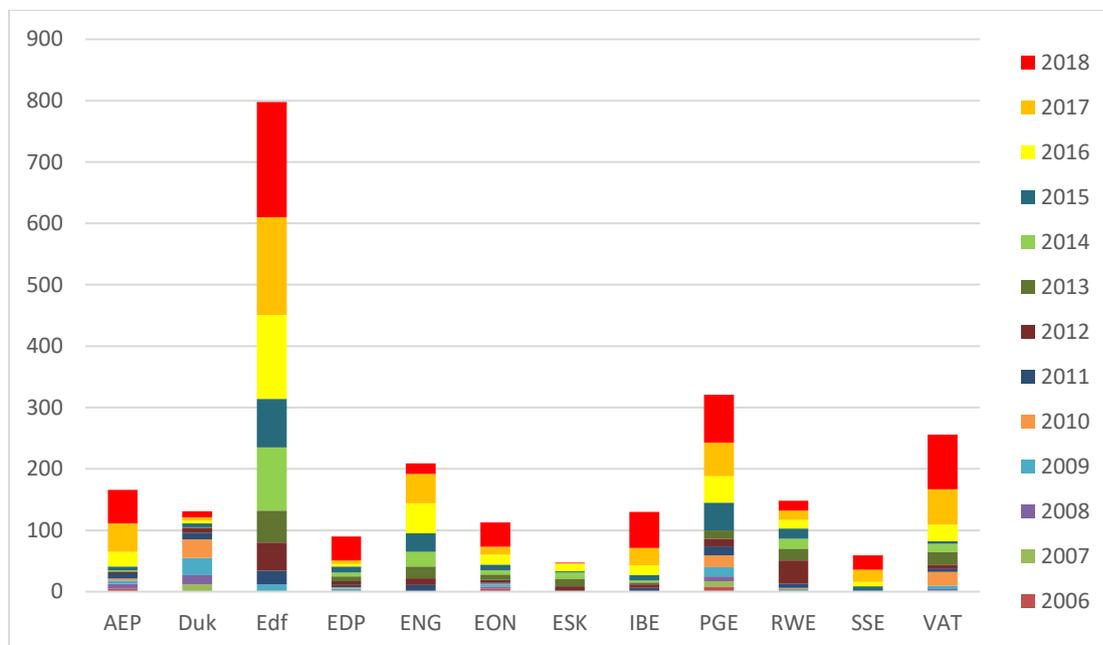
**Figure 47 Specificity calculation by companies of clean energy related concepts (whole corpus is taken into account in table margins for specificity calculation)**



**Figure 48 Bar chart of vocabulary of transition disseminating with years**

Figure 48 show the dissemination of each concept each year. It shows that energy transition “weighs” more and more in the energy landscape. Progression is so steep that it looks almost as a cumulated graph. “clean energy, low carbon” were part of the vocabulary since 2007 at least, and only take more importance in the corpus. “energy transition” steps into the landscape 2012 onwards. “sustainable energy” appears mostly at the beginning of the period then remains in the mean vocabulary.

If the concern on energy transition grows this fast, it is not shared equally across companies. using the same series of vocabulary (“clean energy, low carbon, climate action, fossil free, sustainable energy”), companies are now plotted on a year by year basis on Figure 49.



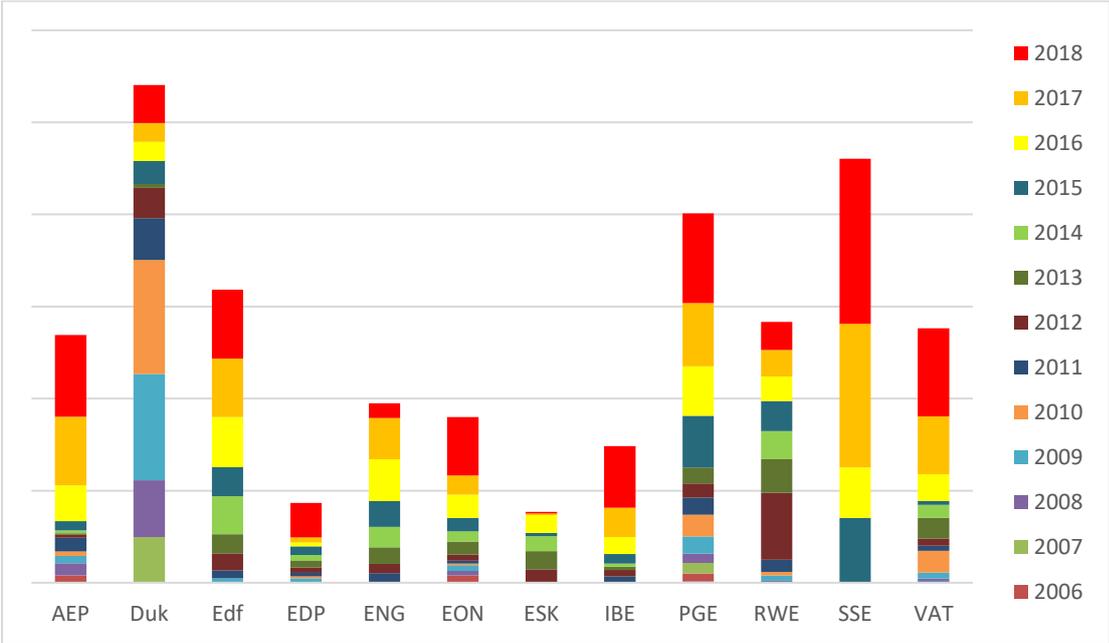
**Figure 49 Bar chart of vocabulary of transition by companies**

Vocabulary of energy transition is mostly present for EDF. This was obvious because “energy transition” is used very often (343#) and because EDF weighs 25% of total corpus. Then PGE, VATTENFALL ENGIE are appearing as next largest users. It is surprising to see PG&E which weighs only 8% of the corpus, and not to see EDP 11%, and IBERDROLA 9%. This means that Pacific Gas and Electric puts a much higher attention to energy transition than its relative size.

Next comment on Figure 49 is the relative importance of last years, 2016-2018 in yellow to red colours, compared to the total. It shows acceleration for each company in the last years: EDF is

the best example, with low attention up to 2015 and a very sharp conversion afterwards. This acceleration is also strong with AEP (USA) with ¾ of total occurrences after 2016. For most of the other companies there is an increase in the last three years.

Because this view is partially misleading with different size of corpus, from EDF overrepresented (25%) to SSE underrepresented (1.3%) same data can be reworked for adjustment to size of corpus for each company.



**Figure 50 bar chart of “transition”, number of occurrences / size of the text (no unit, since it is number of occurrences of concepts linked to transition, divided by size of each company report in total corpus)**

Bar chart in Figure 50 amplifies the message of conversion to energy transition for each company. First an opposition between minimum and maximum use. On one side ESKOM pays low attention to transition, and not more in the recent time. This corresponds to their focus on operational performance, poor financials and governance issues. On the other sides Duke Energy, SSE, and PG&E use a lot vocabulary of transition compared to size of their reports. Then evolution and timing are very different depending on companies. A list of companies who put much more focus on transition since 2016 includes: AEP, EDF, ENGIE, E.ON, IBERDROLA, PGE, SSE and VATTENFALL. If we were to have a list of companies keeping the same trend before and after 2015 there are; EDP, RWE who started much earlier which explains why it does not show in the vocabulary. And Duke Energy together with ESKOM

Explanation for Duke energy follows a totally different pattern, earlier in time. Duke energy uses 131# wording related to energy transition, split in time like:

period 1 2007-2011 "low carbon" 37 occurrences

period 2 2009-2010 "clean energy" 41 occurrences

period 4 2012 - 2014 very limited communication

period 5 2015 -2018 "clean energy" 23 occurrences

There is a peak of attention in 2009 /10 which explains why DUKE Energy is so present, but then it faded out, until a relative come back since 2016.

**What the vocabulary around “energy transition” and synonyms tells us.** No company can stay out of the way of energy transition. In this company sample, only ESKOM is devoting more time to internal question and performance than looking at adaptation to energy transition. Each company translates, so to say, into its own language the changes ahead. Sometimes it is with home-made concept (typically “fossil-free”), or by using external references, like legislation. Together with other constructed concepts, it shows that companies defend their legitimacy by advertising tailor made production mix, or product service mix which shows the best picture. If CSR is to a certain point a self-justification exercise, presentation of energy transition is even more adapted to the context of each company.

Some companies are early adopter of energy transition, we saw RWE as of 2011. While acceleration after 2015 is showing most companies converge after the Paris Agreement. An open question here would be whether it is a minimal adaptation, or a large transformation. This unfortunately cannot be appreciated only with choice of words by companies themselves. Some kind of external evaluation, or independent observers would give additional light to this present research design. Here the focus is on how companies change their legitimacy with energy transition, and not how much it changes.

#### **4.3.2 Carbon and CO<sub>2</sub>: evolution of carbon content in reporting**

##### **4.3.2.1 Main findings in usage of “carbon and CO<sub>2</sub>”**

Carbon content of discourse has changed with the years, and carbon has become a question of transition. There is a large and growing number of occurrences on carbon. We proved that carbon, and CO<sub>2</sub> are interchangeable in the discourse so that it does not impact the analysis.

Metrics and measures of carbon were a large theme at the beginning of the period studied. In the end of the studied period reducing carbon has become a growing theme. We also observe apparition and propagation of “carbon footprint” among electricity companies. Overall, the

context in which “carbon” is employed is completely different with a shift from a technological issue to strategy and commitment.

#### **4.3.2.2 Starting from text reading, and whether carbon and CO<sub>2</sub> are differently used**

In this result section, **we are looking at carbon and CO<sub>2</sub> related vocabulary**. Global warming is tightly linked to carbon emission, and CO<sub>2</sub> concentration, hence this should be reflected in our corpus. Hypothesis tested here is that mentions of carbon increase for all companies. Then we expect Carbon and CO<sub>2</sub> to be rather associated to technical matters in 2008 and before, then to become a question of climate and strategy towards 2018.

A good introduction is to look at statements on carbon back in 2006. At the beginning of studied period, there were some very cautious statements about carbon emissions:

“The greenhouse effect is a naturally occurring phenomenon, keeping the earth hospitable to life by trapping heat. Carbon dioxide and many other gases exhibit “greenhouse” properties. Some of them occur naturally while others are exclusively man-made.

Recent research – accepted by a growing majority of scientists and policymakers – indicates that human activity has increased the concentrations of these greenhouse gases and contributed to the rise in global average temperatures. To avoid the worst effects of climate change, greenhouse gas concentrations in the atmosphere need to be stabilized, then reduced.”

(DUKE ENERGY, 2006, p5)

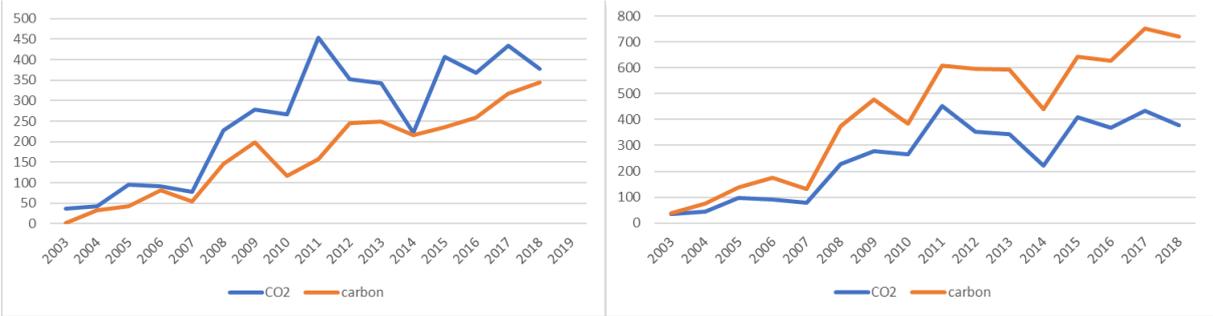
In this example, both the scientific analysis “(growing majority indicates””, and the action plan (“stabilize, then reduce”) are very far from report contents at the end of the period, 2018, and we show in this section when, how, and why it is done so.

At the end of the period studied, Duke Energy is having a different discourse on carbon: “addressing the climate change and reducing carbon dioxide (CO<sub>2</sub>) emissions” (DUKE 2018); where there was still mistrust on reality of global warming, it has become a subject to address. We select words related to carbon in CSR report. Keywords are CO<sub>2</sub>, carbon, to be completed with greenhouse (gas). It is coming from general literature on energy. They are then expanded with more wording from the corpus. This ensures that most occurrences are captured, like carbon dioxide, carbon-content...

There is a large amount of data for statistical analysis and content analysis: CO<sub>2</sub> with 4078, carbon 2833, and greenhouse gas 1536 occurrences. This is a good base to look at evolution in time, variation across companies and association between carbon and other terms.

**Using “CO<sub>2</sub>” or “carbon”, does it matter?** Before looking at association of carbon with other terms, a precautionary check is to ensure if carbon, CO<sub>2</sub> and other terms are used differently or if they are interchangeable. In the end, it shows that both terms are interchangeable along years or companies, but that word vocabulary has to be extended to the various wording.

Figure 51 shows that both terms are increasingly used between 2008 to 2018, with for a while in 2010-2012 much more CO<sub>2</sub>.

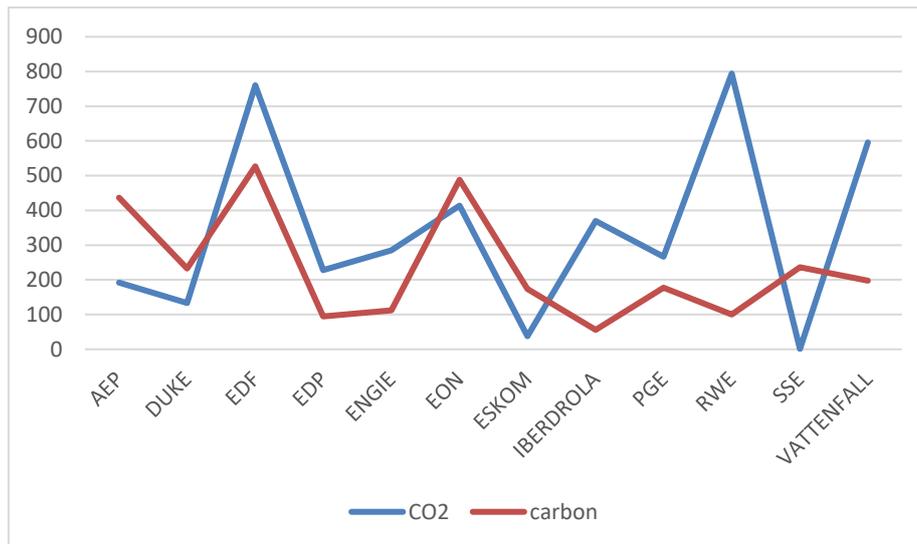


**Figure 51 Number of occurrences of lemma “CO<sub>2</sub>, carbon” by year**

**(on the left CO<sub>2</sub> in blue and carbon in red, on the right both are piled up)**

The timeline can be split in two. 2003- 2008 of Figure 51 should be read very cautiously. Number of reports is much lower (only 6 out of 12 companies), and corpus size as well. Between 2008 and 2018, total occurrences moved from 400 /year to around 700 /year. This is parallel to size of the corpus, which is double in 2018 compared to 2008. In other terms, the focus on carbon related issue is stable compared to size of report, but has grown with other priorities.

Before entering into the context where carbon is used in the corpus, we check that there is no bias by company. Similar analysis on Figure 52 shows the companies using indifferently one or the other, most of them. Exceptions are RWE (Germany) and VATTENFALL (Sweden) using 2 to 4 times more “CO<sub>2</sub>” than “carbon”. We suppose here that this does not create a specific case for these two with an intentional purpose.



**Figure 52 Chart of occurrences of “Carbon, CO<sub>2</sub>” by companies**

#### 4.3.2.3 Evolution visualised on bar charts from 2008 to 2018

After looking at evolution of carbon as a single word, we move to associations of words. Purpose is to look at evolution of the meaning of carbon in CSR reports. And as “meaning is born in context (Mayaffre, 2008) it is the primary focus.

When average environment around carbon is mostly “reduce”, and “indirect, or amount of CO<sub>2</sub>”, the evolution between 2008 and 2018 is shown in Table 20.

| highest 2008     | corpus average   | highest 2018      |
|------------------|------------------|-------------------|
| ton of CO2       | reduce our CO2   | tonne of CO2      |
| tonne of CO2     | reduce the CO2   | to reduce CO2     |
| dioxide ( CO2    | : indirect CO2   | reduce the carbon |
| such as carbon   | amount of CO2    | a low carbon      |
| amount of CO2    | @card@ t CO2     | ton of CO2        |
| to reduce CO2    | reduction in CO2 | to reduce carbon  |
| emission of CO2  | fuel and CO2     | dioxide ( CO2     |
| of reduce CO2    | reduction of CO2 | Eq . CO2          |
| reduction of CO2 | , @card@ CO2     | fuel and CO2      |
| @card@ t CO2     | of the carbon    | tonne of CO2e     |

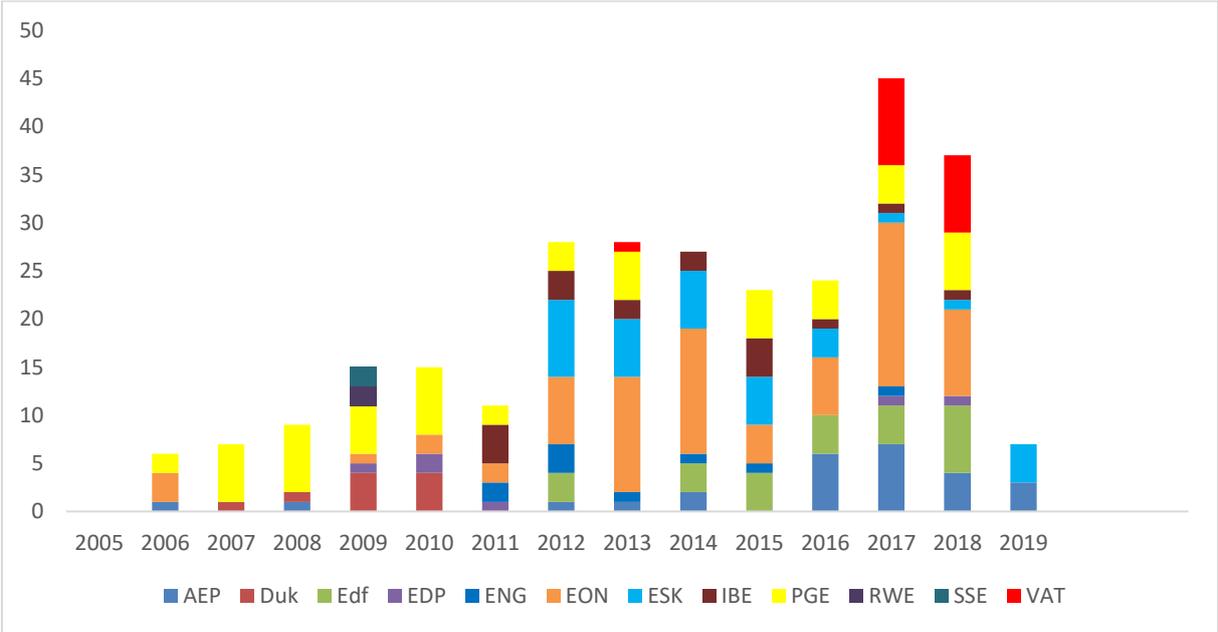
**Table 20 Table of words directly before “carbon, CO<sub>2</sub>”**

Several comments can be made from the simple ranking of expression in Table 20. In 2008 indicators linked to CO<sub>2</sub> we dominant, with Tons produced or emitted. Reports we oriented on measuring carbon. Whereas in 2018 objectives are clearly dominant. This contributes to a

change from managing parameters, air and CO<sub>2</sub> for example, into reduction of \*CO<sub>2</sub> as part of the strategy.

Here we believe that words surrounding carbon will change dramatically over the period, and that we can plot them.

**How does the concept of carbon footprint spread?** One of the important associations to carbon is the concept of carbon footprint. In the world of energy, it is a relatively new object. Figure 53 shows company and by year how it became popular.



**Figure 53 Bar chart of “carbon footprint” by company and by year**

Considering that 2008 is the first year where most companies are represented, carbon footprint remains a concept mostly used by 2 companies DUKE Energy and PG&E for a few years up to 2012. On this second period until 2016 carbon footprint is twice more used, with 7 companies overall. On the end of the period since 2017 use of “carbon footprint” increases again, this time 8 companies in the sample use it. This shows a large propagation of the concept; but not over the total period of time.

There is a converging use for AEP, EDF, E.ON, PG&E with either increasing numbers, or consistent for PG&E. For some companies the concept has faded out for other terms: DUKE energy, EDP, IBERDROLA are no longer using it. While for others it emerged only recently like VATTENFALL. Last, we note that RWE is largely out of this vocabulary; next to very few occurrences, they also use in limited occasions other concepts such as “climate footprint, biodiversity footprint”.

## Evolution of meaning of carbon, the language from 2008-2010 compared to 2016-2018.

Carbon content of discourse has changed with the years. When we isolate an initial period, 2008 to 2010 in order to have sufficient amount of text, and compare to recent period of 2016 to 2018, it shows some interesting evolution.

| cooccurrences of carbon / CO2 in 2008-2010 |      |        |       |          | cooccurrences of carbon / CO2 in 2016-2018 |      |        |       |          |
|--|------|--------|-------|----------|--|------|--------|-------|----------|
| Occ  | Freq | CoFreq | Score | MeanDist | Occ  | Freq | CoFreq | Score | MeanDist |
| emissions                                  | 1595 | 280    | 264,6 | 0,9      | <b>low</b>                                 | 504  | 148    | 182,6 | 0,4      |
| CO2  | 774  | 123    | 96,9  | 5,7      | emissions                                  | 3053 | 666    | 127,0 | 0,9      |
| Reduction                                  | 85   | 52     | 77,8  | 0,1      | CO2  | 1181 | 113    | 81,7  | 6,3      |
| <b>scrubbing</b>                           | 27   | 20     | 33,0  | 2,0      | <b>allowances</b>                          | 86   | 41     | 61,9  | 1,1      |
| <b>atmosphere</b>                          | 48   | 21     | 27,6  | 4,1      | reduce                                     | 1773 | 96     | 61,5  | 2,0      |
| reduce                                     | 583  | 48     | 25,2  | 2,2      | Scope                                      | 349  | 59     | 57,9  | 3,3      |
| tons                                       | 228  | 31     | 23,0  | 3,9      | reduction                                  | 777  | 72     | 51,5  | 2,6      |
| <b>capture</b>                             | 177  | 28     | 22,7  | 1,2      | metric                                     | 170  | 37     | 41,0  | 4,2      |
| <b>technologies</b>                        | 506  | 39     | 19,6  | 3,6      | tonnes                                     | 214  | 38     | 38,5  | 5,3      |
| Carbon                                     | 178  | 23     | 16,8  | 3,6      | carbon                                     | 900  | 61     | 35,9  | 5,9      |
| emitted                                    | 27   | 12     | 16,2  | 1,9      | <b>equivalent</b>                          | 221  | 36     | 35,1  | 0,9      |
| <b>underground</b>                         | 86   | 17     | 15,8  | 2,4      | <b>avoided</b>                             | 152  | 29     | 30,5  | 0,5      |
| generation                                 | 1534 | 61     | 15,8  | 5,1      | emitted                                    | 51   | 19     | 26,5  | 1,9      |

**Table 21 Cooccurrences of Carbon and CO<sub>2</sub> in 2008-2010 compared to 2016-2018**

In Table 21, words associated to carbon and CO<sub>2</sub> are concentrated unsurprisingly around carbon emission, carbon reduction, tons and metrics. But in this landscape of Carbon emission there are several trends between the two periods:

2008-2010 had one dimension on description of carbon and atmosphere, very high in the list, together with idea of scrubbing out carbon. This dimension has disappeared in 2016-2018. It has become so obvious why carbon emissions are an issue that no comment is needed.

Then 2008-2010 was heavily discussing technologies for carbon capture, with the idea that storing underground CO<sub>2</sub> in former mines or existing cavern would be a central solution (“capture, technologies, underground). These ideas have not faded out in 2016-2018 but are no longer in the main discourse around carbon.

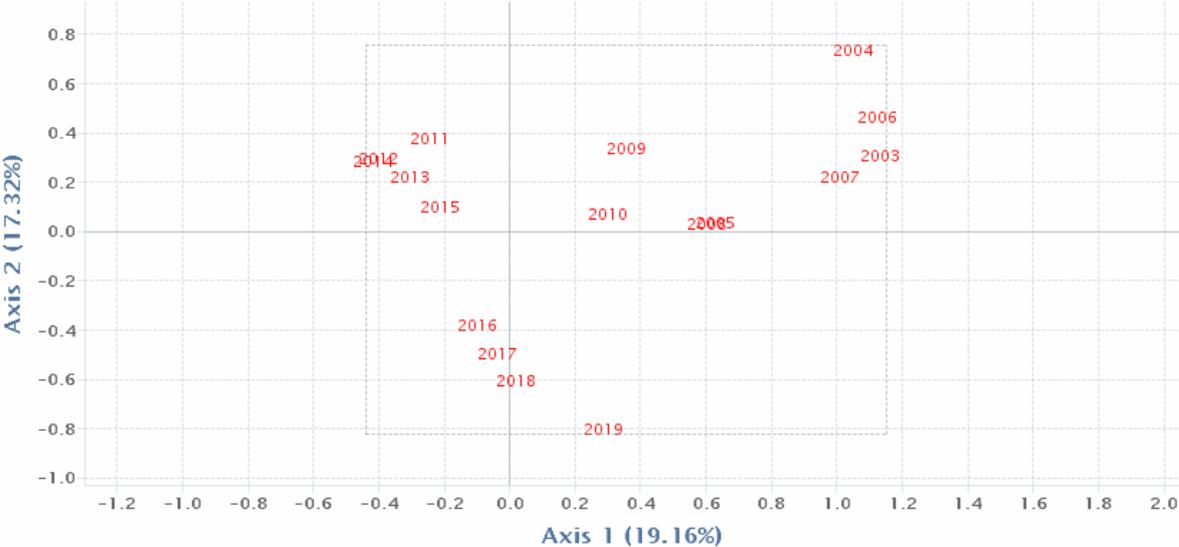
2016-2018 is very centred on “low” “associated to carbon”, and with a distance of 0.4 on average, there are many occurrences of “low carbon”. It shows all the vocabulary around low carbon technologies, solutions... which were not present in 2008-2010.

Then 2016-2018 develops “carbon equivalent and carbon avoidance”. This is new to comment and or measure carbon avoided. It shows how efforts are now presented both in what is done, and what is avoided.

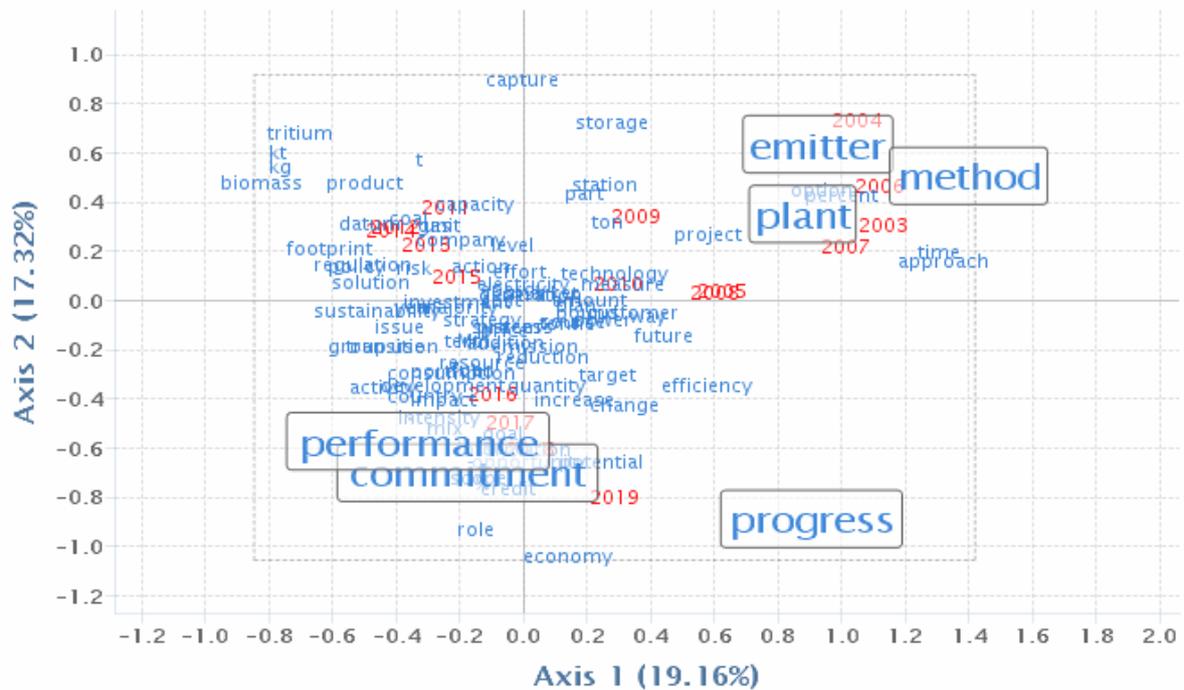
**4.3.2.4 Evolution visualised on correspondence analysis**

We continue on evolution of meaning of carbon and CO<sub>2</sub>, this time not for two given period of time, but overall. Here carbon and CO<sub>2</sub> are represented amidst the most frequent nouns over the whole corpus. We select first nouns to capture measures and concepts associated to carbon. We expect to see a time pattern emerge, and this is the case in Figure 54. Then verbs and adjectives around “carbon” will be analysed.

Correspondence analysis factorial plane of CSRI 29/byYEAR/<@[enpos="NN.\*"]][word!="\p{P}+" &enpos!="NN.\*"]{0,6}{enlemma="carbon.\*|CO2"}>@enlemma ≥ 10 ≤9,489,733 /9,489,733 /@enlemma ≥ 10 /9,489,733



Correspondence analysis factorial plane of CSRI 29/byYEAR/<@[enpos="NN.  
 \*"]][word!="\p{P}+"&enpos!="NN.\*"]{0,6}[enlemma="carbon.\*|CO2"]  
 >@enlemma ≥ 10 ≤9,489,733 /9,489,733/@enlemma ≥ 10 /9,489,733



**Figure 54 Correspondence analysis by year of carbon and CO<sub>2</sub> with nouns with years or with words, (2010 retreated for irrelevant values)**

Both graphs on Figure 54 represent the same view, on the top view with years only and on the bottom one with words only. The evolution in time, or Guttman effect, is mainly visible on the vertical axis, with 2003 to 2012 above and 2016 to 2019 below. So that the time line goes from the top right with 2004 to the top left then down to 2019. We then switch to the horizontal axis to study the word content and this is the second graph.

Looking at words associated to “carbon and CO<sub>2</sub>” we see how carbon is associated to “emitter” in 2003-2008 and then to “transition” in 2016-2018. At the beginning of the period carbon is characterised by “emitter, plant, method”, highlighted in the graph. We are in measurement of emissions, and quantitative “kt, t, kg” are also very present. At the end of the period we read “performance, commitment, progress, performance, impact”, which are all oriented toward actions and improvement. The focus has shifted on what actions can be done on carbon footprint. One part is on measuring, direct or specific and the other on taking actions and commitment.

In the verbatim Table 22 below of CSR report, we can read how the context of carbon is completely different; here with three examples, VATTENFALL (Sweden), AEP (USA) E.ON (Germany) there is a shift from a technological issue to strategy and commitment:

| citation (Company, year)   | citation (Company, year)   |
|--|--|
| (VATTENFALL 2005) and use of <b>innovative energy technologies</b> that can <b>reduce carbon dioxide</b> emissions.  | (VATTENFALL 2018) number of <b>industrial collaborations</b> with great potential to <b>reduce carbon emissions</b> . Last summer we broke ground on a pilot plant |
| (AEP 2006) <b>technologies</b> that might improve service and reliability and <b>reduce carbon</b> without creating burdensome rate increases for our customers. Work Force Issues | (AEP 2018) technologies AEP has already made <b>significant progress in reducing carbon</b> emissions, from our <b>early commitment as a founding member</b>       |
| (EON 2006) taken by the company in the year <b>helped reduced carbon dioxide</b> emissions by 82, 000 tonnes, or eight percent   | (EON 2018) emissions but also are simple and convenient. <b>Reducing carbon emissions is a strategic priority</b> for us and Berkeley,                             |

**Table 22 Verbatim of companies on carbon 2006 and 2018**

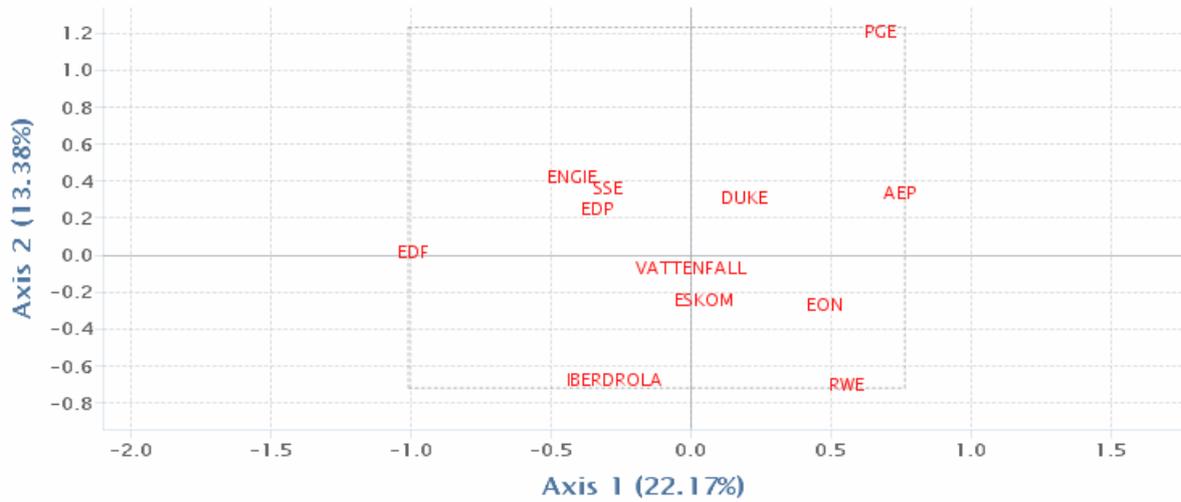
**Variation across companies of wording associated with carbon.** This section looks at how company differ from each other. Here the time dimension is not taken into account, so that the shifts seen earlier will only be marginally identified.

“Carbon and CO<sub>2</sub>” are confronted to most frequent verbs, then nouns, in Figure 55 and Figure 56. From previous elements, we anticipate that “reduce, reduction” be at the centre of both graphs, so that each company will appear closer than other or not.

It is striking that language is very different across companies, with especially an empty centre. Around a weak series of isolated “be carbon, on carbon, a carbon”, some very different groups of companies emerge.



Correspondence analysis factorial plane of CSRI 29/byCY/ <(@[enpos="JJ.\*"] [word!="\p{P}+" &enpos!="JJ.\*"]{0,6}[enlemma="carbon.\*|CO2"])|([enlemma="carbon.\*|CO2"] [word!="\p{P}+" &enpos!="JJ.\*"]{0,6}@[enpos="JJ.\*"])>@word ≤9,489,733 /9,489,733 /@word ≥10 ≤9,489,733 /9,489,733



**Figure 56 Correspondence analysis by company carbon with adjectives**

In Figure 56 carbon and CO<sub>2</sub> are plotted with adjectives for the 12 companies in the sample. With 91 adjectives appearing more than 10 times it can hardly be read on the graph; this is why only company names are indicated to discuss how specific they are. Horizontal axis 1 is opposing “low, competitive” (mostly EDF in this view) on the left, to “metric” on the right. So that PG&E, AEP, DUKE, E.ON, RWE insists more on metrics and numbers. And vertical axis 2 is opposing “efficient, indirect” at the bottom to “potent, avoided” at the top. We see companies insisting on avoiding carbon (PG&E, ENGIE, SSE, DUKE) vs companies insisting on higher efficiency of operations (IBERDROLA, RWE).

Switching from overall adjectives, to the three most specific for companies, we observe:

EDF most specific adjectives “low, competitive, nuclear” are illustrating how low carbon is associated to nuclear. This explains its position on Figure 56. For PG&E, it is “potent, avoided, metric. PG&E is almost the sole company (32 out of 45 occurrences in the full corpus) to use “potent” in a chemistry context (as in “methane, a greenhouse gas that is at least 21 times more potent on a per ton basis than CO<sub>2</sub>” PGE 2009 p61).

On the bottom of the graph, IBERDROLA is specifically using “equivalent, efficient, neutral » and insist here on objectives of improvement on carbon; lastly RWE with « indirect, in-house, metric” is partly on the importance of measure and partly on efforts made, with this “in-house” only used 14 times, but by no other companies.

The outcome of this section shows how **carbon and CO<sub>2</sub> have left the field of technology and entered the field of strategy and legitimacy**. Evolution of words associated to carbon from 2008 to 2018 shows how reducing carbon became a growing theme. At the beginning of the period carbon is linked mostly to R&D and measures. (Carbon Capture and storage, metrics, carbon emission). Then we saw apparition and propagation of “carbon footprint” among electricity companies. Our hypothesis is validated that that carbon content in CSR reports is changing a lot, in particular leaves R&D and technical field to come into strategy. Carbon has become a question of transition and sustainability, at the centre of corporate strategy.

As a result, carbon has become part of legitimacy claimed in 2018. Companies put forward their intentions and actions to limit carbon emission, to limit their carbon footprint, as a significant change from 2008 and earlier.

### **4.3.3 When energy mix moves into renewables**

#### **4.3.3.1 Main findings when observing changes in energy mix**

The most obvious way to measure evolution of production mix from fossil to renewable would be to compute MW, together with capacity in construction or in decommissioning, rather than our analysis of discourse. But there are several interests of plotting a matrix of all 12 companies during the period studied. On the evolution dimension it possible to read speed of change over the period, and on the variation dimension it allows to see transformation of companies with very different size on a same view.

The first finding is that there is not one single pattern. The global view of all companies studied over the whole period shows that companies move on their existing path. We analyse all conventional energy sources mathematically in a plan with renewable perpendicular dimension. As a result, evolution of concern by source of energy appear first and foremost on use of coal, gas, nuclear. Then the evolution into more renewable is analysed with different tools.

By taking all companies together, then only American, only European and one by one, we notice some convergence between companies. In particular 2016 -2018 is a period of acceleration, after the Paris Agreement in late 2015.

#### **4.3.3.2 Building a large word portfolio around energy mix**

This section looks at what energy sources are in the energy mix. It can be production capacity, source of energy, energy mix, there are many concepts around each energy source type. In a first step we inquire how much isomorphism there is across our company sample, whether

everybody moves into renewable. Maybe each trajectory joins at the end: from coal to renewable, or gas or nuclear to renewable. And maybe not.

In a second step, we move to a higher level of abstraction by looking how fossil fuel compare to conventional fuels, and oppose renewable. Are these really oppositions? Or phasing out and phasing in? or dedicated concepts by group of companies which show legitimacy of an existing way of producing electricity, and how it changes progressively.

**What changes can be observed in the energy mix?** Occurrence is not a measure of importance. In this section, we record how attention to different energy sources changes, whether “solar” outnumber “coal” at one point. An approach with discourse analysis can only measure the attention by authors to a subject, and not a metric of tons, megawatt or other units. The purpose here is not to confront number of occurrences of energy sources with real production, or project of the company. Nor to look at relations between evolution of the discourse and evolution of capacity installed. But it serves to see the evolution of companies among themselves: to which extent does the company sample behave in isomorphism all into to renewable at a similar moment in a similar way? And it serves to observe how companies can spend more attention on a given fuel to fix a strategy, communication, operation issue.

**Building word portfolio around mix of energy sources in a three steps process,** we select the list of words to use to compare references to energy sources. Step 1 is starting at most often used terms, occurrences. Step 2 is expanding the list to neighbouring terms (like hydropower for hydroelectricity). And step 3 is deciding the final categories, merging some (wind and solar into one single category) or discarding others (like “oil”).

**Minimum portfolio contains “gas coal nuclear wind solar oil hydroelectric”.** This starting point covers the entire energy mix, while showing evolution from fossil to renewable energy. Some words have already been identified in result sections on most frequent nouns: “gas, coal, wind, oil” and other from result section on most frequent adjectives “nuclear, solar, hydroelectric”.

⇒ A first list of fuels comprises nouns: gas, wind, coal, oil; and adjectives: nuclear, solar, hydroelectric, in Table 23.

| enlemma | nb occ. |
|---------|---------|
| gas     | 14170   |
| nuclear | 10884   |
| wind    | 5958    |
| coal    | 4888    |
| solar   | 2986    |
| oil     | 1549    |

|               |      |
|---------------|------|
| hydroelectric | 1246 |
|---------------|------|

**Table 23 Main energy sources by occurrences**

We confront this list to two questions: should more energy sources lemmas be added? Are these lemmas representing the full energy source to capture?

**Then a need to expand the word portfolio.** The second step is expansion of the vocabulary to a list of lemmas that can correspond to the span of energy mix. For example: is it rather hydro, hydraulic, hydropower? This means verify grammatical forms nouns, adjectives, or associations.

Instead of “gas” as a lemma, we test all lemmas containing “gas” to determine if wider scope is relevant. This is summarised in Table 24 which shows only hydro needs to be expanded. According to companies and years, adding hydropower (1796) and hydro (1056) makes a combined number of occurrences of hydro power of 4098 instead of 1246 identified previously. On the contrary, other lemmas such as “gas-fired” for gas or “coal-fired” for coal are not selected for expanding the word portfolio. The word portfolio is now expanded into 9 terms, which includes: gas, wind, coal, oil; nuclear, solar, hydroelectric, hydropower, hydro.

|               |       |               |       |             |      |             |      |               |      |           |      |               |      |
|---------------|-------|---------------|-------|-------------|------|-------------|------|---------------|------|-----------|------|---------------|------|
| gas           | 14170 | nuclear       | 10884 | coal        | 4888 | wind        | 5958 | solar         | 2986 | oil       | 1549 | hydroelectric | 1246 |
| gas-fired     | 394   | non-nuclear   | 37    | coal-fired  | 1028 | unwind      | 62   | solar-power   | 19   | boiler    | 463  | hydropower    | 1796 |
| biogas        | 240   | nuclear-relat | 12    | Bettercoal  | 277  | window      | 49   | solar-therma  | 5    | soil      | 371  | hydro         | 1056 |
| regasificatic | 110   | anti-nuclear  | 8     | coalition   | 124  | windfarm    | 38   | solar-array   | 3    | oil-fired | 72   | hydrocarbon   | 233  |
| Naturgas      | 94    | nuclear-gene  | 8     | hard-coal   | 112  | wind-power  | 32   | solar-panel   | 3    | fuel-oil  | 21   | hydrogen      | 155  |
| regasifi      | 83    | Eletronuclea  | 4     | coal-fi     | 90   | wind-genera | 20   | Nanosolar     | 2    | Gas-oil   | 21   | hydrological  | 70   |
| gasification  | 78    | nuclear-back  | 3     | coal-fueled | 88   | windfarms   | 17   | rweschottso   | 2    | oil-fi    | 21   | hydroelectric | 47   |
| flue-gas      | 76    | nuclearrelat  | 3     | coal-       | 51   | wind-based  | 13   | solar-based   | 2    | toilet    | 19   | Mini-hydro    | 45   |
| gaseous       | 75    | Thermonucle   | 3     | coalfired   | 37   | wind-farm   | 13   | solar-heated  | 2    | Fuel-oil  | 15   | mini-hydro    | 29   |
| gas-fi        | 67    | electronucle  | 2     | coal-based  | 29   | dwindle     | 10   | solar—partic  | 2    | boil      | 13   | hydro-        | 22   |
| gasoline      | 46    | hydro-nuclea  | 2     | coal-?      | 27   | Swindon     | 8    | solar-relatec | 2    | Soil      | 12   | hydrostatic   | 22   |

**Table 24 Expanding energy source lemmas to wider terms**

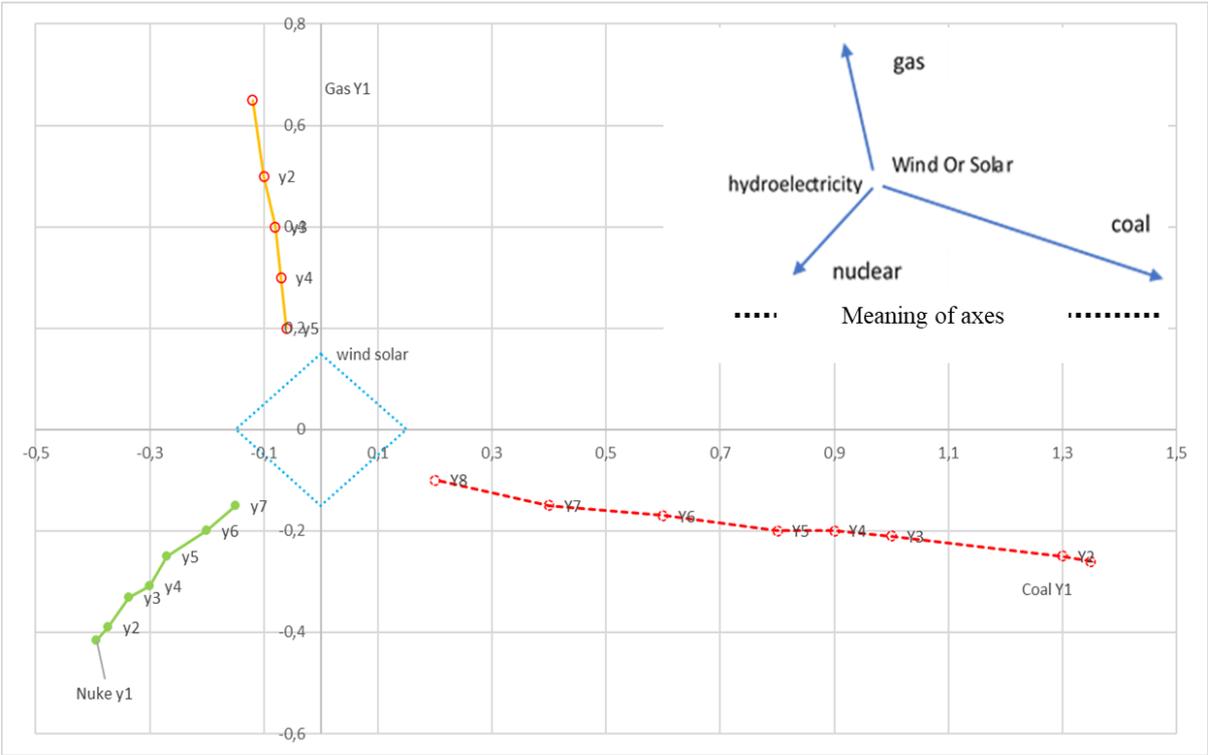
**Merging dimensions to generate clearer results.** The third step here is merging terms and discarding others. Testing the representation on the total 129 CSR reports shows that “oil” is not contributing much to the explanation. Visualisation with and without oil are very similar.

Merging wind and solar in the list gives clearer results, into a category dedicated to renewable; while hydro power stays a different dimension (with the merging of the 3 lemmas selected hydroelectric; hydropower; hydro). This allows to trace evolution of discourse on 5 main dimensions, with opposition for example coal vs renewable. Otherwise the number of word dimensions makes the interpretation much more difficult.

The final word portfolio is made of 5 dimensions, which includes: gas, coal, nuclear, wind or solar (including all wind, and all solar), hydro power (including hydro-electric, hydropower, hydro).

**4.3.3.3 Analysis in correspondence analysis of evolution of energy mix**

Correspondence analysis on the total corpus will allow to project all CSR reports into energy sources axis we have just generated. A theoretical view in Figure 57 shows imaginary companies on real axis. Axis are distributed as per vectorial projection of all occurrences of energy sources (44 450) across the corpus; into 5 dimension of energy sources. In this theoretical example company ‘GAS’ in orange moves in discourse intensity year by year towards renewable represented by any occurrence of wind or solar, and same for the other examples of ‘COAL’ company, and ‘NUCLEAR’.



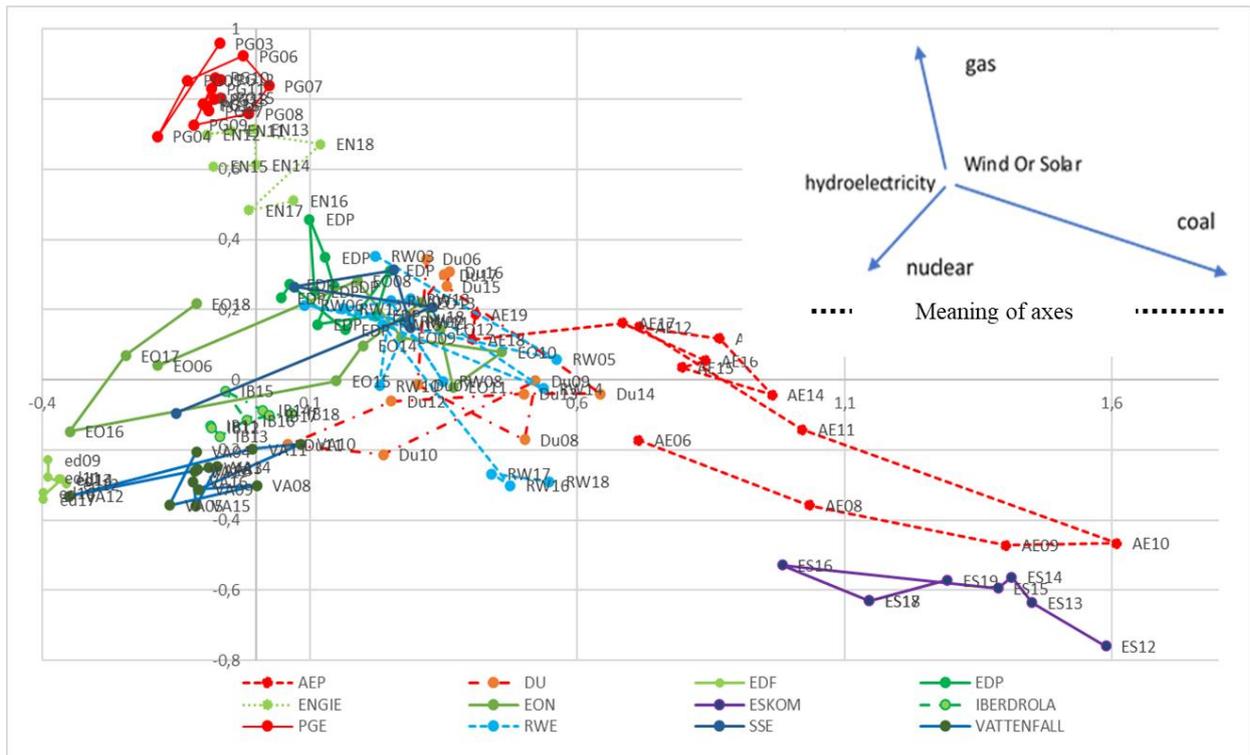
**Figure 57 Simplified model of correspondence analysis convergence from energy sources into renewables**

**Overview of paths in energy mix, is there an obvious trend into renewable?** With the word portfolio as defined above, following graphs are visual representations of how this energy mix changes in the discourse.

We are with these 5 variables in a 4 dimensional space, made of gas, coal, nuclear, wind and solar, and hydroelectricity (or 3 terms for hydro) and look at how each company changes during 2003-2018. There is no unit, rather intensity and proximity of vocabulary.

In correspondance analysis in Figure 58, evolution pattern emerge for each company discourses. The line between “ES12 – ES13”, as an example in the bottom right corner, links CSR report for ESKOM in 2012 (ES12) and in 2013. Similarly, for all 12 companies lines show evolution from one year to the other on the word vocabulary selected. This central graph shows all companies on the same scale. We will see hereafter how some companies follow clear move along the time, while other appear to go into different directions.

This representation has no unit, but rather orientation to axes computed statistically. Each point of Figure 58 is a CSR report in this vectorial representation. Horizontal axis opposes “nuclear” to the left, and “coal” to the right, indicated in the small graph embedded in the figure. Vertical axis shows a proximity to “gas” at the top, and opposition to “nuclear, coal” on the other side. This leaves “wind, solar, hydroelectricity” in the center. Plotting renewable in the middle has not been designed on purpose, but comes in geometrically at this place within word portfolio of nuclear, gas, coal and hydroelectricity. On this representation, explanation towards and out of each extremity are valid statistically, but the center is less representative. It could be looked as a pyramid where the base is made of coal, nuclear, gas and the top cornerstone renewable; if we look at it from the top view, we see one point moving from coal to somewhere in the triangle without knowing if it is more towards the opposite side of the triangle, here nuclear gas, or nearing to renewable. These precautionary remarks being clarified, we will comment progressively from the global 129 CSR points down to regions and individual companies how each trajectory goes. All visualisations generated in TXM have been plotted on Excel to draw lines between years.



**Figure 58 Overall correspondence analysis, by companies by year, on energy sources (Reminder of the list of dimensions: “gas, coal, nuclear, wind & solar, hydroelectricity”)**

First observation is that there is not one single direction for all companies. this is a striking result, because over 15 years it would seem logical that all renewable energy sources take precedence in reporting. We interpret this as each companies is on a specific path, according to discourse analysis. The most consistent trend is to move away from coal, but for ESKOM (South Africa) and to a lesser extent RWE (Germany). For all other the existing installed base seems to overweigh change in discourse.

The second observation is the disparity between companies. Some companies are heavily centered on their expertise, like EDF for nuclear or ENGIE for gas. We will look into sub groups by geography or by dominant fuel to determine thiner evolution.

The third observation is that the graph is strongly centered on wind and solar. This means that companies who focus increasingly on wind will appear at the center with limited time effect. This is true for some European companies, suggesting that this graph could be complemente with further correspondence analysis to show clearer trajectories on renewables.

The main groups appearing in the graph can be characterised with three aspects. First, at the center there are all companies strongly into wind and solar. At this scale there is no clear time evolution. A group of European companies is grouped at this center : IBERDROLA (Spain),

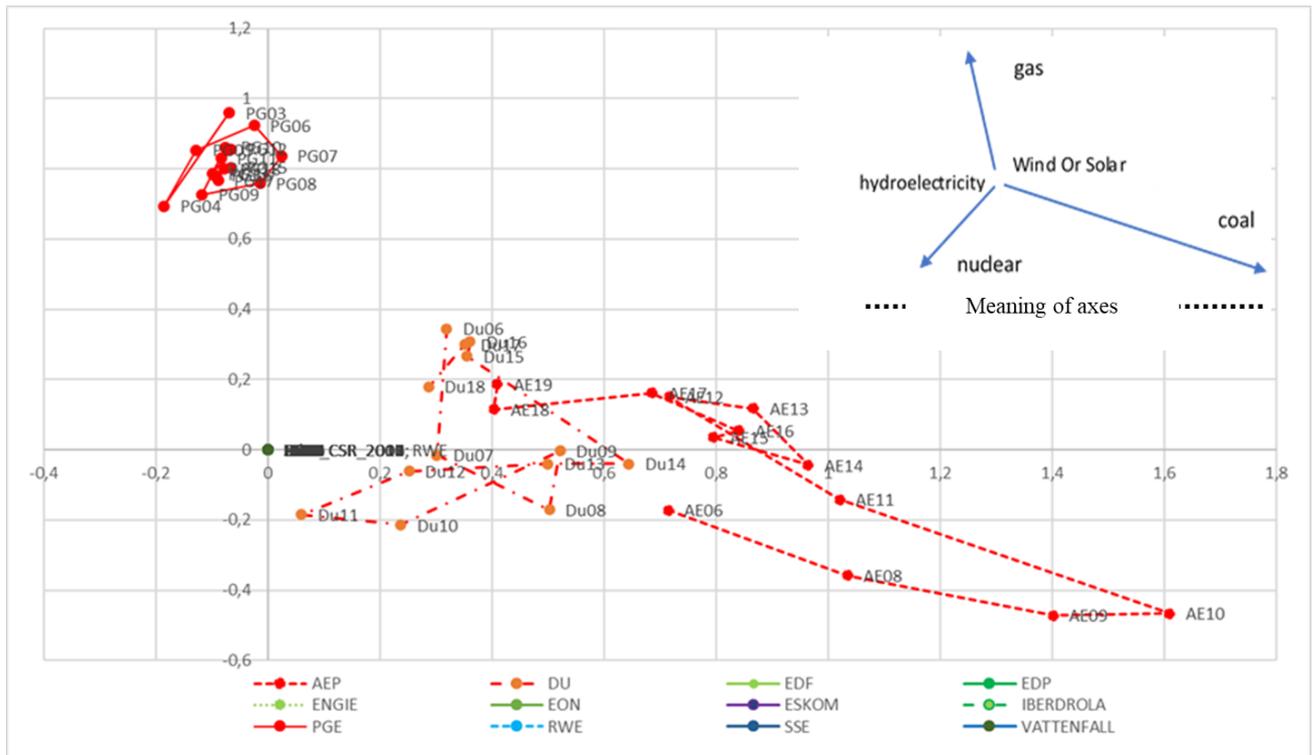
RWE and E.ON (Germany), EDP (Portugal), and SSE (UK). Then around this group there are difference into several direction. Closer to gas there is ENGIE (France), PG&E (USA). Into nuclear on the left there are EDF very static in this vocabulary, and VATTENFALL (Sweden) expect in the late years where it moves towards wind and solar. And last outside of the main group there are companies much closer to “coal”. This is ESKOM (South Africa), with coal overrepresented in each dicourse, despite an apparent change in the 2016 report, but coming back to coal. And also AEP (USA) with a increasing proximity to coal in 2006 -2010, then an opposite move at a higher space into wind.

In summary what this graph shows is that each company is on its existing path, a mix of existing production and direction taken in CSR reporting. But at the same time that these 15 years patterns move at different speed into renewable, here represented by wind and solar. But it is not always the case, as some patterns look different.

Next four representations are slices of this main view, showing following topics:

- Discourse evolution for American companies only
- Discourse evolution for European companies
- Separate pattern inside Europe
- 2016-2018 as a period of higher convergence

The first detail out of four **highlights energy mix with different kind of “clean power” within USA**. From the previous visualisation of all companies in the sample, we now extract only the trajectories for the three American companies, PG&E, DUKE ENERGY and AEP, American Electric. The pattern becomes Figure 59 below.



**Figure 59 Correspondence analysis, companies from USA, each year, on energy sources**

The first observation in the graph is that the three American companies have a very different discourse on energy sources.

For American electric, AEP, moving to the right of horizontal axis is moving towards more coal, which we see in the discourse 2006 to 2010, then in a completely different direction into renewable

For DUKE ENERGY, discourse is balancing between renewables and coal; in the end it looks almost as a circle. The first part 2006 to 2009 is mostly towards coal, then 2009 – 2011 is influenced by renewable. When changing axis in the correspondence analysis, the move from coal to wind and solar is much clearer.

For Pacific Gas and Electric, discourse is very static on these dimensions. Gas is the main influence. As the only gas distributing company in this extract it is normal that the discourse is structured around gas, even more as they do not operate any coal asset.

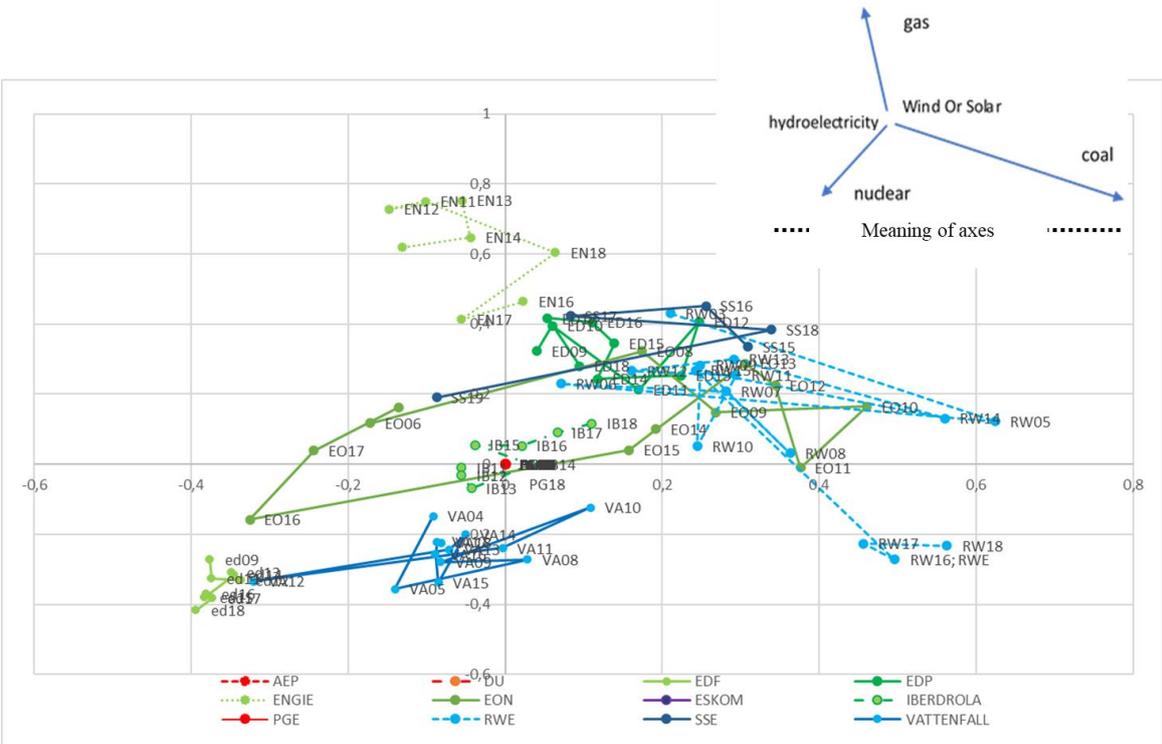
Here discourse is centered on what companies do, gas and electricity for PG&E, and electricity with a significant portion coming from coal for AEP and DUKE ENERGY. What we observe are changes over the years.

PG&E discourse is increasingly centered on gas (and to a small part renewable). That illustrates how a large company dedicated to California is structured differently from other American utilities.

As a result here, American utilities in this sample do not change their discourse into one single direction. On one side those exposed to coal change very rapidly, especially after 2016 towards renewable. On the other side here, California appears as very different pattern, with a gas and electricity utility and a production mix changing mostly into renewables.

**The second detailed view out of four shows energy mix paths in Europe.** It changes the scale since PG&E and American Electric AEP were the most outside the global correspondence analysis in Figure 58. And Duke ENERGY (USA), ESKOM (RSA) are also excluded here, shifting out large focus on coal.

Visualisation of correspondence analysis is changing into Figure 60. The question becomes if European companies evolve in an isomorphic way or very differently?



**Figure 60 Correspondence analysis, European companies by year, by energy sources**

In Figure 60, the remaining 8 companies in the sample are : EDF, EDP, E.ON, ENGIE, Iberdrola, RWE, SSE, Vattenfall.

A first glance at this visual shows that there is no apparent convergence. The way discourse use our main energy sources is very scattered on the visual. This is linked to the visualisation chosen

where wind and solar are in the middle, and this takes a large and increasing role in the discourse of most European companies.

Some companies follow very specific or isolated patterns, according to these 5 variables building a 4-dimensional space of energy sources: EDF with nuclear, VATTENFALL with nuclear and hydro, and ENGIE with gas. This reinforces the idea of slow path and incorporation of renewable into the business rather than swift change, as observed in discourse.

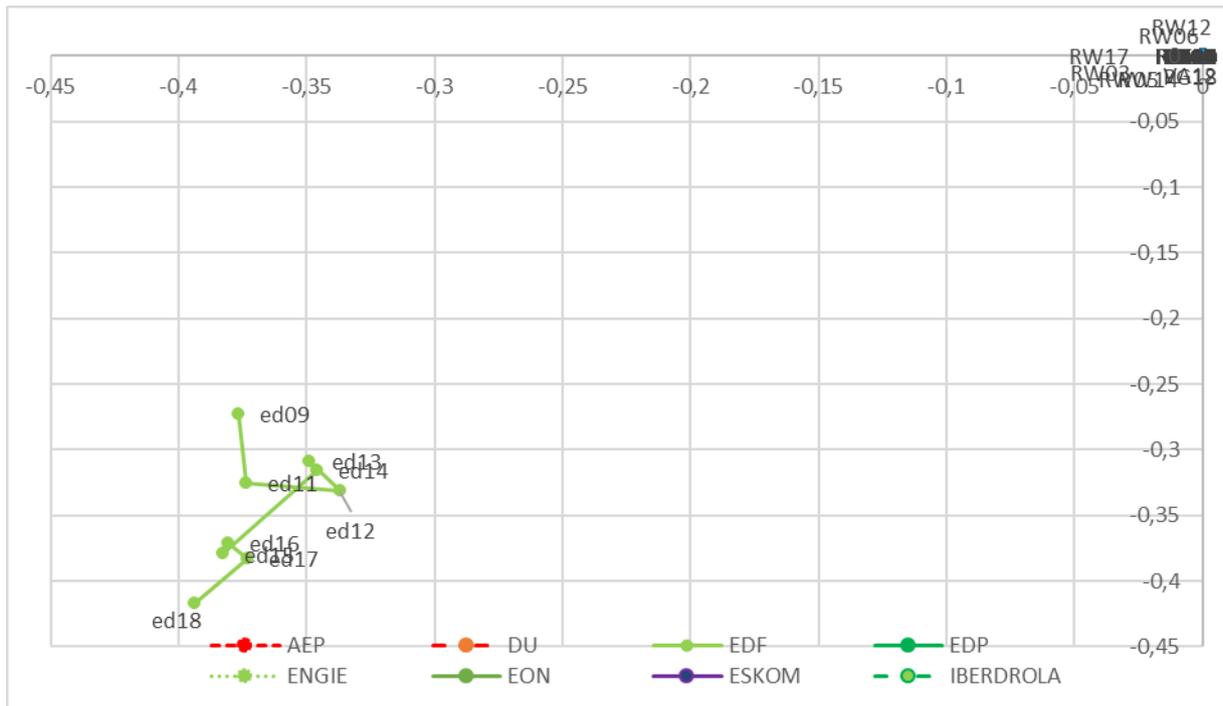
On the other side, some companies change a lot during the time period, mostly visible for RWE. Here the shifting out of coal in Germany is very apparent in the discourse. Instability of governance between the two groups and separation of assets between RWE and E.ON could make their discourse homogeneous, which is not at all the case here.

The centre of the graph is remarkably empty, where wind and solar would be expected to drive a large part of the discourse, about the centre; only IBERDROLA (Spain) has a high focus in its discourse consistent over the years. EDP (Portugal) shows a priority for hydroelectricity, wind and solar, and SSE (UK) a priority for wind and solar.

**Moving one level closer, from the 8 European companies, to individual trajectories.** We now take each company at a time instead of all together, some other comments on trajectories for each company appear.

The evolution based on correspondence analysis is shown for each of the 8 companies in alphabetical order: EDF, EDP, ENGIE, E.ON, IBERDROLA, RWE, SSE, VATTENFALL. They are illustrated one by one to show the pattern followed, but they are commented in comparison of the 8 graphs altogether.

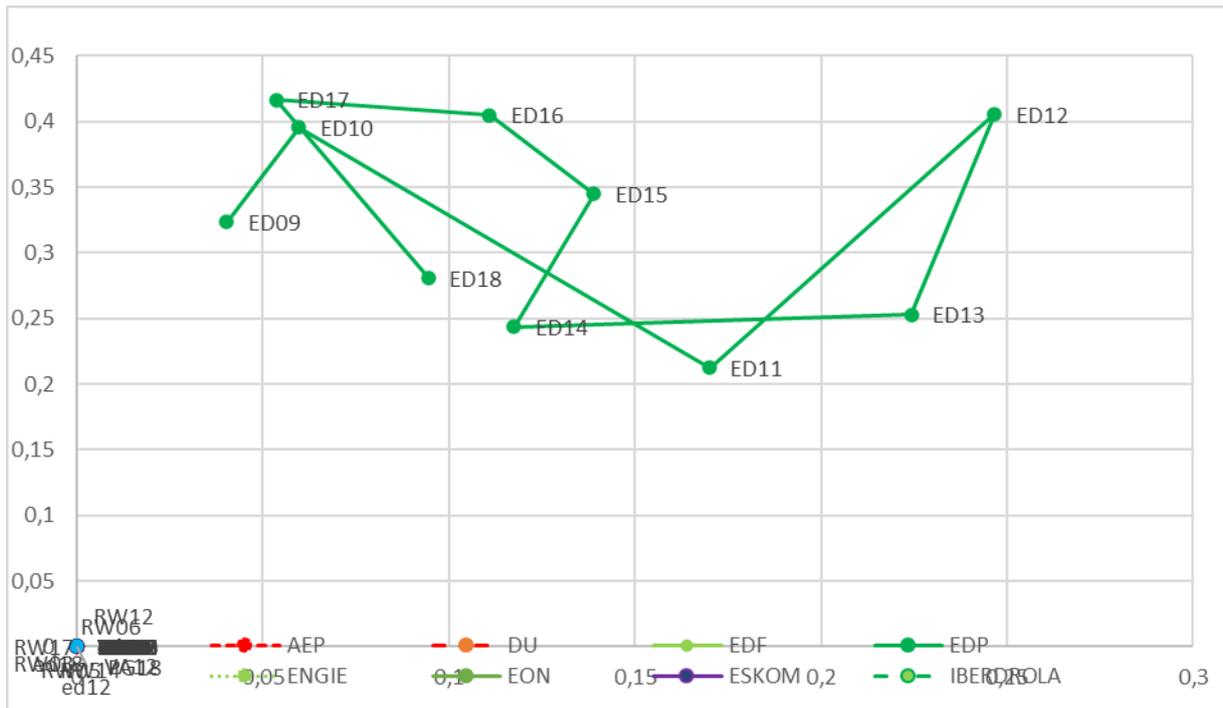
#### **(1/8) EDF**



**Figure 61 Correspondence analysis for EDF on energy sources**

Edf appears in Figure 61 very isolated in its paths. Discourse seems firmly oriented towards nuclear, which is even stronger given the large size of EDF corpus (25% of total) which would bring them mathematically close to the center. Other companies seem close here, VATTENFALL in 2012 and E.ON in 2016 with some accent on nuclear. But the singularity of EDF's discourse is confirmed with 2018 being even further into nuclear focus than all other years.

**(2/8) EDP**



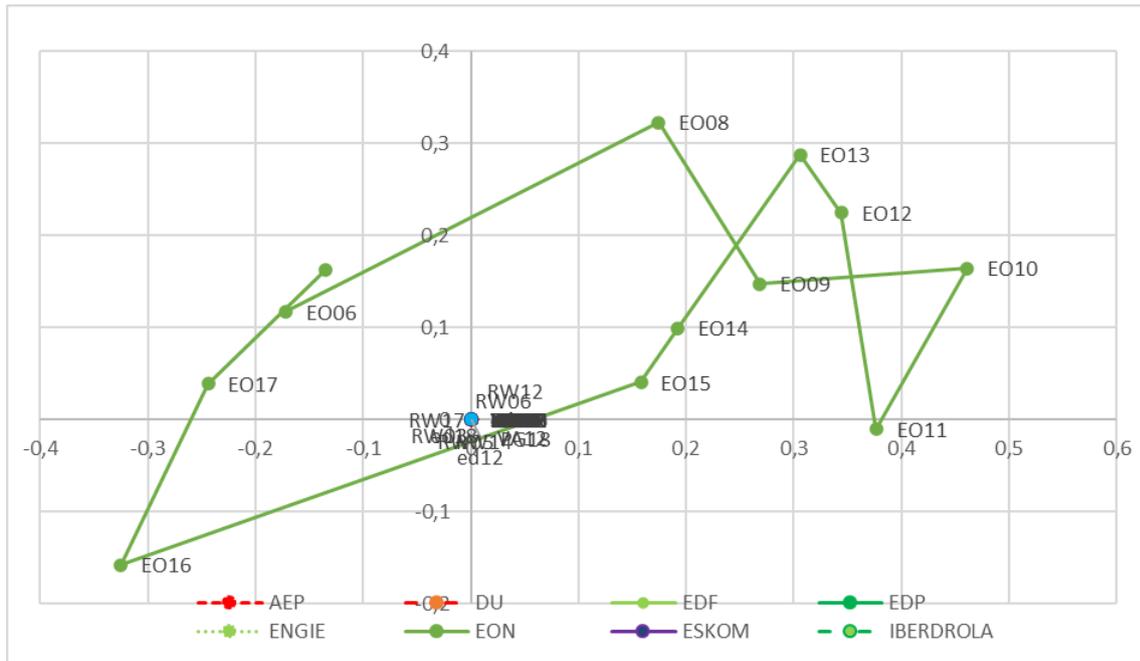
**Figure 62 Correspondence analysis for EDP on energy sources**

EDP's discourse in Figure 62 seems stable in a line renewable to gas when viewed together with all other companies. but on a closer look, the discourse moves from 2009 to 2012 out of renewable with a larger focus on coal, before turning back 2013 to 2018 firm into renewable. The visualisation shows only very marginal changes in the discourse, when the third dimensions of wind and solar is much stronger. This is why this figure should not be read as a circle bringing back discourse to a similar balance than at the beginning. In fact it means here that the dimensions suitable to compare most companies do not reflect how EDP has changed.

**(3/8) ENGIE**



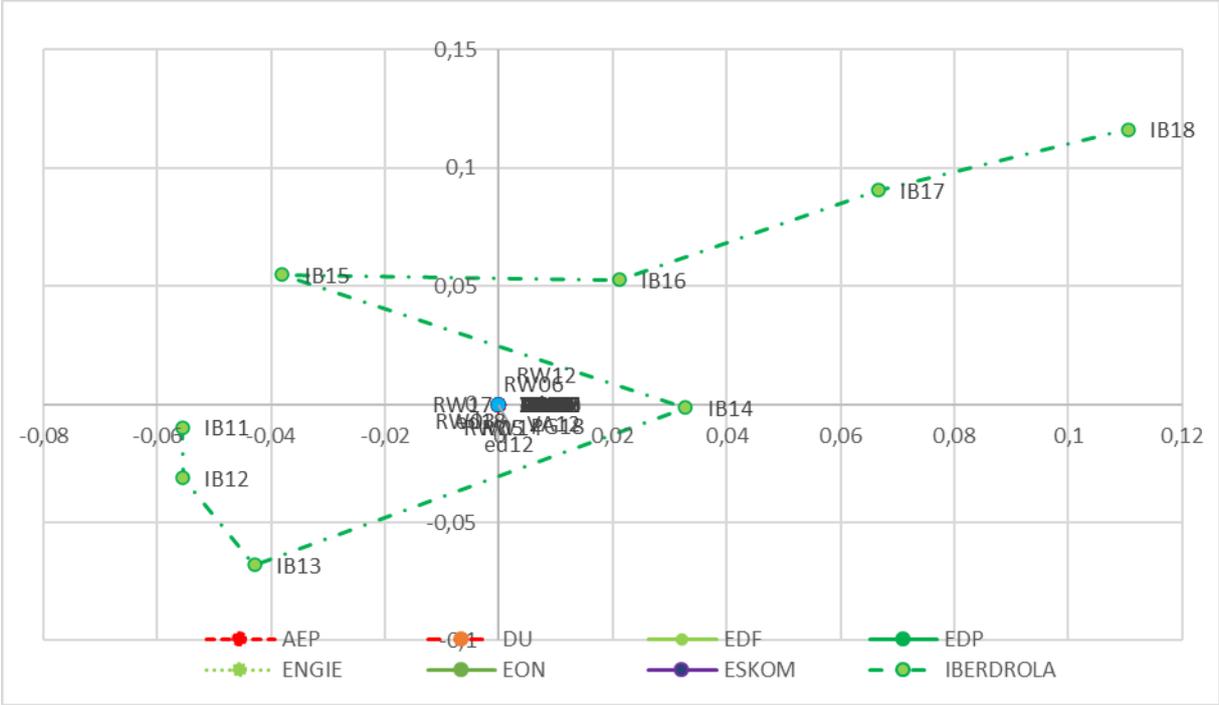
**(4/8) E.ON**



**Figure 64 Correspondence analysis for E.ON on energy sources**

E.ON has a series of changes in the discourse on energy sources as shown on Figure 64. When 2006 – 2011 is stressing more coal as energy source, there is a tipping point and reverse direction, from 2011 to 2015 with some focus on nuclear, but mostly into wind and solar, again poorly represented on these axes. The of energy policy in Germany to discontinue nuclear power is present in the discourse with how to close, when to close and how to finance it. Then, 2016 – 2018 shows a move again with more renewables.

**(5/8) IBERDROLA**



**Figure 65 Correspondence analysis for IBERDROLA on energy sources**

Almost all the representation of IBERDROLA is on the wind and solar axis not show here; but on this visualisation chosen for all companies in the sample, IBERDROLA on Figure 65 appears in the middle of global discourse, in the wind and solar center .In 2011-2013 the discourse still included a nuclear component, with a large legacy in nuclear power; as such the discourse looked close to EDF, or VATTENFALL. But then discourse changed into 2018 to keep only renewable. If the overall trend has a tipping point in 2015, the move beyond renewable is strong into 2018, which means very far from the opposite direction..

The evolution of energy sources in IBERDROLA vocabulary is illustrated in specificity diagram on Figure 66, where the relative importance of wind and solar in the total corpus for IBERDROLA is moving somehow up, when nuclear becomes increasingly ignored in the discourse from 2016 onwards.

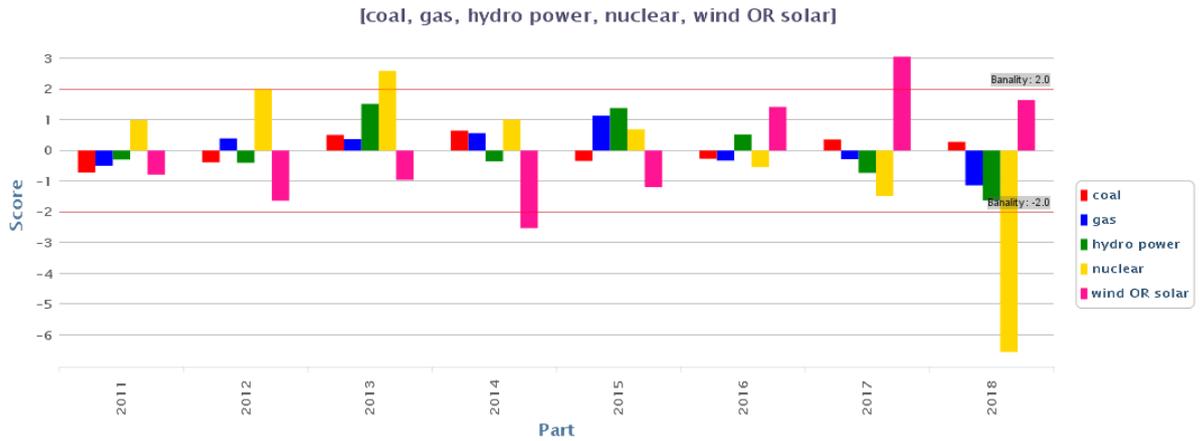


Figure 66 Specificity for IBERDROLA of nuclear, wind/solar across 2011 - 2018

(6/8) RWE

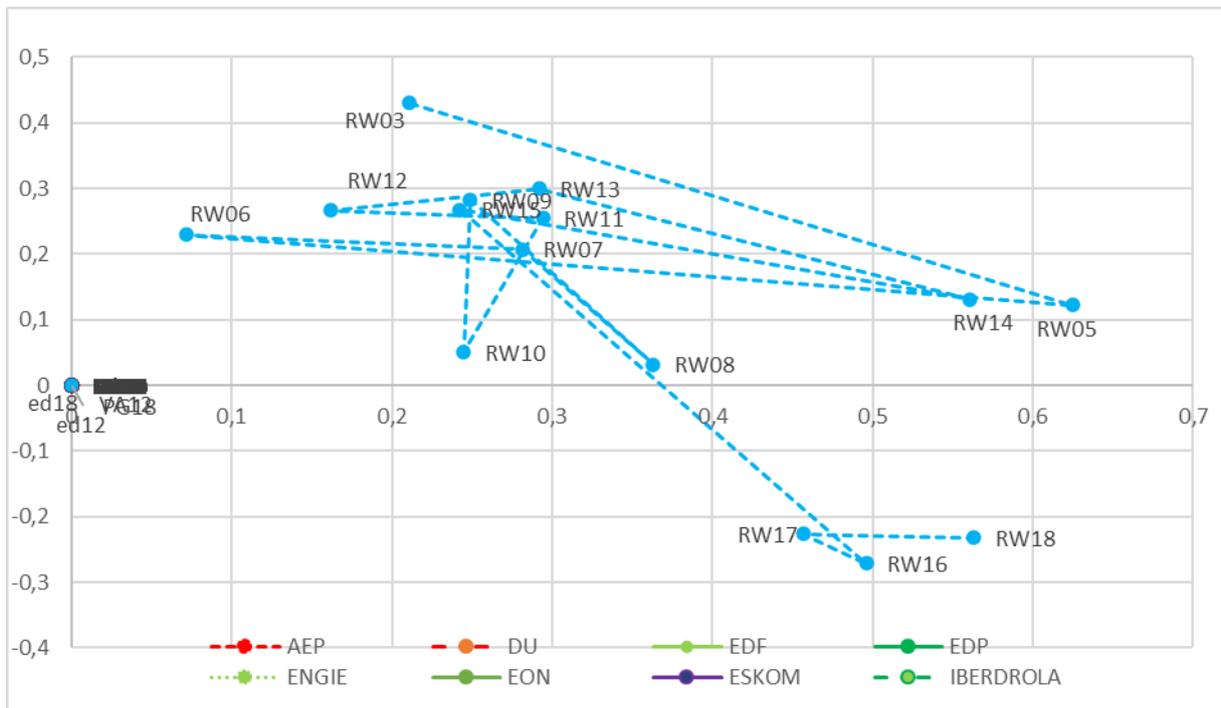


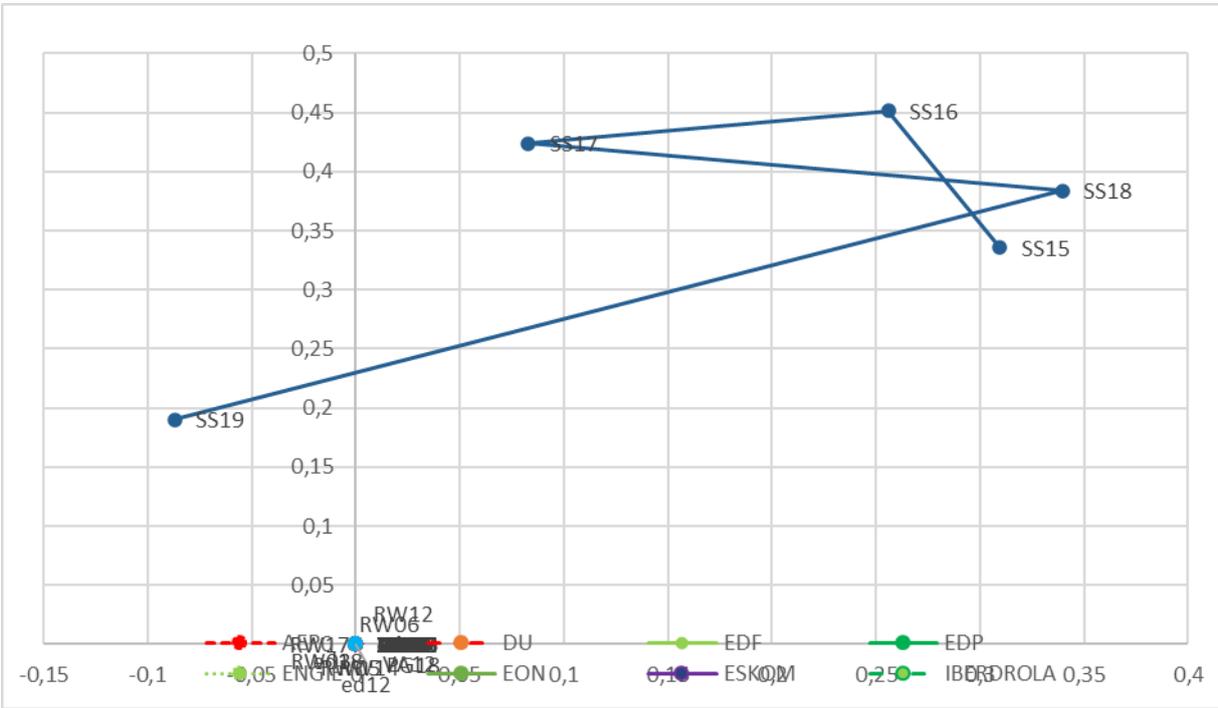
Figure 67 Correspondence analysis for RWE on energy sources

RWE discourse on Figure 67 is positioned in the middle of European companies, so that it seems very isomorphic to the global discourse. But even in the middle of all others CSR reports, it appears that RWE has a stronger discourse on coal, at the beginning around 2005 and in the end of the period studied 2016 to 2018. When isolating only trajectory of RWE along discourse on energy sources, three elements can be isolated.

There are back and forth move between coal orientation and renewable orientation. When the move towards more coal in 2005 was into developments, next ones in 2014 and 2018 arrive in a totally different context. Here it has become when to dismantle, how to convert to other energy sources.

The second observation is that effect, or Guttman effect is not apparent, so that another visualisation would suit better for RWE corpus here. And third that 2016-2018 is probably on a different level than previous moves to coal, which would have to be detailed in proximity with other words.

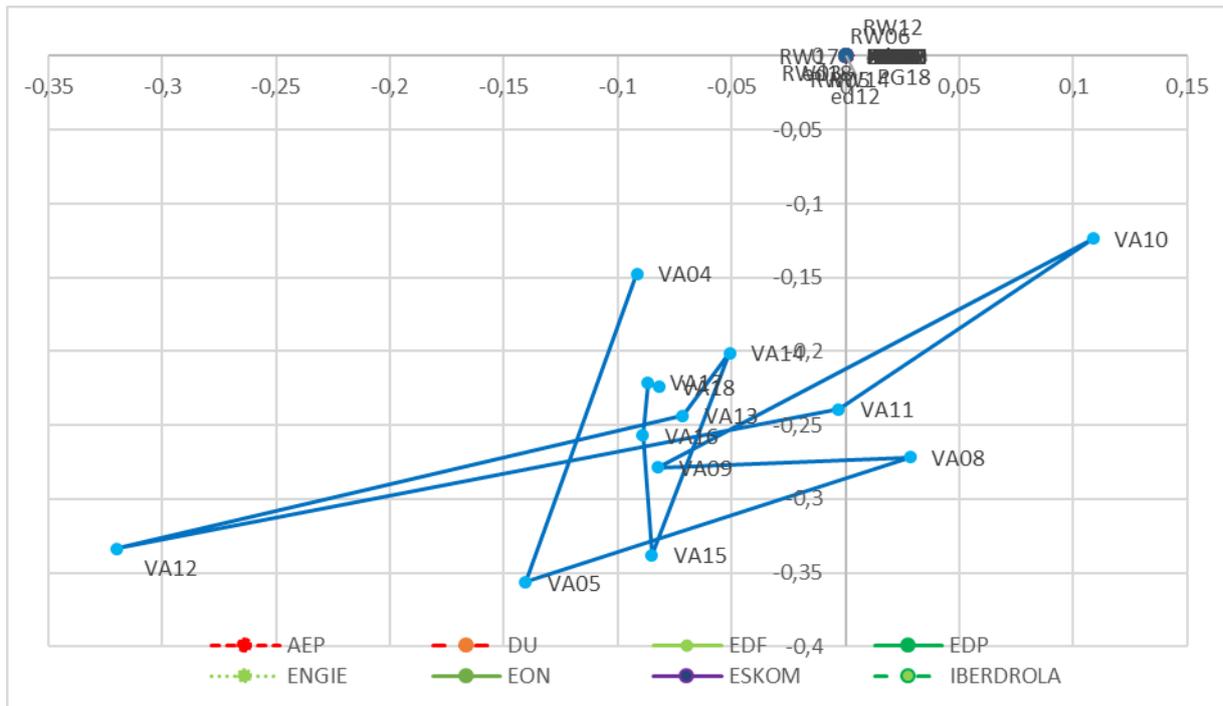
**(7/8) SSE**



**Figure 68 Correspondence analysis for SSE on energy sources**

SSE discourse in Figure 68 elapses over less years than all other companies, so that evolution are less apparent. 2015 – 2018 appear in the middle between gas and renewable. The move in 2019 is quite different, with only focus on renewables. Here 2019 is a 2018/2019 report and not covering full year 2019.

**(8/8) VATTENFALL**

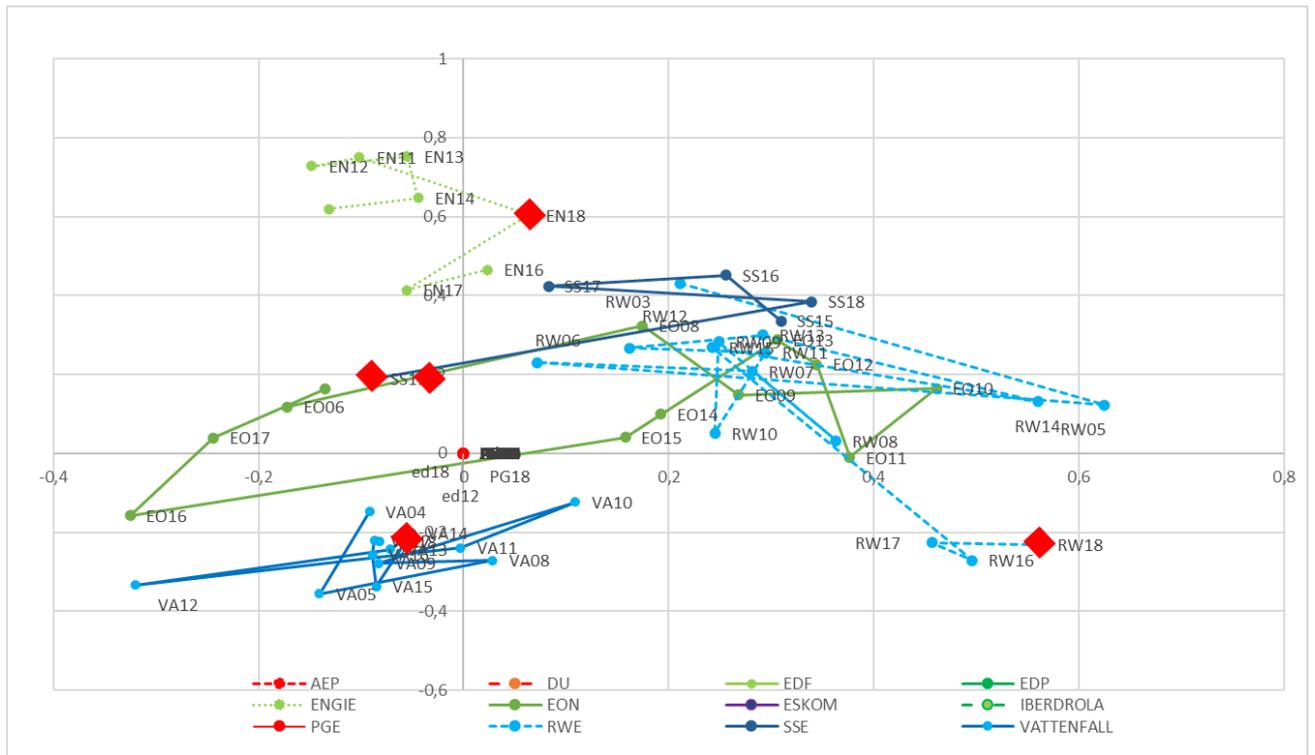


**Figure 69 Correspondence analysis for VATTENFALL on energy sources**

After SSE with only a few years, VATTENFALL is represented on Figure 69 since 2004, with a total of 14 years in a row. Despite a consistency around renewable all through 2004-2018, there are some points outside, one including more nuclear in 2012 discourse, which is also a large asset for VATTENFALL. And one in 2010 in an opposite direction, partly away from nuclear, and closer to gas, and mostly in a renewable perspective not visible here.

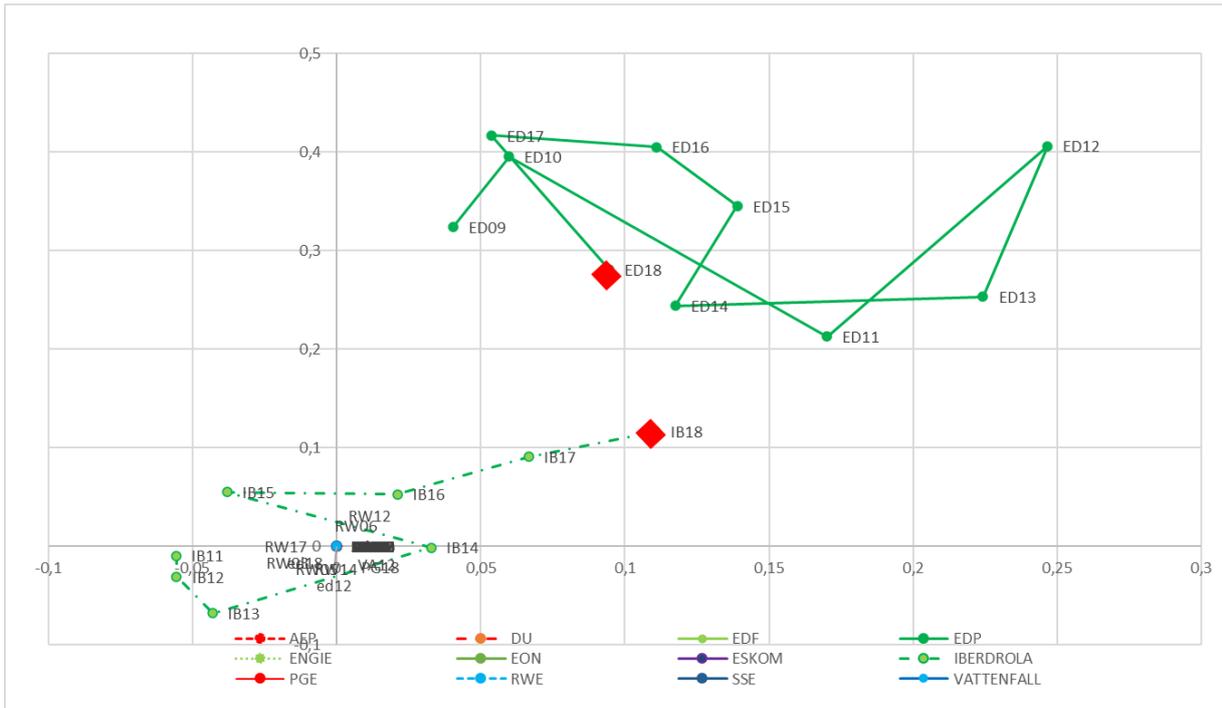
**Two trends on energy mix in Europe.** After looking at Europe as a whole, and at each individual path, is there any level at which converging paths can be observed ?

Looking at a group mostly in Northern Europe with 5 companies RWE, E.ON (Germany), Vattenfall (Sweden) SSE (UK) and ENGIE close to the same vocabulary, there is a marked convergence. Each company is on its own path, with historical energy mix, or gas then electric business for ENGIE. But these paths, if they do not join in 2018 in a magical formula, converge strongly towards a priority for renewable in the discourse. Figure 70 shows both each path and the end point in red for each company.



**Figure 70 Correspondence analysis, ENGIE, E.ON, RWE, SSE, VATTENFALL, (red point corresponds to 2018)**

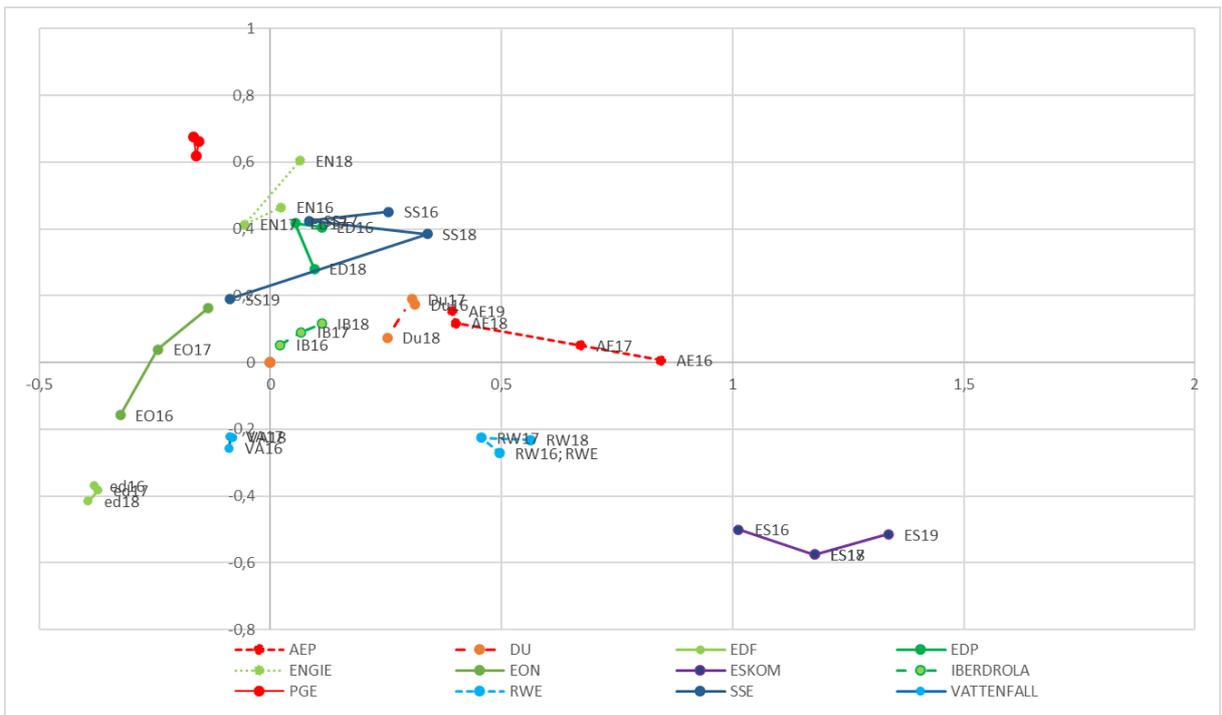
In this representation on Figure 70, RWE is clearly outside this convergence move, and devotes its discourse in 2016 – 2018 to coal. Discourse changes radically in 2016 when wind and solar are cited up to 10 times vs 70 before 2016, and nuclear cited around 45 times per year vs 15. Another scheme of convergence can be observed in Southern Europe between EDP (Portugal) and IBERDROLA (Spain) although partially only on these two axes, most evolution being on an orthogonal axis containing wind and solar. Here if both companies have undergone very different patterns than they are in 2018 in a visually close vocabulary, as shown on Figure 71:



**Figure 71 Correspondence analysis EDP and IBERDROLA**  
 (red point corresponds to 2018)

As both companies operate in numerous countries, these paths should be taken as company orientation, much wider than a specificity in Iberic Peninsula.

**Visualising a stronger convergence in 2016-2018.**



**Figure 72 Correspondence analysis, all companies, 2016 to 2018  
on energy sources dimension**

Beyond geographical dimension between companies, it is interesting to detail the time dimension. Years 2016-2018 already identified in other results section show a large trend into renewable, in Figure 72. Once again, the axes of the graph are showing nuclear, gas and coal as main dimensions, so that wind and solar at the centre would rather be perpendicular to the plan. But this is not contradicting the move to the centre of axis, with wind and solar is very strong for AEP, DUKE ENERGY and E.ON. These three are late converted into energy transition with a large change in the vocabulary

On the contrary, a group of companies have a stable use of energy sources in their discourse: RWE, EDF, VATTENFALL, PGE. This means that the Paris Agreement end 2015 has not changed their way to mention energy sources. Either changes happened earlier as seen in the previous graphs for VATTENFALL, PGE, RWE, or it appears only marginally, like for EDF. A different evolution appears for ENGIE, IBERDROLA, both of them disinterested by “nuclear” more than using more “gas”. These moves could be visualised differently with one axis representing only renewable, potentially reducing explanation potential of all other energies.

#### **4.3.4 How the risk of stranded assets is becoming a threat?**

##### **4.3.4.1 Main findings on stranded asset concern**

The term “stranded” itself is not very much used across the corpus, but the vocabulary directly representing risk of stranding assets and how to address them is very present. Among few exceptions ESKOM is very aware of this risk for South Africa: “we have to consider the timing to avoid stranded assets as a result of the utility death spiral”. This is interesting to connect to the fact that they pledged in October 2020 to discontinue coal as a way to avoid this spiral, although they rely mostly on coal for power production.

Almost absent at the beginning of the period studied, the theme of stranding assets takes on, to a tipping point between 2010 and 2011 where it ceased to be marginal and becomes a large subject. As it appears to be some time ahead of academic research in 2013 onwards, we assume that research gave a theoretical content to a series of risk and concerns which were only emerging.

Initially stranded assets were descriptive of operations, and cost associated. Then it changes into impact on strategy, and higher risk.

#### 4.3.4.2 Building a portfolio from stranded assets in the corpus, and from literature

The concept of stranding assets has been discussed in part 1 as one of potential depreciation of some assets up to the point where they become liabilities. These could be coal power plant in a country stepping out of coal, or a gas or nuclear power plant in another country stepping out of these.

We explore here how the risk of assets losing their total value of assets is reflected in corporate discourse. How companies take this concept developed by scholars around 2013 into account? As pressure against, coal, fossil or even nuclear power grows in the news, risk of stranding assets should grow with the time. Hence companies are pushed to explain what they do to escape this situation and remain legitimate.

We first search for its use in the corpus, which is very scarce. Then we take words related to stranded assets in the literature, and use them to test a wider use of stranded assets in the corpus.

**In the corpus, stranded assets are presented as “utility death spiral”.** The best description of impact of asset becoming stranded is given by ESKOM (RSA):

“Firstly, we have to consider the timing to avoid stranded assets as a result of **the utility death spiral** and secondly, we should explore smaller, incremental responses to reduce the investment risk. » ESKOM 2018 p44

This strong statement applies particularly to ESKOM with highest coal proportion in its energy production mix (77% of coal in South Africa energy mix in 2019). If coal power plants are one by one so depreciated that the value of decommissioning, dismantling, depollution is higher than operating the business, then the company will run into how to get rid of the first assets before the next ones become stranded at their turn. This brings an interesting idea that it is can be a process: first the higher polluting, or further locked in with higher costs, before the next ones. And this also puts forward the question how to escape the process either with early closing when revenues are still comfortable, or selling the asset ‘before it is too late’ so to say, to another player with different economics.

ESKOM calls this also “utility death spiral” as opposed to any other sector, because it is the large production unit first that run the risk of stranding, making the salvage with other segment even more difficult (this is the “smaller, incremental responses” cited). Hence either the risk can be fixed early enough, or next risk in line is carving out from the company assets for defeasance.

**The very concept of stranded assets is not familiar in CSR reports,** but the risk and management of assets are present. There are argumentations on whether to divest or close assets at risk of stranding.

First step is to test concept of stranding cost, and stranding assets directly in the corpus. It is more likely that it can be observed via a series of indirect words pointing towards stranding assets; nevertheless, basic inquiry covers how companies touch the concept of stranding assets. Following this example, we test successively the words “stranding assets, stranded assets,” in the corpus. Then we extend it to a construction with keywords from the literature around stranding assets.

What hypothesis can be made on stranded assets as a way to legitimacy? With energy transition, companies which are mindful about keeping their legitimacy have to integrate first in risk analysis, then in assets management the potential case of having stranded assets. Across the corpus, we can observe emergence of this risk. With the time it tends to become a threat, calling for action to keep up legitimacy of utilities.

**Construction of word portfolio around stranded assets from literature.** From the literature, we derive that concept of stranding assets is linked to legitimacy. Rather than looking for a definition, the intent here is to define an extension of the concept of stranded assets Ansar and Caldecott (2013). Since “stranded cost, stranding assets” are narrow topic to search, we expand it to larger word portfolio. We look at keywords and main terms associated to “stranded” in Ansar and Caldecott (2013 p29). This brings a list containing: “divestment, divestment campaign, cash flow affected, downward pressure, close off, survival, threaten, restricted pool, withdraw, difficult technical.” These terms will be the first list for request into textometry. We acknowledge that some words are ambiguous (affect could be linked to accounting), some are expected to be absent (survival). They are tested along the way.

For this section, stranded assets will be analysed via a word portfolio containing 11 lemmas roots (for example including divest and divestment, or threat and threaten): strand, divestment, affect, downward, pressure, close, survival, threat, restrict, withdraw, difficult.

**Limited results on words “strand, stranded” themselves.** A first analysis includes single word: “to strand, stranding, stranded” all into the lemma “strand”. This is a direct reading of how stranded cost, then stranded assets can be observed.

Numbers are very limited, 46 occurrences, with ESKOM 14, AEP 14, ENGIE 9, DUKE ENERGY 4 and EDF 5. On the yearly basis, 2012 is a peak year with 11 occurrences, by AEP and ENGIE. Then 2015 only ENGIE, and 2017 -2018 mostly ESKOM with 12 occurrences. This shows that there is no trend, rather individual stories.

The story for AEP, American Electric, is around stranded cost. The focus is first on unrecoverable costs of the past. Out of the 14 citations, 6 alone are for year 2012, with citation here, completed with Table 25:

“While recovery of stranded costs caused by the transition to a competitive market is a proper regulatory use, it is also the responsibility of AEP to ensure that the cost impacts to customers are acceptable and mitigated where possible. Securitization legislation has been proposed in other AEP jurisdictions whose customers may experience similar upward price pressures» (AEP, 2012 p44).

|                                  |          |                     |
|----------------------------------|----------|---------------------|
| to recovery of                   | stranded | costs in Texas      |
| the recovery of                  | stranded | costs in Texas      |
| fuel costs,                      | stranded | costs are           |
| state-mandated restructuring and | stranded | costs. While        |
| While recovery of                | stranded | costs caused by     |
| regulatory assets and            | stranded | costs in connection |

**Table 25 Concordance table for AEP on “stranded cost” extract for 2012**

Then AEP changes its discourse into addressing how this impact financing, as per 2016 citation:

« Some investors are especially concerned about the potential impact to their investment portfolios from stranded coal assets – such as a coal plant that loses economic value well ahead of its anticipated useful life” (AEP 2016 p10).

The discourse here is about recoverable to non-recoverable costs. It is presented in a context of stranded cost is a regulatory frame in the USA, including a focus in Texas. This is not the risk of depreciation that challenges legitimacy of utilities.

The story for ENGIE, using stranded cost 5 times in 2012 and 4 in 2015, is mostly around Link to a legal arbitration.

“On November 30, 2012, the court of arbitration rejected the Group’ s claims, except for the claim based on the principle of fair and equitable treatment in relation to the stranded costs arising from the termination of the long-term agreement, which was approved by the European Commission in April 2010.” (ENGIE 2012 p410)

|                            |          |                              |
|----------------------------|----------|------------------------------|
| relation to the            | stranded | costs arising from           |
| compensation mechanism for | stranded | costs. The approximately     |
| amount of its              | stranded | costs and allowing           |
| illegal and the            | stranded | costs. The compensation      |
| the amount of              | stranded | costs, which could result in |

**Table 26 Extracts of “stranded cost” use by ENGIE in 2012**

Table 26 confirms the legal and arbitration context for ENGIE, particularly with Hungarian State. In 2015 the 4 occurrences are no different, with

“Asked the Hungarian State to review these contracts, recover the related State aid from the power generators and, when necessary, to indemnify the parties to the agreements via a compensation mechanism for stranded costs ». (ENGIE 2015, p432)

If the use of stranded cost by ENGIE is different than AEP above, it is not in a sense of risk, threat to assets, but rather evidence of all incurred cost and what makes them recoverable.

As for ESKOM, for which the formula “utility death spiral” was commented as introduction to stranded asset matter, the 14 occurrences start only in 2017. Intensity of the risk, with 6 citations in 2017, same in 2018 and 2 in the report covering April 2018 to 2019 can be directly appreciated:

“This means that we are likely to be left with stranded assets which cannot be optimally utilised. A long-term strategy is required to deal with the operating surplus capacity, while minimising the impact on our workforce, suppliers and the community at large » (ESKOM 2017 p28)

“Inability to sell in the region in the long term, partly due to an inability to build transmission lines fast enough to support the capacity increase, leading to stranded assets in South Africa and over-investment in transmission assets in the region » (ESKOM 2017 p37)

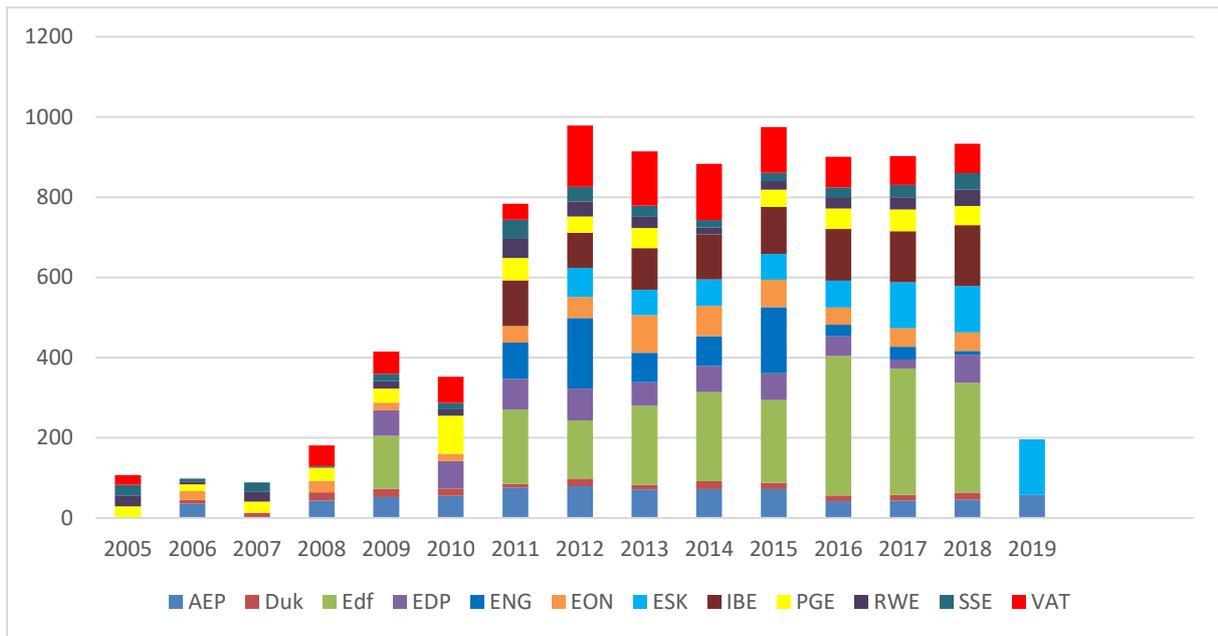
While the first citation insists on having a coal power plant in reasonable condition in a time where electricity out of coal is no longer legitimate in South Africa; the second insists on wrong investment allocation between different options.

Together with performance issues of electricity network in South Africa, ESKOM is very aware of the mid-term objective to escape coal power plant before stranding them all.

What can be concluded from use of “stranded “itself, is that the risk of stranding assets is not significantly covered with the words ‘to strand, stranded, stranding’. This leads to study how companies are concerned to maintain their legitimacy against stranding risk with a more indirect vocabulary.

#### **4.3.4.3 Emergence of stranding with occurrences tables and bar chart analysis**

Word portfolio associated to stranding assets reveals a very limited concern back in 2005-2008, even if the corpus is smaller for these years. The word portfolio contains “strand, divestment, affect, downward, pressure, close, survival, threaten, restricted, withdraw, difficult”. It is taking on, as visualised on Figure 73 by year and by company.



**Figure 73 Bar chart of composite stranding use across the corpus**

Here we look at the evolution of stranding assets and study how they evolve over time. Is it taking a different form after 2013 with academic research? Is it progressive for all companies or not? Are there any companies who shift away from risk of stranded assets, or suddenly become very concerned?

Between 2005 and 2018 the risk of having assets become stranded has been taken into account by most companies. It emerged progressively and then stood at a high level of concern, for about all companies.

There is a tipping point between 2010 and 2011 where it ceased to be a marginal subject and becomes a larger subject, even in respect of the larger corpus size of these years. This comes before academic research in 2013 onwards. We assume that research gave a theoretical content to a series of risk and concerns which had emerged.

This tipping point is characterised by intensity and choices between 2009 and 2012. Vocabulary used shows that there is a step change in intensity. But it remains on affecting, closing businesses. But in 2012, beyond these “affect, close”, pressure to discontinue assets is getting strong “withdraw, divestment” have become key topics in Table 27. Specificity calculation reinforces the emergence of “divestment” in the discourse. It is interesting to note the predominance of divesting assets over closing-down in the discourse.

|            | 2009 | 2012 | +   |
|------------|------|------|-----|
| affect     | 138  | 362  | 224 |
| close      | 63   | 169  | 106 |
| difficult  | 58   | 43   | -15 |
| withdraw   | 28   | 61   | 33  |
| pressure   | 25   | 52   | 27  |
| disclose   | 22   | 50   | 28  |
| threaten   | 8    | 18   | 10  |
| divestment | 7    | 52   | 45  |
| downward   | 3    | 16   | 13  |
| strand     | 0    | 12   | 12  |

**Table 27 principal stranding asset vocabulary 2009 / 2012**

Some typical examples of the evolution in use of stranding assets team can be found for “divestment “ for example: if most occurrences are from VATTENFALL in 2012 such as “at the right time through the divestments we decided on in 2010, and we cut our annual costs”; this compares to a typical 2009 by EDP “making decisions on investments (or divestments) in an informed, clear and concrete fashion. Not only is the use growing in quantity but also in context, less presented as an alternative investing or disinvesting assets, but more like an obligation to step out.

Finally, we need to mention that this historical progression as visualised is partly misleading, since companies in the sample are all only present in 2009 onwards. (in 2009 8 companies out of 12 have data). When looking at 2009 onwards, the concern growing until 2012 and then remain constant in the same pattern than the size of texts in the corpus but in much larger progression.

**Environment of stranded assets moves to actions and operations.** Our present word portfolio is studied inside its environment. We test how some words around stranded asset register change. We want to show how association to other themes as changed over time; whether it suggests sense of urgency or proof of action.

After testing with most nouns or adjectives, not just next to one of studied word but in vicinity, it turns out that verbs are the most significant. Selecting 2 years for illustration, 2008 is closely related to an external vision of stranding asset as shown in Table 27. It is mostly a description “include, occur”. When on the contrary 2018 is mostly into action.

Testing association verb to stranding asset related term. Table 28 below shows:

| 2008    |   | 2018     |    |
|---------|---|----------|----|
| include | 5 | make     | 13 |
| take    | 3 | operate  | 12 |
| occur   | 3 | relate   | 11 |
| make    | 2 | do       | 9  |
| work    | 2 | reduce   | 8  |
| cover   | 2 | include  | 7  |
| ensure  | 2 | expect   | 6  |
| do      | 2 | continue | 6  |
| affect  | 2 | lead     | 5  |
| find    | 2 | use      | 5  |

**Table 28 Most frequent verbs & stranded assets in 2008 and 2018**

In Table 28, number of verbs associated to stranded assets is moving up with the corpus size in 2018. The full list not reproduced here shows total occurrences are 150 in 2008 and 730 in 2018. What is most relevant is that the ranking of verbs is very different, with a focus on running assets “make, operation”, then neutral verbs “relate, do”. While at the beginning most verbs were descriptive (include, take, occur), stranded assets are now linked in 2018 on one side to operations and on the other side to an action plan; this is represented by “reduce, expect, lead, use”.

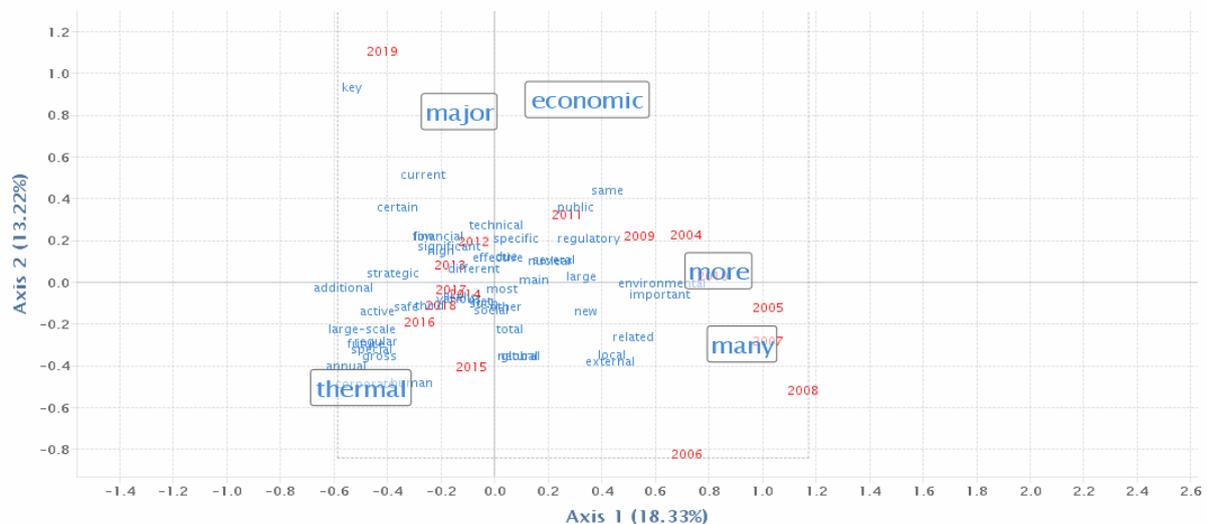
We can interpret that companies have taken the risk of stranding assets into their business at an operations level. Whether reinvesting to keep assets running, or closing earlier, and even selling while there are still some companies interested.

It has been detailed on part 1 but just for illustration of recent transaction, in 2019, German company UNIPER sold coal power plants in France to Czech EPH group " (including Gardanne near Marseille, Emile Huchet near Nancy). From the seller’s point of view this could be a way to escape stranding asset.

#### **4.3.4.4 Evolution visualised on correspondence analysis.**

We explain how stranding risk is moving from neutral position, among other issues, into a threat for business. This is tested by looking at environment around stranded asset vocabulary: what kind of adjective to qualify stranding assets?

Correspondence analysis factorial plane of CSR1 29/byYEAR/<@[enpos="JJ.\*"]|word!="\p{P}+"}{1,6}|enlemma=".\*strand.\*|. \*divestment.\*|. \*affect.\*|. \*downward.\*|. \*pressure.\*|. \*close.\*|. \*survival.\*|. \*threaten.\*|. \*restricted.\*|. \*withdraw.\*|. \*difficult.\*"]>@enlemma ≥ 10 ≤9,489,733 /9,489,733/@enlemma ≥ 10 /9,489,733



**Figure 74 Correspondence analysis stranded asset vocabulary with adjectives (without national adjectives like French, German, and excluding 2003 less than 1%)**

We visualise on Figure 74 how the vocabulary around stranding asset evolves. **Associations with any adjective shows how it turns from neutral to a “major” threat.**

In 2005-2010, when the question on stranding assets was still a low signal, we see “local, environmental” are dominating then “more, important, regulatory, political...”, most of them around the notion of “external” risk. At that time the risk of stranding asset is identified, together with main risks covered in CSR reports, social, environmental and financial for those company who include more financial aspects in their reports.

Then in 2016-2018 the environment changes as the vocabulary associated is now moving from “thermal” to “key, certain, current”. If “major, economic” highlighted on Figure 74 appear very isolated, they have a very low statistical relevance (as year 2019 weighting only 2.5% of the corpus).

#### 4.3.4.5 Variation across companies studied with correspondence analysis

This section looks at the differences of approach of companies in the sample. Is the concern unanimous, beyond the 3 companies specifically using “stranded cost”, (ESKOM, ENGIE and AEP for memory) And the question what specificity can be found among the companies in this sample. It appears that there is a specificity with VATTENFALL, the only one with

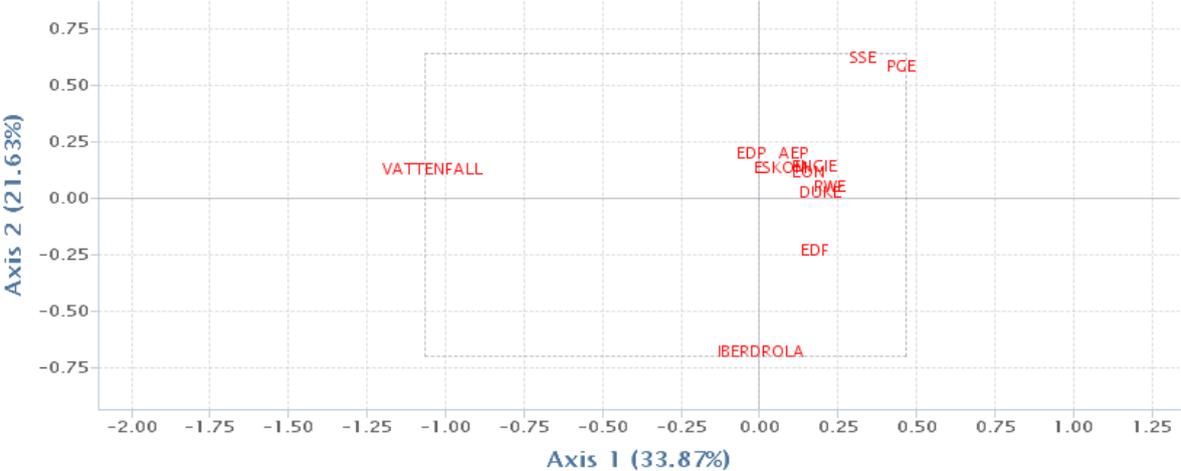
“divestment” as major concern. Then, IBERDROLA is specific about “Withdraw, withdrawal”, and to a lesser degree “affected” when most other are more consistent.

“While we recognise that divesting coal-fired plants will not produce any environmental benefit, opportunities to do so will be taken when they are economically attractive.” (VATTENFALL 2010).

In this quote VATTENFALL is at very purpose of stranded asset discussion. At one point, asset can become stranded assets and monitoring this point is the target here. The point of view from a divesting perspective will be further demonstrated hereafter.

The same word portfolio for stranded asset theme is used here, but this time on a variation dimension instead by years. First, correspondence analysis of Figure 75 shows how company can be visualised on “stranded assets” dimension:

Correspondence analysis factorial plane of [enlemma="\*.strand.\*.divestment.\*.affect.\*.downward.\*.pressure.\*.close.\*.survival.\*.threaten.\*.restricted.\*.withdraw.\*.difficult.\*"]: enlemma:enlemma 10 / 9999999



**Figure 75 Correspondence analysis stranded assets concepts, by company, global view**

As detailed below, horizontal axis is “divest” to the left, marked for VATTENFALL, and vertical axis is towards “withdraw and withdrawal”.

This can be looked into more details with the content of wording used:

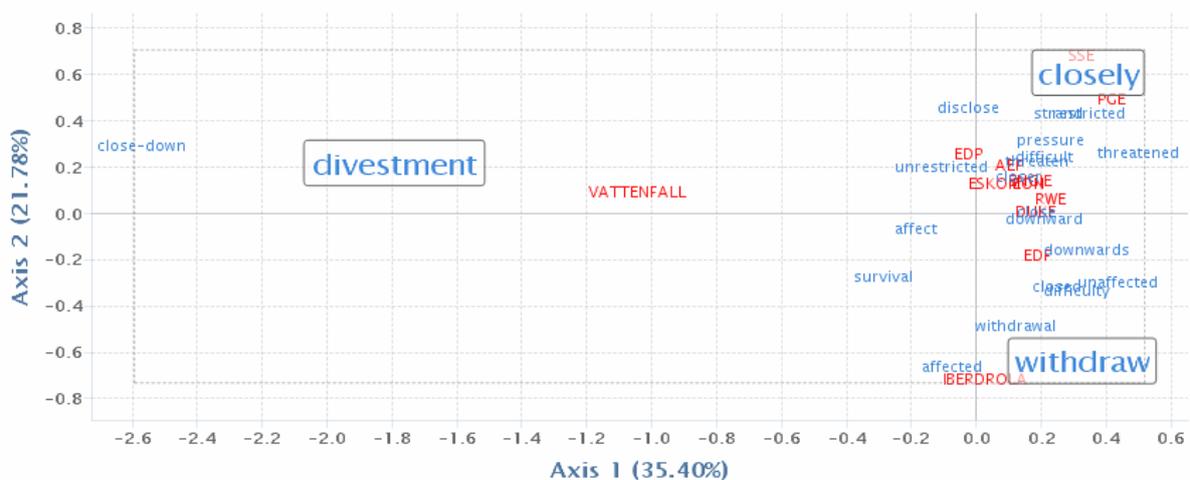
| enlemma    | F    | AEP | DUKE | EDF | EDP | ENGIE | EON | ESKOM | IBERDROLA | PGE | RWE | SSE | VATTENFALL |
|------------|------|-----|------|-----|-----|-------|-----|-------|-----------|-----|-----|-----|------------|
| affect     | 2643 | 277 | 74   | 551 | 175 | 178   | 134 | 254   | 338       | 98  | 87  | 14  | 463        |
| close      | 1574 | 84  | 44   | 570 | 149 | 139   | 94  | 114   | 96        | 88  | 71  | 20  | 105        |
| closely    | 582  | 75  | 17   | 55  | 17  | 62    | 95  | 34    | 10        | 133 | 34  | 16  | 34         |
| pressure   | 520  | 24  | 4    | 122 | 61  | 43    | 12  | 77    | 20        | 77  | 38  | 9   | 33         |
| withdrawal | 512  | 20  | 6    | 142 | 3   | 48    | 59  | 5     | 131       | 29  | 27  | 0   | 42         |
| difficult  | 405  | 65  | 21   | 86  | 26  | 27    | 39  | 41    | 14        | 17  | 32  | 14  | 23         |
| disclose   | 359  | 39  | 1    | 43  | 66  | 44    | 24  | 42    | 8         | 22  | 12  | 15  | 43         |
| affected   | 325  | 24  | 1    | 24  | 11  | 3     | 18  | 45    | 129       | 13  | 21  | 1   | 35         |
| difficulty | 306  | 22  | 2    | 157 | 26  | 14    | 13  | 12    | 38        | 9   | 6   | 2   | 5          |
| withdraw   | 302  | 14  | 17   | 107 | 0   | 24    | 21  | 6     | 85        | 13  | 11  | 1   | 3          |
| divestment | 292  | 4   | 0    | 24  | 23  | 7     | 12  | 3     | 8         | 0   | 0   | 0   | 211        |

**Table 29 Lexical table with occurrences of stranded assets concepts by company**

Table 29 shows that most companies are using common vocabulary, but for VATTENFALL around ‘divestment’, and IBERDROLA around ‘withdraw, withdrawal’. This is apparent on below graph, and in number of occurrences: VATTENFALL represents 211 out of 292 occurrences of ‘divestment’

When selecting a few terms in the current vocabulary, shows the specificity of one or the other company. In the figure below, ‘withdraw’ is very strongly associated to IBERDROLA as discussed above, but EDP and VATTENFALL underrepresented, it means this is very far from their concern. The lemma ‘close’, which includes to close, closes, closing, closed. is mostly associated with EDF. This does not come as a surprise with all debates on closing now or later nuclear power plants. On the opposite vocabulary about ‘threaten’ is overrepresented for American companies AEP. PG&E. On the contrary only E.ON is using it really less than other After seen the lexical table, we can now return to the correspondence analysis, with the word environment, on figure below.

Correspondence analysis factorial plane of CSRI 29/byCY/<[enlemma=".\*strand.\*|. \*divestment.\*|. \*affect.\*|. \*downward.\*|. \*pressure.\*|. \*close.\*|. \*survival.\*|. \*threaten.\*|. \*restricted.\*|. \*withdraw.\*|. \*difficult.\*"]>@enlemma ≥ 10 ≤9,489,733 /9,489,733/@enlemma ≥ 10 /9,489,733



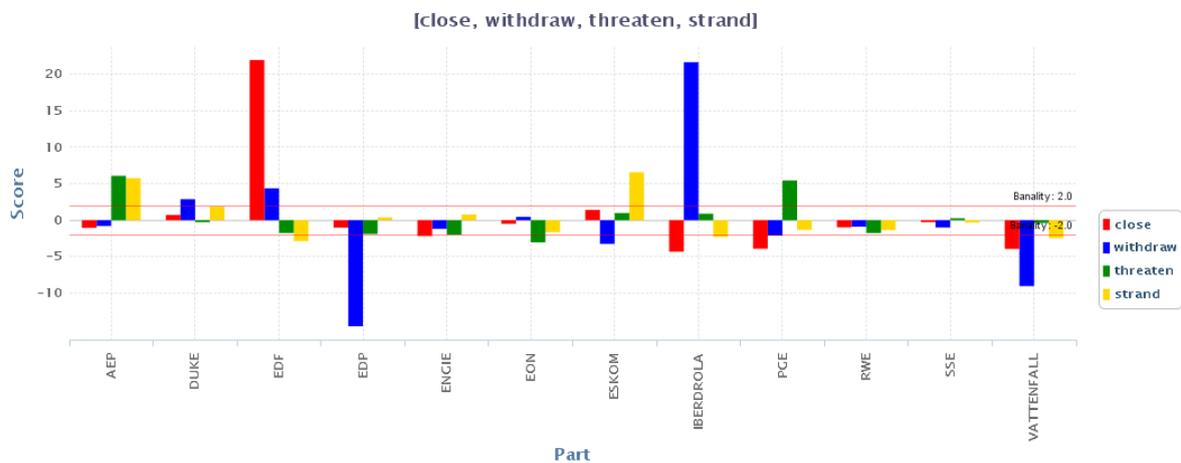
**Figure 76 Correspondence analysis stranded assets concepts, by company**

(excluding “low pressure, high pressure, closed loop” part of technical vocabulary)

Companies who communicate the highest specificity about stranded assets are VATTENFALL (score 19) AEP (score 19) IBERDROLA (score 13) and ESKOM (score 13). Figure 76 details the vocabulary contained inside the theme of stranding assets. Horizontal axis 1 is mostly oriented with “divestment, close-down” which are very specific to VATTENFALL is mostly. On the vertical axis 2 the bottom side is around “withdraw”, and the upper side around “closely” which is far less relevant. For AEP the highest specificities are “difficult, restricted” For IBERDROLA is mostly “affected, withdraw” and for ESKOM “pressure, strand”. Each of the main four companies use very different wording.

In complement to correspondence analysis, we perform specificity calculation to determine what keywords are more or less specific of each company, taking their size and structure into account.

After testing the different words here, 4 verbs were retained: “close, withdraw, threaten, strand” down in the specificity calculation Figure 77 below.



**Figure 77 Specificity of “close, withdraw, threaten, strand” across companies**

This view shows additional information. Closing assets is not a question shared by most companies in the sample, but only EDF is at grip with this question. The size of corpus has an influence, since EDF (25%) is the largest corpus; this makes the different use of a lemma appear even more in the specificity. The main message of this diagram is that discussion on closing nuclear power plant, if to close, how and when to close is a cornerstone of EDF discourse by

EDF. Even if closing nuclear plant is not considered as a question of stranding assets for EDF, this is a marked specificity in the vocabulary used.

Next observation is about “threaten”. It is tested here to see if companies use a much more urgent vocabulary. It appears to be specific here only for AEP and PG&E. Apart these two American companies it does not seem specific to any other one, we consider here that country of origin plays a large role rather than more urgency.

Last comment is for the specificity of “to strand” itself. We discussed already how ESKOM (RSA) was using the most “stranded costs”; here it appears more forcefully, with only AEP also specificity score significantly above 3. In comparison, ENGIE who also uses the concept, does not have any specific use here.

Conclusion of this section on variation across companies is that there are clear differences between a core of most companies, and 2 very different patterns; VATTENFALL on one side, IBERDROLA on the other.

#### **4.4 THEMES AROUND LEGITIMACY**

##### **4.4.1 Phasing out of operations, and phasing in of transformation?**

###### **4.4.1.1 Main findings from legitimacy vocabulary in 2008**

From the extract of CSR report dealing with mission and vision of the company, we select a large portfolio of 70 most frequent terms. These words from 2008 or close data are grouped into 4 themes and represent affirmation of legitimacy at that time. The four themes are operations, utility and energy, finance, and change. We study them in a longitudinal perspective, looking how this vocabulary develops 2008 onwards.

**The theme of operations:** maintaining a good operations level was in 2008 and remains a concern, in proportion of the overall discourse. The content of operations and performance has changed, and widened into sustainable dimension. We observe a shift from asset operations to environmental footprint.

**Second theme around utility and energy shows a move from growth to sustainability.** There is a switch from electricity supply chain to service activities. Where utility vocabulary was strongly attached to growth and acceleration, evolution into 2018 shows a marked “sustainable development” orientation.

**Third theme is a word portfolio around finance.** Finance was a main legitimacy claim at the beginning of the period, it is not a focus in 2018. This can be explained partly because financials

are discussed in other reports, like annual report, and partly because transformation and new priorities do not use the word portfolio associated to finance.

**Last word portfolio on “change” shows that all companies are embarked on change**, and communicate about it. This is a confirmation in numbers of what was expected. But the way changes are presented is different. When beginning of the report period insisted on metrics around efficiency and performance, 2018 is influenced by energy transition, sustainability and development.

#### **4.4.1.2 Identifying main words of affirmation of legitimacy in 2008-2010**

Most companies in our sample devote a section to their mission, vision or values; or at least some highlights of their strategy. In this section we take the keywords from these statements. We convert them into a word portfolio that we trace across the years. these affirmations are considered to be the affirmation of legitimacy at a starting point. The purpose here is to see how these elements move along the time.

Most companies are present in the corpus by 2008, some earlier (VATTENFALL, RWE since 2003) and a few other are only present in 2011 onwards (IBERDROLA and ENGIE in 2011, then ESKOM 2012). This makes the vocabulary studied a mix of companies concerns as they enter the sample, not a one specific year. This result section considers only 11 companies, excluding SSE which is present only in 2015. We considered the time line was too short to measure evolution here.

Some cornerstones are present all along the corpus; “operations, finance, energy...” and are here to stay. But others will fade out or transform. The observation here is, among the key aspects of the beginning period, which have given way to other priorities, or what is no longer used by a majority but only few players.

**Generating a word portfolio with 70 words around legitimacy in 2008-2010.** 4 themes emerge from 2008 corpus: operations, finance, utility and energy, change. They are generated by following process.

First, a cursive reading allows to identify in which section each company details its key strategies section. Then these sections are read to extract the main concepts put forward. For each company the report based is 2008, or the first year available for those where information is available later. SSE (UK) is not in the sample, since the first year available is 2015 and considered here not probably too short to see significant change in how the company presents itself.

This results in the following list of 70 words:

operate, responsible, efficient, profitable

“path forward”, operations, identity and culture, reliable, “cost management”, investment, “financial position”,

Leadership, competitive advantage, energy efficiency, renewable, investment, provider, leader, creating value, innovation, sustainability (earth?)

Changing, integrated, competitive advantage, clear, strengthen, expand

Accelerate, development, strengthen, refocus, streamline, reinforce, secure, cash flows performance, grow, sustainably, leading, partnering, reducing, securing, implementing, pursuing

Deploy, ensure, clean energy, development, renewable, improve environmental, downward trend in emission, fuel consumption, produce

deliver safe, reliable, and affordable Responsive, producer, provider, vital infrastructure

Supplier, operate, sensitive, markets, offer, maximize, performance, environmental, product, services

leading, profitable, growth, create value,

next, these 70 words are grouped into 4 themes: operations, finance, utility and energy, change:

- theme one around operations. This one is expected to be the foundation of all CSR. We anticipate stable over the period.
- theme two around energy. Here all vocabulary of utilities, produce and consume energy. It is anticipated to remain stable
- theme three around finance. Our hypothesis is that finance would be less central in CSR communication
- theme four around change, new, development. We expect that this is increasing in frequency, intensity, and with a sense of urgency.

Some hapax could be further studied to see how they are used. Eg: “path forward” (DUKE energy), “vital infrastructure’ (PG&E)

And “accelerate” (ENGIE), “deploy” (IBERDROLA) that are specific.

**We study hereafter each of the 4 themes identified at the beginning of the period.**

“Operations of assets, energy and utility, finance, change” are not expected to disappear from CSR reporting, on the contrary. With increase in size of corpus, and also in number of companies in the corpus in 2008-2010, we will pay attention at how it is increasing, for which company. Size of the total corpus by year will be kept on the background all along the analysis as benchmark.

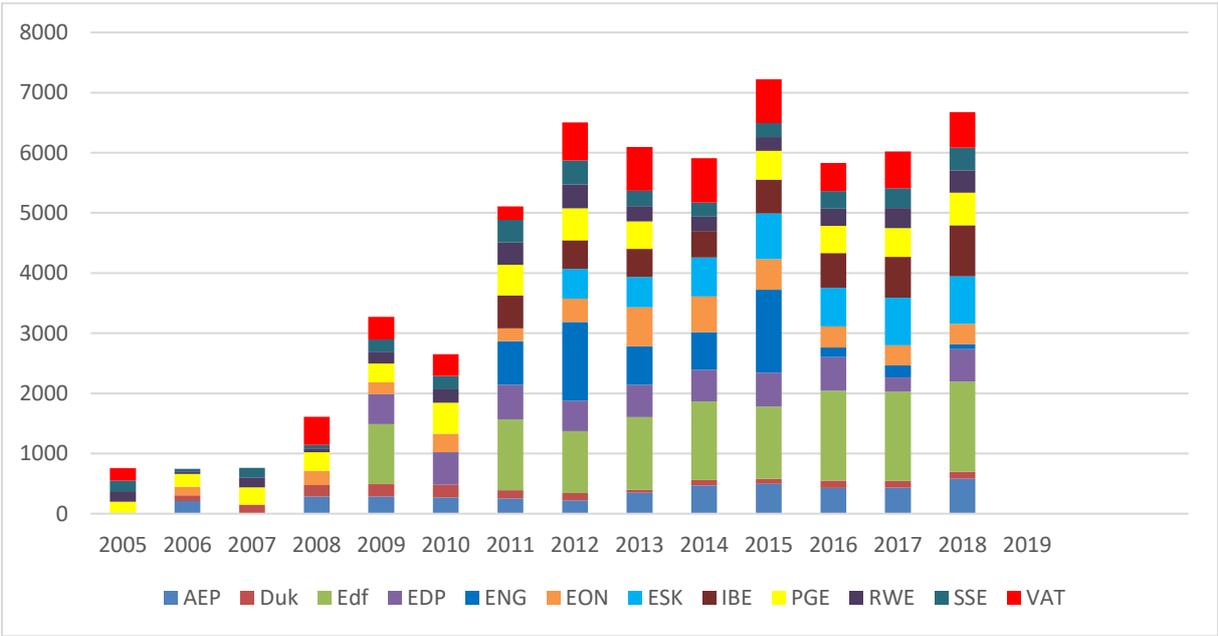
Choice of words inside of the 4 themes studied is not the only possible one. But it is made explicit by taking strategy summary from companies and main terms contained.

**4.4.1.3 Evolution in the vocabulary on operations**

The first word portfolio studied here is around legitimacy in operations. In mission statement of 2008. Some companies in the sample affirm their legitimacy by their expertise in operating complex assets. List of lemmas included is made 11 different ones, totalling 59 454 occurrences:

“affordable, value, efficient, ensure, implement, maximize, operate, performance, pursue, focus, reliable, safe, secure”. By taking lemma instead of word, it allows to include maximising and maximised together with maximise, and we also expand when useful the invariant part of word (eg capturing efficiency and efficient by screening all lemmas including “efficien-“

Occurrences by company and by year shows the propagation of operations in discourse in Figure 78 below.



**Figure 78 Bar chart of words around “operations”, by year and by company**

The use of operations follows the general trend of increase in corpus size. 2005-2008 operations are cited in a range of 800- 1500 times for the whole corpus, then a second period in 2009 and 2010 with 3000 occurrences a year, and since 2011 a range 5000 to 7000, less marked since 2018. It means control of operations remain a subject of same focus, not significantly larger with increase in corpus size, but not phasing out either.

This is very consistent to the historical business of utilities of reliable supply. And control of operations is also a demonstration that new technologies, new production sites developed are also managed in a sensible way.

Then operations can also have a broader sense than just parameters in a control room. In the graph VATTENFALL is very present in 2005. Their representation of performance for example, is wide:

“This is the third year that Vattenfall has published a Corporate Responsibility Report, and for the first time the report has been prepared in accordance with the 2002 GRI Guidelines. We believe it represents a balanced and reasonable presentation of our organisation’s economic, environmental, and social performance. Now we invite you as a reader to make your own assessment (VATTENFALL 2002, P6)”

In this quote VATTENFALL offers a very wide range of interpretation of the “performance” but in the same time targets to be able to control and demonstrate skills in all of these dimensions.

In 2018, VATTENFALL is rephrasing performance in an even wider range, this time including climate impact.

“Customer centricity and sustainability are key for us in attracting customers, talent and investors. Customers are increasingly considering climate impact, social and environmental performance, and energy efficiency when choosing energy solutions and suppliers”. (VATTENFALL 2018, P2)

After the view of propagation of operations theme, next focus is to look at the environment of operation theme. What are main associations, or cooccurrences of operations related words, in 2008 and in 2018. As expected, verbs such as improve, measure are at the centre at the beginning and in the end of the sample. This is much more contrasted for adjectives qualifying operations, in following Table 30:

| 2008 word  | freq | cofreq | score | distance |  | 2018 word   | freq | cofreq | score | distance |
|------------|------|--------|-------|----------|--|-------------|------|--------|-------|----------|
| affordable | 99   | 61     | 32    | 1.6      |  | safe        | 483  | 232    | 89    | 2.1      |
| reliable   | 185  | 81     | 28    | 2.3      |  | sustainable | 1548 | 393    | 54    | 3.7      |
| clean      | 299  | 98     | 22    | 2.5      |  | reliable    | 418  | 170    | 53    | 2.4      |

**Table 30 Cooccurrences with operations 2008-2010 compared to 2016-2018**

Operations are associated in 2008-2010 to traditional missions of utilities: provide affordable energy, reliable at all time, and target clean energy. The high scores in cooccurrences are

reinforced by proximity in words, where adjectives are within 3 words from operations vocabulary.

In 2016-2018 the focus has changed. “safe” comes first, followed by “sustainable, reliable”. “safe” was present in 2008 but only behind economic, suggesting that economic performance was more in the centre of the discourse than safe operations. Conversion of operations into sustainable is a strong move, although it did not replace the need for reliability in cooccurrences. Number of cooccurrences of sustainable with operations word portfolio moved from 345 to 1548 when corpus size doubled.

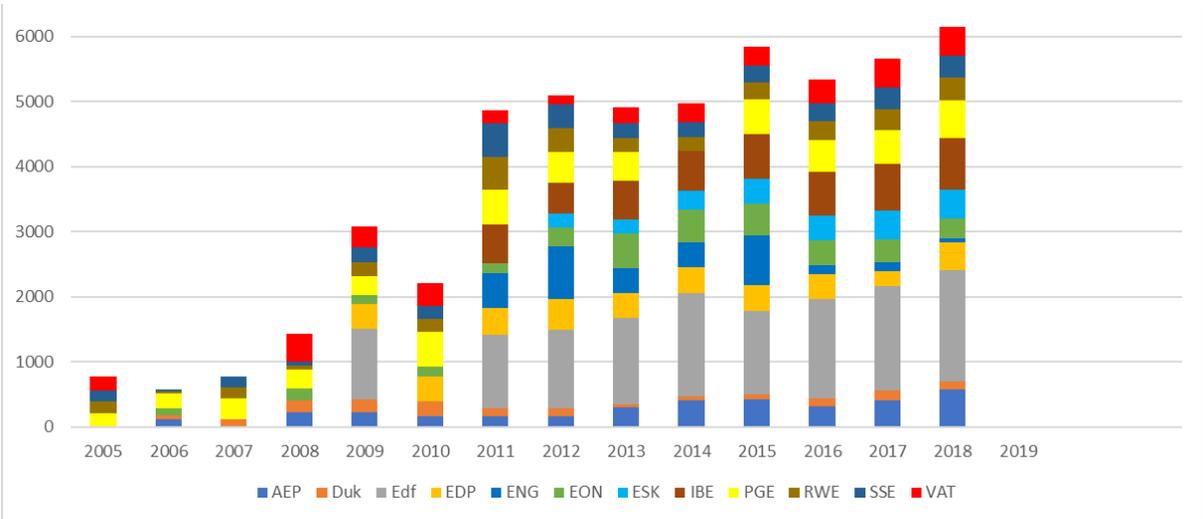
Analysis of word portfolio around operations consists in two points: maintaining a good operations level was and remains a constant concern, relatively to overall discourse. Explaining how operations are done is one mean of affirming legitimacy. Second, content of operations and performance has changed, and widened into sustainable dimension. We observe a shift from asset operations and environmental footprint and performance of operations.

**4.4.1.4 Evolution in the vocabulary on energy and utility**

The second portfolio here is around energy and utility. The list of 9 lemmas includes 51 244 occurrences. It is made a little wider to capture both “provider” as noun, and “provide” as verb. List of selected lemmas include:

“clean, consumption, fuel, infrastructure, produce, provide, supplier, supply, utility“. We also expand when useful the invariant part of word (for example capturing provide and provider by screening all lemmas including “provide-“), as well as variation supply and supplier.

Occurrences by company and by year shows the propagation of operations in discourse in Figure 79 below.



**Figure 79 Bar chart of words around “energy and utility”, by year and by company**

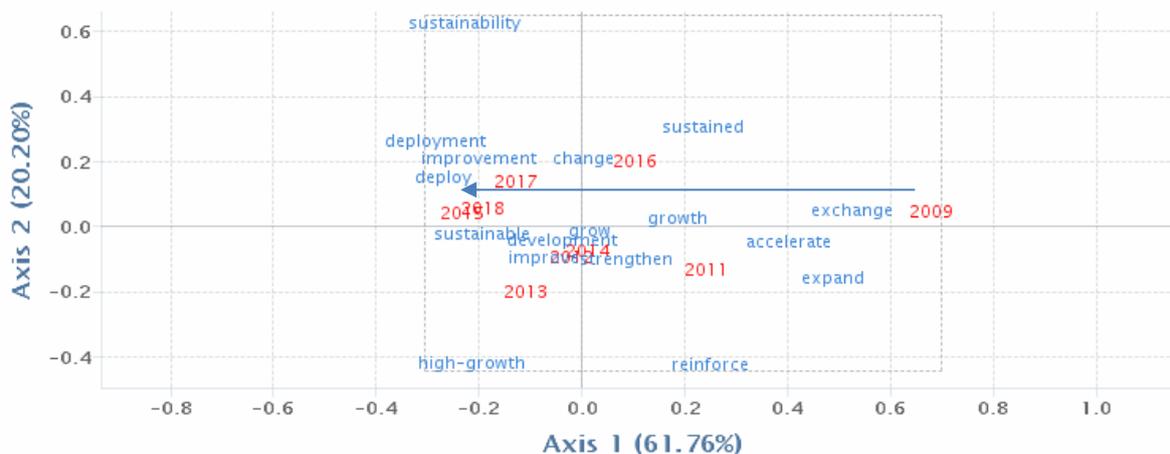
**A moderate increase in number of occurrences, opening door to new businesses.** The vocabulary around energy and utility is increasingly present with increase in number of pages and number of companies in the sample, stabilised in 2012. A first period 2005 to 2010 shows a large increase of attention to this theme. 2010 would follow the same trend if data for EDF (in grey here) would have been available. But then from 2012 – 2019 energy theme is very stable, within 20% when total corpus size varies by 50%. This second period tends to say that energy and utility are decreasing in order of focus.

Vocabulary is not more and more centred on energy; this could rather indicate that each company searches new legitimacy outside of utility role, or at least in addition to this historical role.

In 2018 EDF is the largest company communicating on energy and utilities (1717 occurrences or 28%) but just at the same level as its share in the total corpus. As such it is a good benchmark for comparison of other companies. EDF has constantly used this vocabulary along the years, showing the company has not deviated from a production and supply of energy role.

This vocabulary has changed over the years. In 2011-2012 EDF associates this vocabulary to “accelerate, expand”. The focus is to develop core competencies as utility into expansion. This is illustrated in the correspondence analysis of Figure 80 below. In 2017- 2018, the energy vocabulary is now associated to “sustainable, deployment”. This shows a shift in priorities.

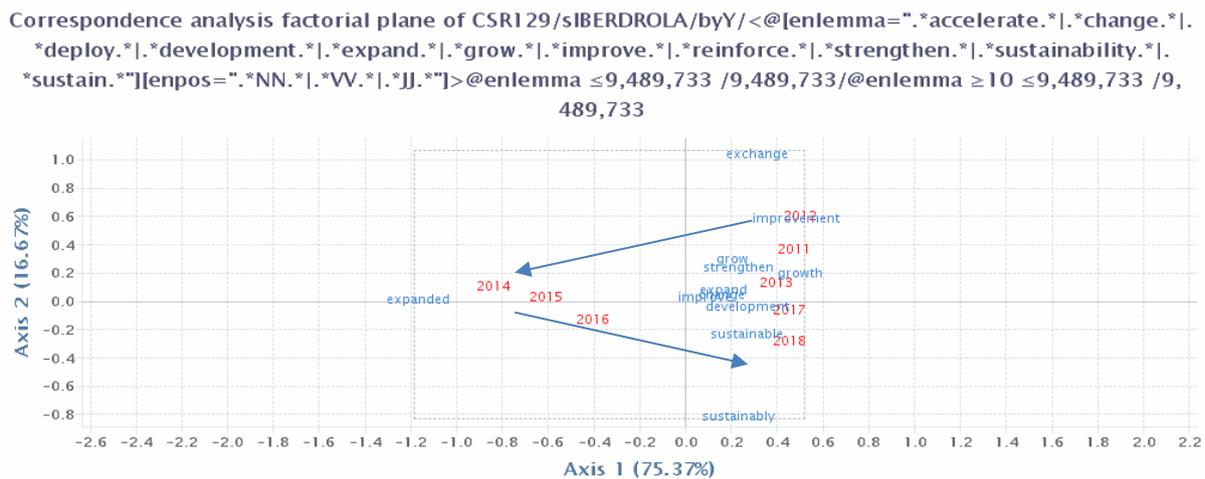
**Correspondence analysis factorial plane of CSRI 29/sEDF/EDFy/<@[enlemma="\*.accelerate.\*|.change.\*|.deploy.\*|.development.\*|.expand.\*|.grow.\*|.improve.\*|.reinforce.\*|.strengthen.\*|.sustainability.\*|.sustain.\*"]enpos="\*.NN.\*|.VV.\*|.JJ.\*"]>@enlemma ≤9,489,733 /9,489,733/@enlemma ≥10 ≤9,489,733 /9,489,733**



**Figure 80 Correspondence analysis, EDF “energy and utility”, by year**

In comparison, three companies are highly represented in this graph of Figure 80. For IBERDROLA representing 13% here and only 9% in the total corpus. It is also the case for PG&E 10% here and 8% of the total corpus and AEP 9% here and 6% of the total corpus

What is the use by IBERDROLA of energy related vocabulary? It is not directly apparent in number of occurrences, but the evolution of use is remarkable. While all vocabulary on energy is plotted against most frequent words, in correspondence analysis in Figure 81, it shows that in 2011-2013 energy and utility vocabulary is associated to “improvement, growth”, then 2014 “expanded”, and in 2017 – 2018 the vocabulary associated is now “sustainable, development”. This explains why IBERDROLA refers a lot to this vocabulary, in quite a different use of sustainable development in 2017-2018 than beginning of the studied period.



**Figure 81 Correspondence analysis, IBERDROLA “energy and utility”, by year**

After the progression of the theme, we look at associations in direct environment in the corpus. Between the first years in the corpus and last ones, there are interesting changes of associations, in Table 31 below.

| 2008 word   | freq | cofreq | score | distance |
|-------------|------|--------|-------|----------|
| energy      | 4241 | 982    | 135   | 2.6      |
| electricity | 2177 | 575    | 103   | 2.7      |
| chain       | 169  | 116    | 73    | .6       |
| supplier    | 830  | 258    | 61    | 4.9      |
| gas         | 1929 | 445    | 61    | 3.7      |
| fuel        | 976  | 281    | 59    | 4.2      |

| 2018 word   | freq  | cofreq | score | distance |
|-------------|-------|--------|-------|----------|
| supplier    | 3080  | 980    | 239   | 4.8      |
| service     | 4070  | 1159   | 236   | 2.7      |
| customer    | 7373  | 1513   | 156   | 4.3      |
| gas         | 3035  | 804    | 144   | 3.1      |
| energy      | 11075 | 2853   | 127   | 2.6      |
| electricity | 4978  | 1548   | 127   | 2.3      |

|            |     |     |    |     |
|------------|-----|-----|----|-----|
| fossil     | 142 | 108 | 76 | .4  |
| reliable   | 185 | 101 | 50 | 2.1 |
| affordable | 99  | 58  | 31 | 2.7 |

|            |     |     |     |     |
|------------|-----|-----|-----|-----|
| fossil     | 296 | 228 | 162 | .2  |
| reliable   | 418 | 190 | 76  | 2.8 |
| affordable | 226 | 106 | 44  | 2.3 |

**Table 31 Cooccurrences with energy 2008-2010 compared to 2016-2018**

Energy and utility are associated in 2008-2010 to energy and electricity. This result shows the relevance of calculation, since “energy, and electricity” were not in the words tested, but come here at the closest cooccurrences of produce, supply... this cannot be considered to be a -result- but more a consistency test.

**Highlighting a move into service activity.** A strong change in 2018 is that “service, supplier, customer” are now the highest scores of cooccurrence. They were present of course in 2008 but with much lower cooccurrences scores (service at 50 vs 236, supplier at 61 to 236, and customer at 57 vs 156). We interpret this as transformation of utility into a service business. And supplier, customer participate to a much more open environment and strategy.

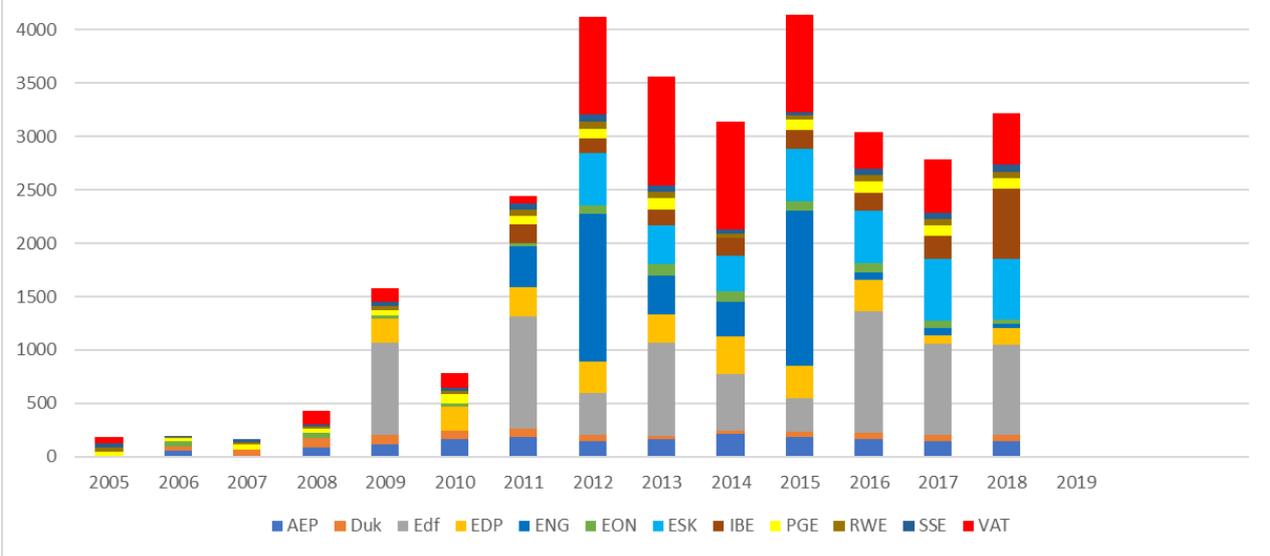
As for the adjective at the bottom of same Table 31, they have remained the same with “fossil, reliable, affordable”. Even with a yearly corpus twice the size, scores of cooccurrences are much higher, showing a nearer vocabulary.

Analysis of word portfolio around energy and utility consists in two points: first that traditional utility role is less present in the corpus with the years. It progresses less than the total corpus size. This moderate increase in number of occurrences is opening door to new businesses. One of them is a switch from electricity supply chain to service activities. Second, where utility vocabulary was strongly attached to growing, acceleration, the evolution into 2018 shows a marked “sustainable development” orientation.

#### **4.4.1.5 Evolution in the vocabulary on finance**

The third dimension identified in legitimacy claim at the beginning of the period is around finance. With 30768 occurrences in total, it is significantly lower than other themes. But CSR report is to some extent structured in non-financial as opposed to annual report on financial.

The difference is not clear cut, but it explains why financial questions are more presented more as economic calculation, than financial performance. For example, E.ON writes report without any mention of Euros, with clear separation from annual report.



**Figure 82 Bar chart of words around “finance”, by year and by company**

Lemmas included in Figure 82 are: “advantage, value, cash, cashflow, cost finance, financial, invest, investment profit”.

Finance is very fluctuating, rather than a constant priority

In a first period 2005-2011 finance related vocabulary is very marginal when only AEP DUKE ENERGY PG&E, the three American, and RWE and E.ON the two German companies are represented. CSR report seems voluntarily excluding financial impacts. This continues when EDF and EDP are represented; in 2010 if EDF data was present it would be at the same level. 2012-2014 is a second period were finance fluctuates a lot, high in 2012 and 2015, lower in 2013 and 2014. Here mostly ENGIE puts finance as new priorities.

For 2016-2018 use of financial vocabulary is back to a lower level, ENGIE and EDP have almost taken it out of their vocabulary

Evolution for ENGIE is illustrated in Table 32 of main lemmas of the finance vocabulary. When report size has been cut 2016 onwards, the prorata would still be to use “financial” 67 times in 2016 and 33 times in 2018; but in reality ENGIE refers to these terms even 3 times less, at 22 in 2016 and 10 in 2018.

|           | 2011 | 2012 | 2013 | 2014 | 2015 | prorata 2016 | real 2016 | 2017 | prorata 2018 | real 2018 |
|-----------|------|------|------|------|------|--------------|-----------|------|--------------|-----------|
| financial | 210  | 671  | 215  | 176  | 652  | 67           | 22        | 28   | 33           | 10        |
| cost      | 98   | 392  | 71   | 55   | 337  | 35           | 12        | 12   | 17           | 9         |
| cash      | 39   | 262  | 55   | 30   | 270  | 28           | 7         | 10   | 14           | 2         |

**Table 32 ENGIE index of key “financial” vocabulary 2011 to 2018**

This trend for ENGIE is a transformation of perspective between 2011 and 2018: in 2011 finance is number one priority, cited as such in the first pages of report:

“In 2012, the Group reinforces its efforts with the launching of a Group actions plan, with the following priorities: 1 increasing financial flexibility; 2 enhancing existing assets (reinforcement of Efficio plan); 3 increasing focus on recurring net income; 4 anticipating major developments.” (ENGIE 2011, p11)

While in 2018 not only are financial less present in CSR reports, but also in strong link to global warming

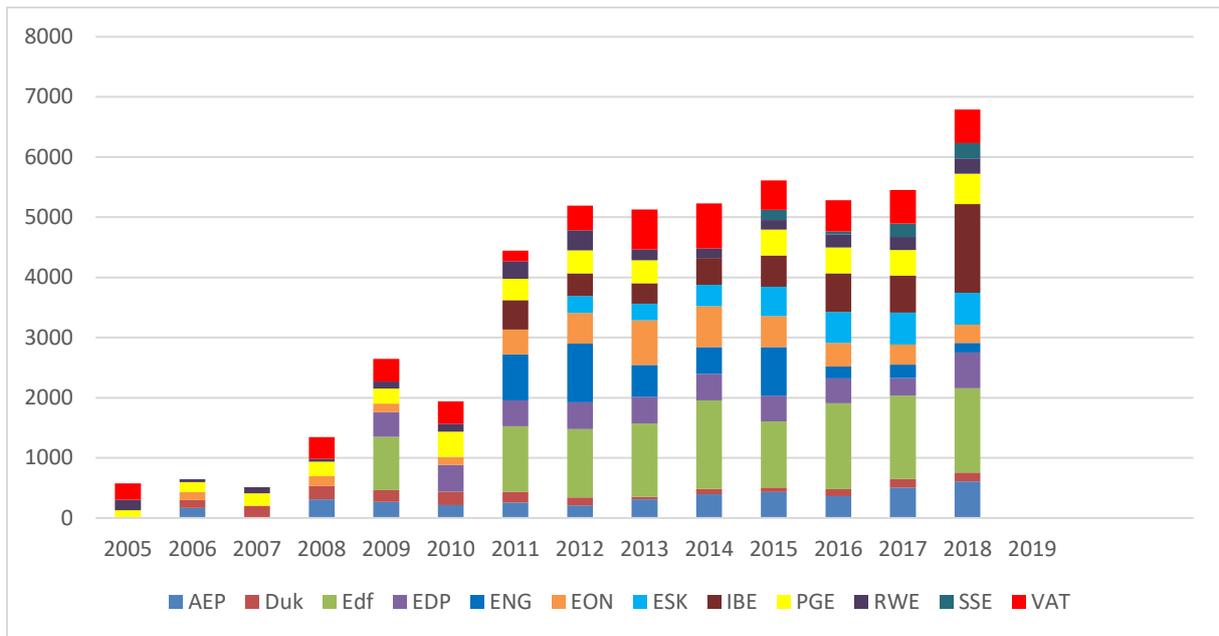
“To reduce the impact of climate change across the planet, a change in behavior in terms of energy consumption and production is underway. This underlying trend has translated into solid commitments from industrial and financial companies to limit global warming to + 2° C” (ENGIE 2018 p6)

To conclude on word portfolio around finance:

If finance appear as one of the four main legitimacy claims at the beginning of the period, it is not a focus in 2018. Partly because financials are discussed in other reports, like annual report, and partly because transformation and new priorities do not use the word portfolio associated to finance.

#### **4.4.1.6 Evolution in the vocabulary on change**

The theme associated to “change” is tested on an evolutionary dimension. We expect that this is increasing in frequency, intensity, and with a sense of urgency. And it is confirmed in analysis. As in previous paragraph, the list of lemmas is projected by year and by company on Figure 83.



**Figure 83 Bar chart of words around “change”, in 2008 by year, by company**

First remark is that word portfolio is largely used, 53 000 occurrences in total. It is mostly concentrated on 5 lemmas (development 10619, change 9369, sustainability 6687, improve 5934, sustainable 4088).

The intensity of this word portfolio shows how 2011 – 2018 is a period concerned with change. It is a radical change to the previous period, even in adding EDF non available data for 2010. And much more than 2008 -2010. Last year 2018 appears a new level of intensity in change related vocabulary. Is it due to specific companies?

IBERDROLA (Spain) is the company most represented in 2018 on this graph with a strong impact in 2018 (from 620 to 1474 occurrences). Before this date it was relatively stable since first report in 2011.

Small extract from individual lemmas show the difference from 2017 to 2018. On Table 33, when the corpus size for IBERDROLA moves by 45%, “sustainable, sustainability, change, development” are much more in focus of the company.

| year            | 2017   | 2018   | % delta |
|-----------------|--------|--------|---------|
| corpus size     | 121678 | 176372 | 45%     |
| development     | 140    | 256    | 83%     |
| sustainable/ity | 142    | 666    | 369%    |
| change          | 93     | 168    | 81%     |
| improve         | 68     | 119    | 75%     |

**Table 33 IBERDROLA index of key “change” vocabulary 2017 and 2018**

This shows that IBERDROLA put sustainable and sustainability at the centre of their discourse in 2018, it is new and for a large part specific to this company.

Then several companies focus at the same absolute level in 2018, AEP EDP ESKOM PGE VATTENFALL all around 500 occurrences.

Almost all companies are concerned in the same way by this increase. 2017-2018 higher than all others.

Only exception ENGIE is using a lot less this vocabulary, with an average of 500 occurrences up to 2015 and around 200 after. The downward revision of corpus size, together with change from GDF SUEZ to new ENGIE name also comes with significant change in discourse.

| 2008 word   | freq | cofreq | score | distance |
|-------------|------|--------|-------|----------|
| climate     | 908  | 456    | 209   | .7       |
| efficiency  | 995  | 291    | 66    | 2.8      |
| performance | 1145 | 289    | 50    | 2.8      |

| 2018 word   | freq | cofreq | score | distance |
|-------------|------|--------|-------|----------|
| Information | 926  | 454    | 185   | 1.4      |
| developmen  | 3519 | 960    | 161   | 2.9      |
| climate     | 1885 | 991    | 127   | .7       |

|             |     |     |    |     |
|-------------|-----|-----|----|-----|
| organic     | 86  | 61  | 41 | .5  |
| sustainable | 345 | 126 | 40 | 2.2 |
| economic    | 598 | 150 | 26 | 2.2 |

|             |      |     |     |     |
|-------------|------|-----|-----|-----|
| sustainable | 1548 | 680 | 241 | 1.5 |
| continuous  | 421  | 286 | 169 | .6  |
| economic    | 1398 | 479 | 119 | 1.8 |

**Table 34 Cooccurrences with “change” 2008-2010 compared to 2016-2018**

**From change in performance to new developments.** Change vocabulary is moving as per Table 34 from a focus on performance to a focus on development.

When “climate” was the highest score in cooccurrence in 2008, with double frequency the cooccurrence scope is halved. “climate change” is the first association that is expected here, and in 2008-2010 all companies together used “climate change” 371 times, for 816 in 2016-2018 for a corpus size doubled. “climate” is now firm in the vocabulary of change, but no longer the highest cooccurrence.

Efficiency and performance are much lower in 2016-2018, and no longer the key elements of change. Either change in performance happened, or it was replaced by more stringent elements around change.

Information and development have become in 2016-2018 the main drivers of change. Development is associated to many more areas than in 2008-2010 as seen in following Table 35.

New areas are “smart grids clean energy, localisation, region” which were not part of targeted development in 2008. And areas already present, as renewable energy, is multiplied by 3.

| 2008-2010                               |     | 2016- 2018                      |      |
|---|-----|---------------------------------|------|
| development of renewable energy         | 15  | development of renewable energy | 54   |
| development of society                  | 12  | development of energy           | 31   |
| development in society                  | 8   | development of smart grid       | 19   |
| development of CR                       | 8   | development and operation       | 14   |
| development and deployment              | 7   | development of skill            | 14   |
| development of new technology           | 7   | development and implementation  | 13   |
| development and implementation          | 6   | development of electricity      | 13   |
| development in the regulatory framework | 6   | development of the company      | 12   |
| development of energy                   | 5   | development of clean energy     | 11   |
| development and demonstration           | 4   | development and localisation    | 10   |
| development and diffusion               | 4   | development and management      | 10   |
| development be that skill               | 4   | development of the region       | 10   |
| out of a total of                       | 560 | out of a total of               | 1285 |

**Table 35 “Development” of different objects 2008/10 and 2016/18**

In the list of areas for development, “society” was present in 2008-2010 and is no longer in the most frequent. Does it mean that development of society is no longer a target for utilities in this panel? In fact these two expressions “development of / in society” are almost exclusively used by VATTENFALL (overall 33 occurrences for 40 in the whole corpus). And VATTENFALL used these expressions before 2008 and 2010, after that vocabulary has changed.

This is not the case for “information” in this example. Information is not related to any object, it is more about provide, give information.

Analysis of word portfolio around change consists in two points: first there is a clear move that all companies are embarked on change, and communicate about it. This is a confirmation in numbers of what was expected. Second, presentation of change is different. When beginning of the report period insisted on metrics around efficiency and performance, and changes associated to them, the landscape becomes different. In 2016-2018, word portfolio is very much influenced by energy transition, sustainability and development.

**All four themes studied have a different content in 2008 compared to 2018.** Each of the theme is evolving more in its content than in its importance in the overall size in the corpus. It is more a question of financing which assets and why, than whether finance will be more or less on the forefront of the reports. Priority around energy has switched from electricity supply chain to wider service activities. Changes are now more oriented towards energy transition, sustainability. Operations are integrating sustainability and environment which was not the case

before. And finance appears to be less at the centre, and considered more as a mean than an end, as can be read in CSR reports.

But observation at the same time of evolution in time and by companies requires many precautions, since change in structure of report can lead to much higher or lower numbers which are not meaningful without much detailed analysis.

#### **4.4.2 Projection on different types of legitimacy**

The purpose of this last result section is to use insights from legitimacy research on energy to identify some word portfolio representing each form of legitimacy. We start from a vocabulary taken from literature (Ayling, 2017) . It results into:

- Pragmatic legitimacy is represented by affirmation of values but also relies on numbers.
- Legal legitimacy: claimed as specific by two companies, and opposite view for two others.
- moral legitimacy is used by some companies to justify their operations, for the other words associated to it are only qualifiers of performance.
- Cognitive legitimacy appears very evenly shared. This is because it is so close to the historical role of utility.

For each of the 4 dimensions, we detail main findings.

##### **4.4.2.1 Main findings in legitimacy categories dimensions**

**Findings on the pragmatic legitimacy dimension.** The use of “pragmatic” itself is rare but significant, EDP (Portugal), uses it as an iterative way to set targets. Here “pragmatic” is a rephrasing of what some external observers could have called ‘random’. Analysis shows that pragmatic legitimacy is much more salient in American companies, in Pacific Gas and Electric on being safe as a value, and American Electric Products, AEP with emphasis on environmental benefits. As a result, the focus on safe, has been increasingly used by PG&E moving from an initial position of being safe in operation, to a much wider mission. This is embodied by the “North Star” of delivering safe energy. Overall contrast between a core group of companies who demonstrate their legitimacy on numbers. A cost benefit approach is sufficient to ground their behaviour. And other patterns around behaviour (lead by IBERDROLA) safety as guiding principle (PG&E) or simpler operations (ENGIE).

**Findings on the legal legitimacy dimension.** It is not shared by most electricity companies in the sample. Complying to legal environment, adapting to its changes is only advertised as a legitimacy argument by both German companies in the sample, RWE and E.ON. For most other companies it is neither over nor under represented. It means they abide by the rules, without claiming a particular message here. On the contrary, we analysed two cases of companies underrepresenting legal legitimacy. First ESKOM, South Africa, explaining that legal compliance is as an objective than a current strength to expose. But also, VATTENFAL, Sweden, where legal vocabulary is significantly minimised to the profit of associating wording of legal legitimacy to projected energy transition (like “affordable and easy to use” or “CO<sub>2</sub> emissions easier to capture”).

**Findings on moral legitimacy dimension.** Moral legitimacy is a large theme in the corpus. It is very evenly spread for a majority of companies in the sample, but not the case for IBERDROLA and E.ON overrepresented in moral legitimacy. On the other side, EDF and ESKOM very much underrepresented. For the overrepresented, it becomes a strategic argument, putting forward at the beginning of the studied period values like equal opportunity, non-discrimination and respect for diversity when widening in 2018 into “sustainable development goals and commitments”. On the contrary for underrepresented EDF moral legitimacy is in fact merely qualifying, moral legitimacy vocabulary (especially good) with financial performance.

**Findings on cognitive legitimacy dimension.** All companies communicate on an even distribution on cognitive legitimacy, except IBERDROLA insisting much more. IBERDROLA insists on all dimensions “model, governance, certification” present in most European company, presenting its achievements. In other words, companies communicate on their strengths. But “strength” is particularly belonging to American vocabulary, whether “historical, financial or greatest strength”. In contrast, strong cognitive legitimacy is referred to when it has been lost. When ESKOM longs for “commitment, tenacity and resistance of all stakeholders”, repairing cognitive legitimacy is a target expressed close to Suchman’s description.

#### **4.4.2.2 Construction of word portfolios for each type of legitimacy**

**How we create the word portfolio.** The process is to start from literature, then generate word portfolio, and study them with TXM. Starting point in the literature is a contest for legitimacy: in Australia, opposite view on coal industry between 2013 and 2016. On one side there are views of energy industry and on the other side, NGO and associations (Ayling, 2017).

**Building vocabularies around legitimacy.** We start from a literature (Ayling, 2017) for a number of reasons. It allows to identify legitimacy and lines in energy company, especially on the question of divesting fossil fuels. Here the methodology used by interview of pro and cons of divesting fossil fuel, is reused as entry for statistical text.

To show tension between the two parties states “ For over thirty years, climate campaigners and the fossil fuel industry have engaged in an intense competition for the hearts and mind of investors” (Ayling, 2017) p1.

It was a successful attempt to use statistical analysis on discourse, and show how legitimacies can be observed. The rhetoric dialog between the company and its opponents was reduced to one sided opinion. Here we do not focus on this opposition, since we have only CSR position from companies, deemed always favourable.

We show how indicators of the types of legitimacy in our corpus change. How references to each dimension increase along time and how to qualify it.

We start by testing words directly from literature. Then they are expanded with context, and most of all with cooccurrences for nearby terms. This process is not detailed here, jumping to the four portfolios.

As discussed already in the theoretical part, some literature inquired how forms of legitimacy can be traced in energy changes. For each of the four types of legitimacy used by Ayling, we first take the corresponding wording and test it in the full research corpus.

This is performed with specificity calculation of each vocabulary within the whole corpus. It is important to use the total corpus as reference to compute over and underrepresentation; otherwise the calculation would only show difference inside the vocabulary on “legitimacy”.

#### **4.4.2.3 Variation of pragmatic legitimacy vocabulary**

The initial vocabulary from literature includes “Behaviour, Benefit, Clear, Concrete, Convenient, Easy, Economical, Practical, Pragmatic, Safe, simple, Smart, Suitable,

This list is explored in the corpus for adjustment. For examples variation in spelling between behaviour and behavior. Or pragmatic which is expanded to include also pragmatism.

On the other side some words were taken out. “smart” was an interesting word, because of its meaning of quasi evidence action. But it was discarded because of intensive references to smart technologies in the corpus. The total of 2214 occurrences for “smart” brings “smart grid (692) smart meter (426), smart city” and so on which are not linked to our purpose here.

“benefit” has to be left out also. First because of ambiguity of benefit as a noun (1790 occurrences) or verb (900), but mostly because of a direct association to finance vocabulary. The

first associations are: “benefit obligation, benefit pension, benefit cost, benefit plan, benefit expenses” which are all far from pragmatic legitimacy.

Final vocabulary after exploration becomes: “behaviour behavior clear concrete convenient easy economical practical pragmatic/pragmatism safe simple suitable”.

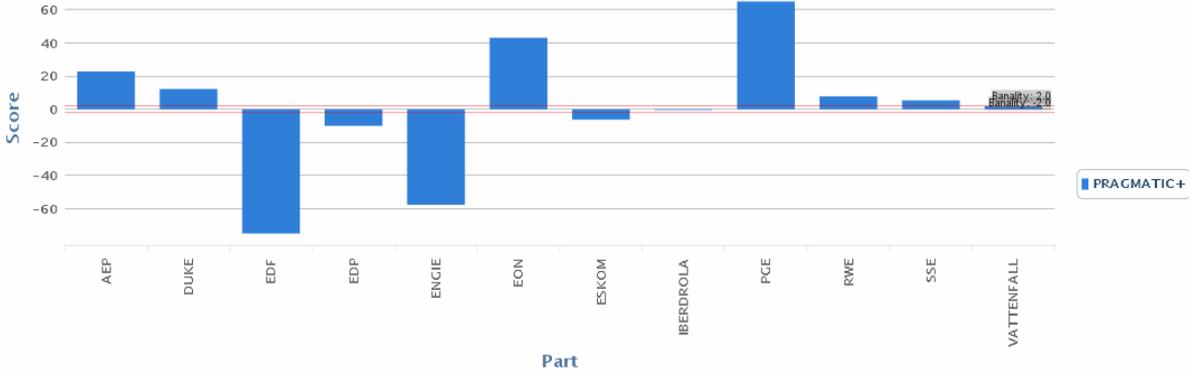
The link of how companies justify their pragmatic legitimacy is illustrated in two examples:

For use of “pragmatic”, an interesting quote from companies include for the Portuguese EDP a “pragmatic approach” which is not shared by other. “These successive reductions since 2008 represent a pragmatic approach to the new reality in which we find ourselves.” (this concern the investment budget down from 2.2 B EUR in 2010 to 1.5 B EUR 2012. EDP 2012.

Here association new reality and pragmatic approach shows the choice of a literature style in the report for EDP (Portugal), in contrast to most other companies in the sample. Justification is not presented with target setting but as an iterative one. Here “pragmatic” is a rephrasing of what some external observers could have called ‘random’.

second example here is use of “simpler”: “More than 1 million Duke Energy customers are receiving the report about eight times a year, and they’re expected to save an average of 2 percent, or approximately \$ 20 on their annual energy costs, just by making simple behavioral changes at home” DUKE 2012. Here we have association of two lemmas included into studied portfolio, simple and behavioral. The company’s line is to be the one bringing change to households, and suggesting they could be simple (and not complex, expensive) and behavioral (as opposed to new equipment, heavy changes).

**A focus on pragmatic legitimacy for American PG&E and AEP, and German E.ON :** This first set of word portfolio is tested across the corpus by companies, to look at what use is done of pragmatic legitimacy related words. A specificity calculation is done on the full list of this list vs the full corpus. Result in Figure 84 shows that half of companies in our sample have a specific use compared their overall place in the corpus, while another 6 have a generic use. Since all words are merged here, it can contain some positive and some negative values.

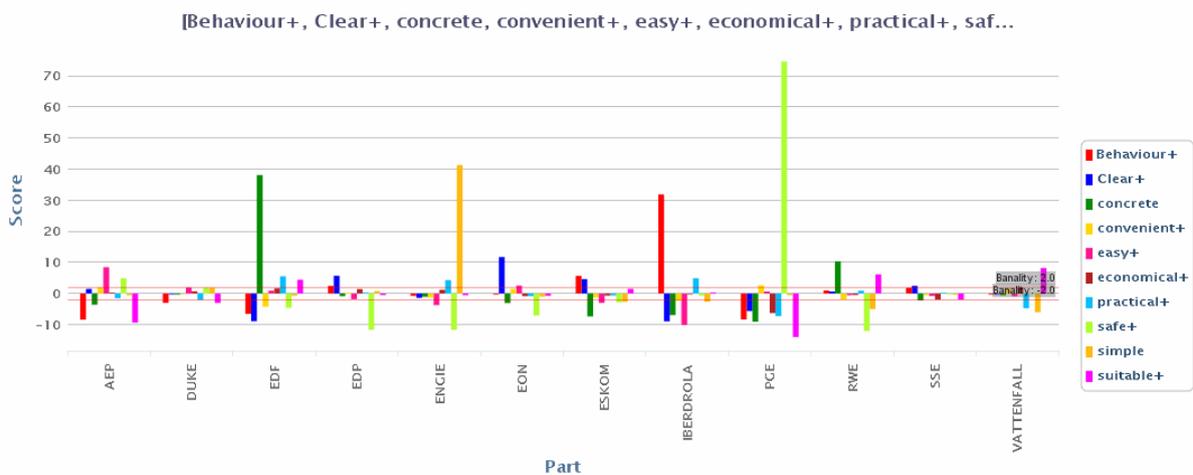


### Figure 84 Specificity calculation of pragmatic legitimacy vocabulary by company

The most specific here are AEP, E.ON and PG&E (specificity scores of 65, 43 and 23). And a strong underrepresentation of EDF and ENGIE (specificity scores -75 and -58). Together with Figure 85 below, detailing words in the pragmatic legitimacy portfolio, this shows how each company focuses on some aspects.

Taking AEP into more details, we see they use a lot pragmatic legitimacy, much more specific than the content of the corpus. This is particularly marked with use of “easy” is used 68 times compared to 319 for the entire corpus, 21% of the total when AEP weighs only 6%. The same specificity exists for benefit, to a lesser extent.

In this first level of analysis, pragmatic legitimacy is much more salient in American companies from the sample. Pacific Gas and Electric on being safe as a value, and American Electric Products, AEP together with E.ON.



### Figure 85 Specificity calculation of pragmatic legitimacy vocabulary details

Pacific Gas and Electric, PG&E highest representation of pragmatic legitimacy, is especially around “safe”, then marginally “easy and clear”, detailed on Figure 85.

Safety has been a sharp increasing communication area for PG&E. This is followed in Figure 86 bar chart with number of occurrences. We compare introductory pages 2003 and 2018 on this vocabulary:

“PG and E's primary responsibility is to deliver safe, reliable, and affordable energy to the more than 14 million people that live and work” (PG&E 2003 P2). Here the reference points to nuclear energy and safety issue, as much as general safety in energy.

“Our North Star of a sustainable energy future guides our mission to deliver safe, reliable, affordable and clean energy to our customers. (PG&E 2018 p2)

The company is remarkably constant in describing its activities, maybe just copying each year from the previous one, or more probably grounding again company’s priorities. The main differences, in these sentences, between 2003 and 2018 is that responsibility has become mission. And the addition of the image of North Star, is putting sustainable and traditional missions of energy supplier into a single roof.



**Figure 86 Specificity calculation of “safe” in PG&E corpus, 2003 -2018**

As a result, the focus on safe, on Figure 86 has been increasingly used by PG&E moving from an initial position of being safe in operation, to a much wider mission. This is embodied by the “North Star” of delivering safe energy.

On the other direction, there are two companies with underrepresentation of pragmatic vocabulary, EDF and ENGIE.

**Why is EDF underrepresenting pragmatic legitimacy?** In the specificity calculation above, we saw that pragmatic legitimacy had a large negative specificity score, of -80. And inside the word portfolio it is more marked for “clear, behaviour, benefit”. It is difficult to document why EDF is not using this word.

**When looking at the environment of “behaviour” compared to other companies, they are quite different. In table we compare cooccurrences of “behaviour/behavior” from**

**EDF and PG&E the largest user of pragmatic legitimacy, in**

| <b>EDF</b>    | freq | cofreq | score | dist |
|---------------|------|--------|-------|------|
| clients       | 142  | 8      | 12    | .9   |
| ever-changing | 4    | 4      | 12    | 1.5  |
| incentives    | 38   | 6      | 12    | 1.8  |
| energy-saving | 16   | 5      | 11    | .0   |
| demanding     | 22   | 5      | 11    | 4.2  |
| changing      | 140  | 7      | 10    | .0   |

| <b>PGE</b> | freq | cofreq | score | dist |
|------------|------|--------|-------|------|
| Mechanisms | 13   | 10     | 23    | 5.6  |
| ethical    | 57   | 11     | 17    | 1.1  |
| values     | 132  | 13     | 16    | 3.4  |
| driving    | 90   | 10     | 13    | .3   |
| lawful     | 5    | 5      | 13    | .0   |
| actions    | 199  | 12     | 12    | 4.0  |

Table 36.

| <b>EDF</b>    | freq | cofreq | score | dist |
|---------------|------|--------|-------|------|
| clients       | 142  | 8      | 12    | .9   |
| ever-changing | 4    | 4      | 12    | 1.5  |
| incentives    | 38   | 6      | 12    | 1.8  |
| energy-saving | 16   | 5      | 11    | .0   |
| demanding     | 22   | 5      | 11    | 4.2  |
| changing      | 140  | 7      | 10    | .0   |

| <b>PGE</b> | freq | cofreq | score | dist |
|------------|------|--------|-------|------|
| Mechanisms | 13   | 10     | 23    | 5.6  |
| ethical    | 57   | 11     | 17    | 1.1  |
| values     | 132  | 13     | 16    | 3.4  |
| driving    | 90   | 10     | 13    | .3   |
| lawful     | 5    | 5      | 13    | .0   |
| actions    | 199  | 12     | 12    | 4.0  |

**Table 36 Cooccurrences table of “behaviour” EDF to PGE**

For EDF, behaviour is mostly a, so to say, marketing issue. How clients behave, that they are ever changing or demanding. It is a question of relationship, not a question of behaviour of the company, of how EDF presents itself.

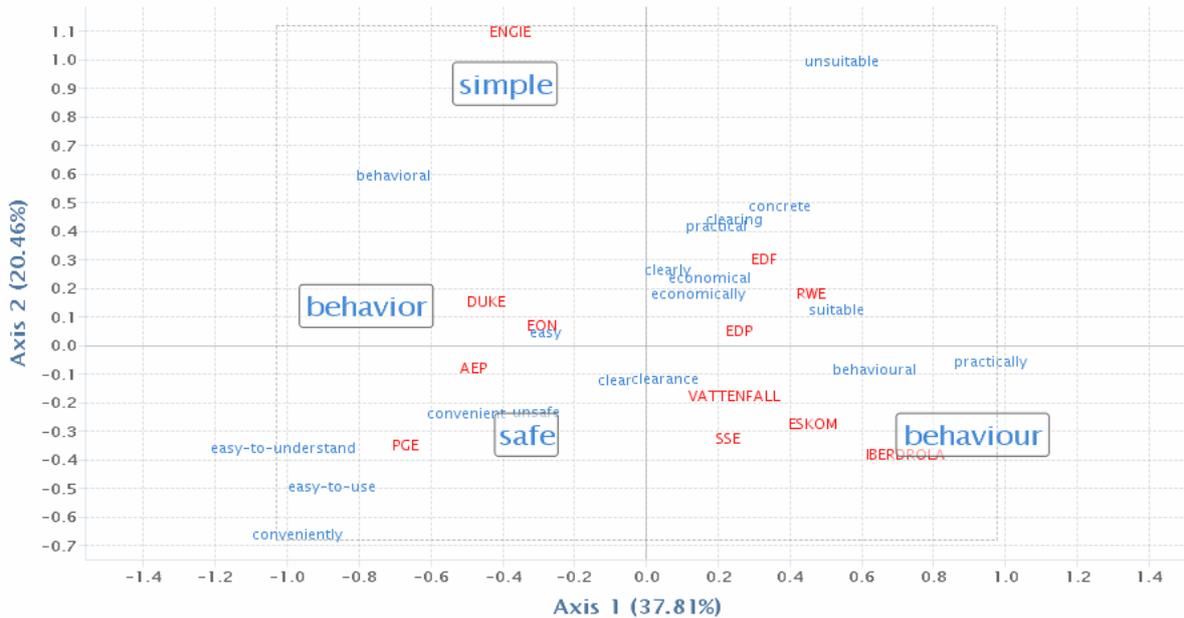
On the contrary, for Pacific Gas and Electric, behaving is a company attitude: it is communicated together with values, ethics, action.

This underlines not only that EDF underestimates the vocabulary of pragmatic legitimacy, but also use in in a very limited sense.

**Proximity of each company in pragmatic legitimacy vocabulary:** To complement the visualisation of specificity of each company to pragmatic vocabulary, we finish here with a global view of proximity of each company on this word portfolio.

Following correspondence analysis in Figure 87 shows how companies are positioned to each other in the register of this vocabulary.

Correspondence analysis factorial plane of CSRI 29/byCY/< [enlemma="\*.pragmatic.\*|.simple.\*|.easy.\*|.economical.\*|.practical.\*|.convenient.\*|clear.\*|.suitable.\*|.behavior.\*|.concrete.\*|.safe"]>@enlemma ≥ 10 ≤9,489,733 /9,489,733/@enlemma ≥ 10 /9,489,733



**Figure 87 Correspondence analysis of pragmatic legitimacy word portfolio, by company**

We recognize proximity seen earlier, like the orientation of PG&E towards “safe”, or proximity of IBERDROLA with “behaviour”. What this graph tells us more is how a core of companies root their pragmatic legitimacy on different directions. Highlighted are the main contributors to each axis. Horizontally it is mostly an opposition between “behavior”, American driven, and “behaviour, with English spelling. While vertically it is an opposition in priorities between “safe and simple”.

- With being safe as primary legitimacy, Pacific Gas and Electric is also attracted by vocabulary of “easy to understand, easy to use” (low numbers but very specific, only used by PG&E and E.ON). And in Europe this is strongly the case for VATTENFALL, SSE, IBERDROLA (plus ESKOM in south Africa). For this group, pragmatic legitimacy is: be safe, and focus on safety.
- on the opposite direction is “simple”. ENGIE shows the strongest proximity to “simple” with a specificity score of 41, it is followed by AEP with “easy” (highest specificity score 10) and EDF with “concrete” (highest specificity score 38). Here the focus is close to value proposition. In a complex world of energy, these companies propose concrete, easy or simple solutions.

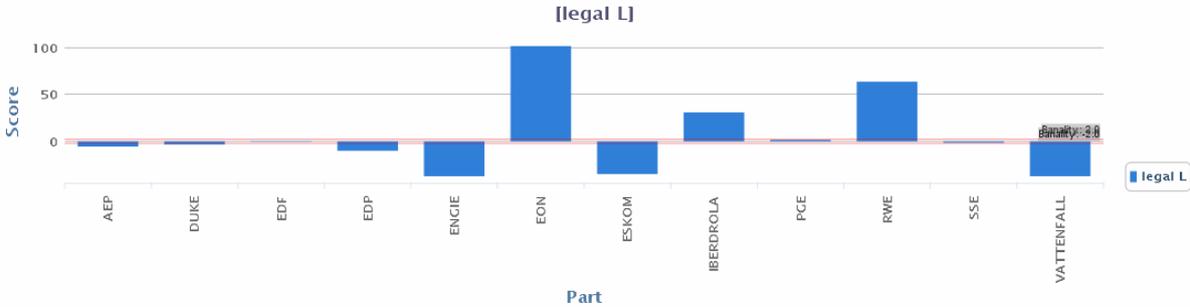
**Final remarks on pragmatic legitimacy.** The use of “pragmatic” itself is rare but significant, EDP (Portugal), uses it as an iterative way to set targets. Here “pragmatic” is a rephrasing of what some external observers could have called ‘random’.

Our analysis shows that pragmatic legitimacy is much more salient in American companies Pacific Gas and Electric on being safe as a value, and American Electric Products, AEP with emphasis on environmental benefits. As a result, the focus on safe, has been increasingly used by PG&E moving from an initial position of being safe in operation, to a much wider mission. This is embodied by the “North Star” of delivering safe energy.

An overall contrast appears between a group of companies who demonstrate their legitimacy on numbers. For these ones a cost benefit approach is sufficient to ground their behaviour. And other patterns around behaviour (lead by IBERDROLA) safety as guiding principle (PG&E) or simpler operations (ENGIE).

**4.4.2.4 Variation of legal legitimacy vocabulary**

The second out of four types of legitimacy studied here is the legal one. On legal legitimacy, the specificity of presence inside the whole corpus shows a singularity of both German companies RWE and E.ON over all other, in Figure 88 below:



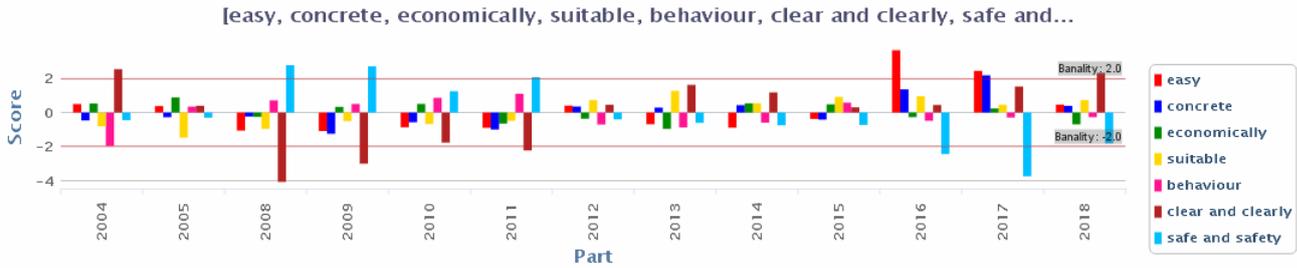
**Figure 88 Specificity calculation of legal legitimacy by companies**

It does not come as a surprise that German company rely heavily on compliance to legal environment. Many other companies in this sample are neither over or under represented it can be translated that they declare to comply, without making it an argument of their legitimacy. Then there are three companies all with specific scores -37 to -34. Does it mean that they do not care by legal environment? Or even do not comply, as in text mining research finding indication of frauds in exploration of annual report? (Goel & Gangolly, 2012). In fact, Figure

88 is an aggregate of the legal legitimacy vocabulary, this is why it appears quantitatively low. At a detailed level, there is always one lemma with positive specificity for each company. For ESKOM, all governance issues and lack of performance make legal compliance more as an objective than a current asset. On example from CSR report in march 2019 are the audit performed on private lifestyle of managers to check risk of corruption:

“We are conducting mandatory lifestyle audits on all executives, all senior management and other occupational levels, as deemed necessary (...) We are also working together with relevant law enforcement authorities to investigate concerns and any violation of the law, even where implicated individuals have subsequently left Eskom's employment” (ESKOM 2019 p 17).

For VATTENFALL the principal comment is that communication about safety is replaced, in relative importance in the corpus, by communication around easiness and concrete action. Evolution of the vocabulary for each component is given in specificity calculation Figure 89



**Figure 89 Specificity calculation on legal legitimacy, VATTENFALL**

When safety was the most salient legal legitimacy argument, 2008- 2010, it has become easy, and concrete. This is particularly the case in 2017 with arguments such as “choose smart technologies for producing their own electricity or heat, and change over to cleaner alternatives that are both affordable and easy to use. (VATTENFALL 2017, p156) or “CO<sub>2</sub> emissions will be purer and thus easier to capture and take care of.” (VATTENFALL 2017, p44). Associating easy with these elements is bolder than what other companies do.

**Final remarks on legal legitimacy.** The outcome of legal legitimacy across our corpus is that it is not shared by most electricity companies in the sample. Complying to legal environment, adapting to its changes is only advertised as a legitimacy argument by both German companies in the sample, RWE and E.ON. for most other companies it is neither over nor under represented. It means they abide by the rules, without claiming a particular message here.

On the contrary, we analysed two case of companies underrepresenting legal legitimacy. First ESKOM, South Africa, explaining that legal compliance is as an objective than a current strength to expose.

But also, VATTENFAL, Sweden, were legal vocabulary is significantly minimised to the profit of associating wording of legal legitimacy to projected energy transition (like “affordable and easy to use” or “CO<sub>2</sub> emissions easier to capture”).

**4.4.2.5 Variation of moral legitimacy vocabulary**

Our starting point with Ayling includes expression such as: “rightness of its cause. Civil society “holds tremendous power for good,”, doing what is right, better future for all,” solutions that are “people-centric”, justice, fair”.

This gives an initial list of lemmas: “right, good, better, justice, fair”. A good aspect is that this list corresponds to a high number of occurrences, but an inconvenient here is that this list is very short. After a cooccurrence research we can extend it to: “non-discriminatory, respect”.

The vocabulary ready for exploration becomes, as per

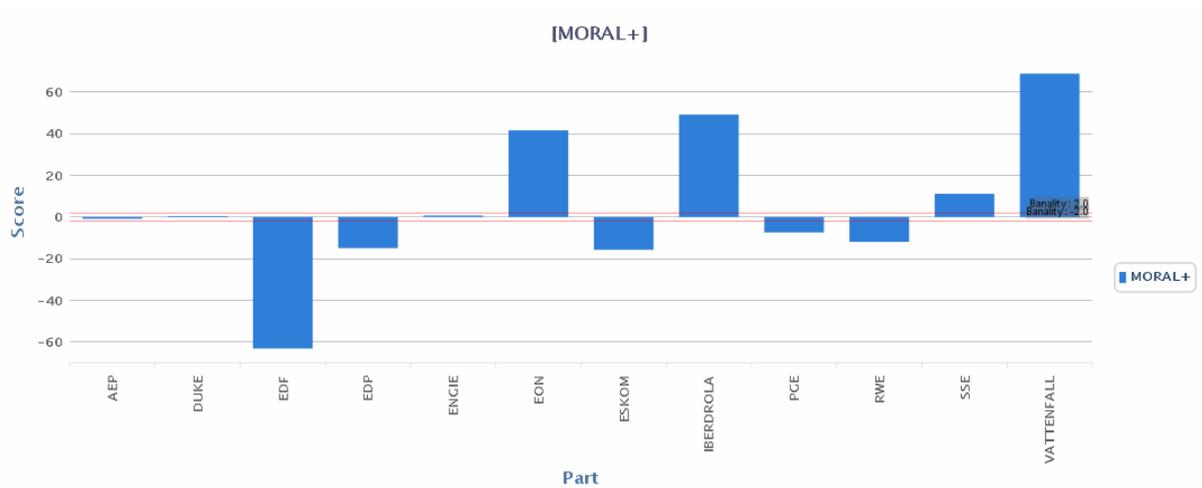
Table 37:

| Lemma              | Nb occ. |
|--------------------|---------|
| Good               | 4996    |
| Right              | 4622    |
| Respect            | 2529    |
| Fair               | 1845    |
| Discrimination     | 331     |
| Non-discrimination | 146     |
| Justice            | 107     |
| Non-discriminatory | 93      |
| Discriminate       | 34      |

**Table 37 Vocabulary for moral legitimacy**

This vocabulary is then plotted against each company to see how they use it within the total corpus. This view on chart Figure 90, shows that IBERDROLA and E.ON use this vocabulary specifically (scores of 92 and 55 vs average ). On the contrary EDF and ESKOM have a strong underrepresentation.

For IBERDROLA it is mostly an intensive use of “respect, and right”, whereas for E.ON it is only “good, and right”.

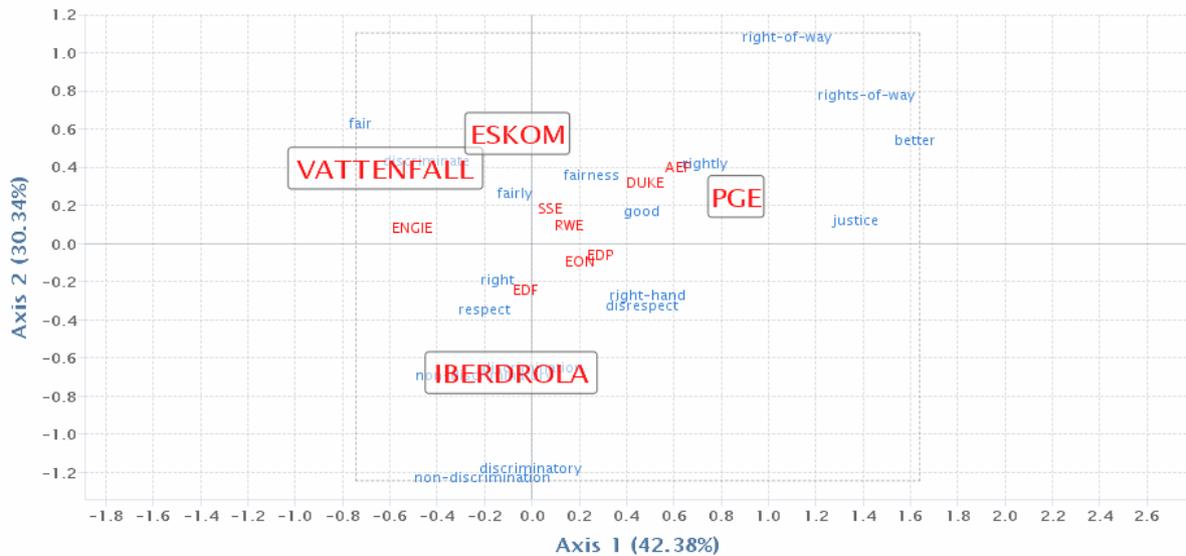


**Figure 90 Specificity calculation of moral legitimacy by company**

VATTENFALL comes first on the moral legitimacy vocabulary, with “fair” as a high contribution. For IBERDROLA they communicate about “respect, and right, in growing occurrences with the time, more or less similar with evolution of corpus size.

But the object is changing, it used to be respect associated to “autonomy, shortfall, concern” in 2011-2012 to the right in correspondence analysis figure. Then it moves in the graph to the top part, with a focus on “supplier, review, review, assessment” in 2013- 2017. Here this is traditional reporting of risk in CSR report (risk review, risk assessment). And the tendency starting in 2015 but fully apparent in 2018.

Correspondence analysis factorial plane of CSRI 29/byCY/<[enlemma=".\*better.\*|fair.\*|good.\*|justice.\*|discrimin.\*|respect|right.\*"]>@enlemma ≥ 10 ≤9,489,733 /9,489,733/@enlemma ≥ 10 /9,489,733



**Figure 91 Correspondence analysis by companies, representation of moral legitimacy**

Inside vocabulary of moral legitimacy there are interesting differences shown in Figure 91. When horizontal axis 1 is structured along “fair, respect” on the left and “justice, better” on the right, the other vertical axis 2 bottom is towards “non-discriminations”. “right, good” in the middle of axis 2 are not well represented in this plan.

Four marked profile are highlighted on the graph, first IBERDROLA with specificity on “respect, non-discrimination”. We read this in full verbatim, comparing 2011 to 2018:

“Diversity and Equal Opportunity IBERDROLA has established equal opportunity, non-discrimination and respect for diversity as strategic objectives” (IBERDROLA 2011, P121). And: “Due to the diversity of sustainable development goals and commitments, the group uses a broad set of indicators that allows for an evaluation of the contribution from various viewpoints” (IBERDROLA 2018 p53).

The context is much wider and applies to the whole business in 2018.

VATTENFALL is only oriented towards “fair”, (specificity score 190) in front of PG&E claiming “good, justice” (specificity scores 81 and 54). Beyond the cultural difference Sweden to California, we see a much different claim of moral legitimacy. ESKOM is an interesting compromise between them with highest specificity score on “fair, good” (28 and 12).

We then perform a comparison on moral legitimacy between EDF and IBERDROLA. Looking at cooccurrences for EDF compared to previous IBERDROLA, we see, that beyond “good practices” is the first association for both companies, they follow very different patterns. Cooccurrence Table 38 indicates that “good” for EDF is mostly accounting and performance. Taking out “good practices” as a generic expression used by both, then IBERDROLA insist on governance and contribution, opposed to EDF insisting on accounting. This illustrates the low use of moral legitimacy vocabulary for EDF. EDF communicates here on purely on a dry performance.

| EDF cooccurrences to "good" |      |     |     |     | iBERDROLA cooccurrences to "good" |     |     |     |     |
|-----------------------------|------|-----|-----|-----|-----------------------------------|-----|-----|-----|-----|
| practices                   | 411  | 179 | 266 | .4  | practices                         | 483 | 140 | 171 | .6  |
| sharing                     | 131  | 30  | 35  | 1.6 | transparency                      | 147 | 30  | 32  | 2.9 |
| performance                 | 1483 | 70  | 34  | 2.7 | governance                        | 446 | 42  | 30  | .9  |
| ensure                      | 837  | 46  | 25  | 3.2 | international                     | 367 | 38  | 29  | 3.3 |
| understanding               | 135  | 20  | 19  | .0  | transporting                      | 16  | 12  | 21  | 5.8 |
| faith                       | 9    | 9   | 19  | .0  | proportionality                   | 9   | 8   | 15  | 1.8 |
| irrespective                | 13   | 10  | 19  | 1.8 | Contributing                      | 13  | 8   | 13  | 5.4 |
| working                     | 797  | 38  | 19  | 1.6 | wellbeing                         | 13  | 8   | 13  | 2.8 |
| formulating                 | 10   | 9   | 18  | 2.7 | recommendations                   | 91  | 14  | 13  | 1.6 |
| international               | 1023 | 41  | 17  | 2.2 | Promoting                         | 16  | 8   | 12  | 5.2 |

**Table 38 Cooccurrences “good” as moral legitimacy, EDF and IBERDROLA**

**Final remarks on claiming moral legitimacy.** Moral legitimacy is a large theme in the corpus. It is quite evenly spread in most companies. This is not the case for IBERDROLA, VATTENFALL and E.ON overrepresented in moral legitimacy, and EDF, EDP, PG&E, RWE and ESKOM very much underrepresented.

For the overrepresented, it becomes a strategic argument, putting forward at the beginning of the studied period values like equal opportunity, non-discrimination and respect for diversity when widening in 2018 into “sustainable development goals and commitments”

On the contrary for underrepresented EDF moral legitimacy is in fact merely qualifying, moral legitimacy vocabulary (especially good) with financial performance.

While some companies rely on moral legitimacy to justify their operations, for the other words associated to it are only qualifiers of performance.

#### 4.4.2.6 Variation of cognitive legitimacy vocabulary

As done with the three other types of legitimacy from our literature extract, the starting point for cognitive legitimacy is Ayling (2017).

“Given the newness of the movement, this is hardly surprising. However, it does make a claim that divestment is the wave of the future [...] and that the movement has the strength, tenacity, and intention to persist “for as long as it takes” (p12).

A first list of lemmas to test is made of: “newness, claim, wave, strength, tenacity, intention, curtailment, withdrawal, inevitable”, in Table 39.

| Lemma         | Nb occ. |
|---------------|---------|
| Strengthen    | 1631    |
| Claim         | 657     |
| Withdrawal    | 512     |
| Strength      | 290     |
| Wave          | 209     |
| Intention     | 178     |
| Strengthening | 119     |
| Curtailment   | 53      |

**Table 39 Index of lemmas on cognitive legitimacy (from literature)**

This list is confronted to our corpus, for adjustment. some lemmas are not existent and needs to be replaced, some other have ambiguous meaning in our corpus (curtailment, wave).

We discard, “newness “, not appearing in the corpus. Hence the meaning of “newness of a movement” needs to be captured differently. On the other side “new” is way too wide, with 26 700 occurrences, and mixing specific energy concepts (“countless” renewable energy) and any noun associated (like new supplier 55 new technologies 33).

Then lemmas “wave, curtailment” have to go out. Wave is taken in the sense of heat wave and climate impact (40 occurrences) or wave energy from tidal power (32 occurrences) which disqualifies the term for a legitimacy analysis.

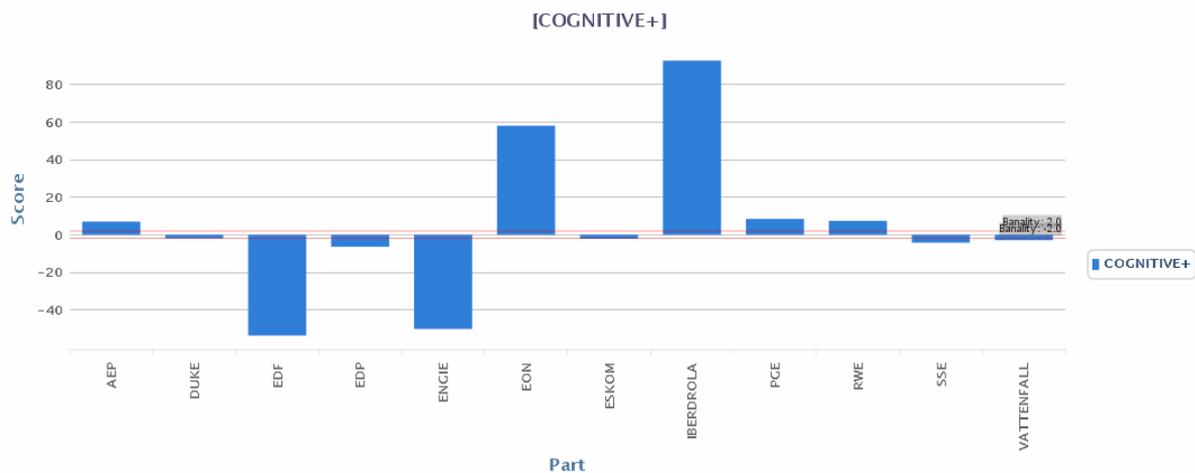
Curtailment is also a term specifically used in energy. “Impact of load shedding and load curtailment on customers”. (ESKOM, 2015 p31)

The updated list of lemmas becomes in Table 40:

| lemma         | nb occ. |
|---------------|---------|
| certification | 751     |
| claim         | 657     |
| formalize     | 42      |
| inevitable    | 54      |
| intention     | 196     |
| label         | 218     |
| model         | 2987    |
| norm          | 97      |
| standard(ise) | 386     |
| strength      | 2072    |
| tenacity      | 2       |
| withdraw      | 1024    |

**Table 40 Index of lemmas on cognitive legitimacy (from the corpus)**

This vocabulary is then plotted in the whole corpus as specificity to see which companies are strongly relying on cognitive legitimacy. It turns out that looking at the full list in one go shows only IBERDOLA as highly specific, in a similar way to moral legitimacy studied previously. In Figure 92 we look below takes more detail of lemmas inside the vocabulary.



**Figure 92 Specificity calculation of cognitive legitimacy by companies**

Overall, IBERDROLA is overrepresented in cognitive legitimacy vocabulary, like previously seen in moral legitimacy vocabulary. In almost all words identified. This is particularly marked for “model”, “label”, “standard” in a theme around standardisation, and in a different direction “withdraw” (applied to withdrawal of water or resource). For E.ON second most specific score at 58, the discourse is centered on “standard, standardise”. In the other direction, for EDF and ENGIE the lemma with the lowest specificity is “standard” (-61 for EDF, -29 for ENGIE); this is the least important concept for both French companies in this aspect of legitimacy, which put on the forefront “claim”.

For example, “strength” for IBERDROLA is evolving from a focus on internal resource to relationship external to the company. We read in 2013 “strong winds and rain caused interruptions to supply that were restored by strengthening the teams at the Distribution and Maintenance Operation Centre (IBERDROLA 2013, p137) compared to 2018 “vision of its responsibility is based on the long-term creation of value for our Stakeholders. For this reason, we focus our work on meeting their expectations and strengthening the links of mutual trust with our shareholders, employees, suppliers, environment and society in general ». (IBERDROLA 2018, p61)

EDP position is very contrasted. For the overall vocabulary it appears not specific across the company sample. But in more detail, use of “model” is very specific (score of +48), while on the opposite “withdraw” is very underrepresented (score of -34), as well as “standard” (score of -61).

One example is the systematic use of “governance model” by EDP (109 occurrences over a total of 166 for the whole corpus). This is indeed a strong argument on which EDP finds its legitimacy.

The governance model, they promote since 2006 is qualified, “ this governance model promotes the separation between management and supervision functions and has shown to be adequate in the effective management of the Society, in the prosecution of its own goals and interests, those of its shareholders, employees and remaining stakeholders, thus contributing to achieve the degree of confidence and transparency necessary to its adequate operation and optimization. (EDP 2017, p9).

Exposing “strength” in affirmation of key achievement is typical in the corpus of American companies. Together AEP, DUKE ENERGY and PG & E use it 39% of total corpus size (total number of occurrences 115 vs 290, when they represent only 16% of corpus size)

This is illustrated for AEP, as well back in 2010 as in 2019:

“Investments in new infrastructure will increase future earnings strength and potential while allowing us to provide safe, reliable electricity to our customers” (AEP 2010, p3). “AEP has laid a strong foundation for growth as we transform our company for operational excellence, financial strength and workforce readiness. (AEP 2019, p13)

This focus to communicate on positive values is present in Pacific Gas and Electric, with a comparison 2003 to 2015.

“One of our greatest strengths as a corporation is our commitment to high standards of behaviour and business conduct in everything we do “(PG&E 2003, p19).

“The chance to create new value for our customers, while also positioning California to tap the promise of a low-carbon economy, is a task we are eager to tackle, and one that is consistent with P G and E’s historic strengths” (PG&E 2015, p2).

**Legitimacy is often what is looked for when it has been lost.** This applies well to ESKOM with difficulties in operating power plants, as well as difficulties in governance (incl. corruption, bribery). In the vocabulary identified, “tenacity” is what you need when legitimacy is lost:

“Given the prevailing operating context and macroeconomic environment, the path to structural, financial and operational sustainability is complex and will require the commitment, tenacity and resilience of all key stakeholders to ensure effective execution of our strategic turnaround plan and the 2019 / 20 to 2021 / 22 Corporate Plan” (ESKOM 2019, p58).

This word “tenacity” is almost totally absent of the whole corpus screened. And for ESKOM it is part of future objectives, and part of what is expected by people, and internally as well as externally. It is a good summary of the lost legitimacy ESKOM is running after.

**Final remarks on cognitive legitimacy.** All companies communicate on an even distribution on cognitive legitimacy, except IBERDROLA and E.ON insisting much more.

In other words, companies communicate on their strengths. But “strength” is particularly belonging to American vocabulary, whether “historical, financial or greatest strength”.

In contrast, strong cognitive legitimacy is referred to when it has been lost. When ESKOM longs for “commitment, tenacity and resistance of all stakeholders”, repairing cognitive legitimacy is a target expressed close to Suchman description.

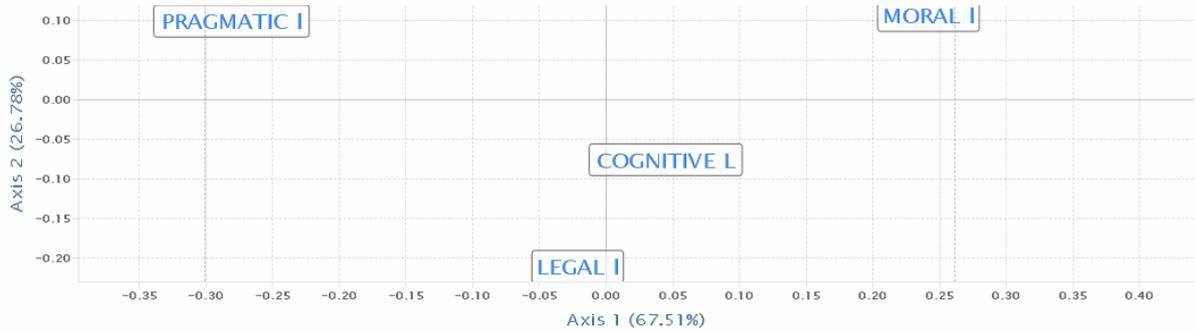
In the end, cognitive legitimacy appears commonly shared. This is because it is so close to the historical role of utility: a necessary provider of cheap, reliable and equitable power which became so obvious that it becomes taken for granted, even under risk of expensive, intermittent and disturbed networks.

#### **4.4.2.7 Final visualisation on the 4 dimensions of legitimacy**

After the exploration of the four dimensions translated from recent academic research associating legitimacy and energy (Ayling, 2017), we look at them all together. For pragmatic, legal, moral and cognitive dimensions of legitimacy, we plot corpus on each axis.

The vocabulary of legitimacy dimensions (about 70 lemmas) is aggregated on a correspondence analysis into four categories mathematically making three dimensions. Figure 93 shows a horizontal axis 1 with “pragmatic” legitimacy vs “moral”. The vertical axis 2 is showing strong “legal” at the bottom, opposed to both “pragmatic” and “moral”. This draws a triangle with axes 1 and 2. The “cognitive” is not well represented in this view, which will be adapted in another visualisation of the same correspondence analysis (we do this by rotation of axis 1 and 2 into 2 and 3 which lowers the percent of variation explained).

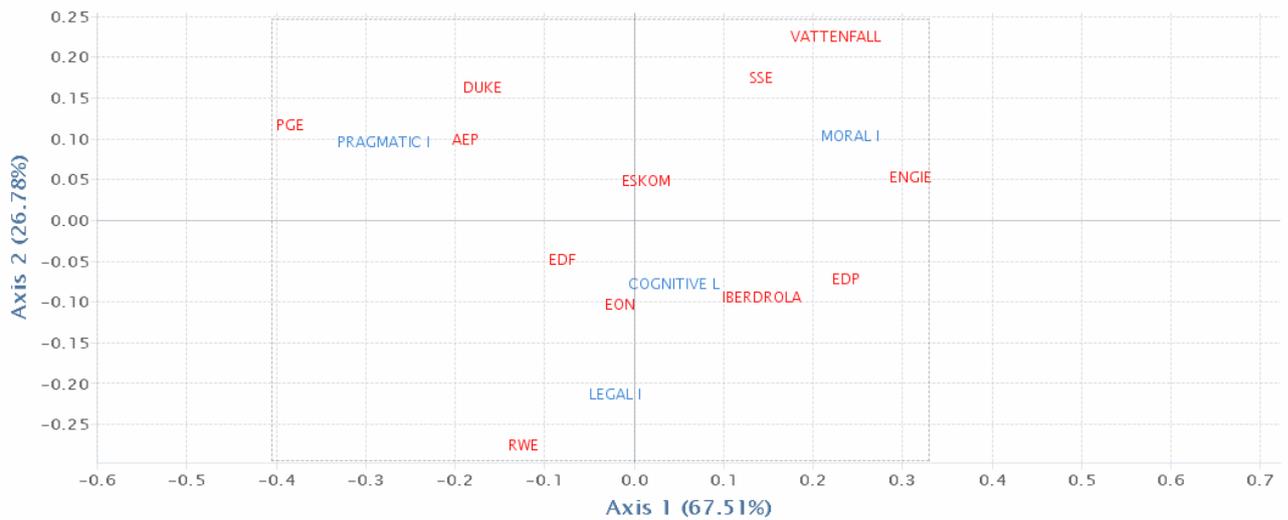
Correspondence analysis factorial plane of CSR129/byCY/<[enlemma=".\*pragmatic.\*|.\*simple.\*|.\*easy.\*|.\*economical.\*|.\*practical.\*|.\*convenient.\*|clear.\*|.\*suitable.\*|.\*behavio.\*|.\*concrete.\*|.\*safe.\*"]|enlemma=".\*legal.\*|.\*complain.\*|.\*civil.\*|.\*obey.\*|.\*viol.\*|peace.\*|.\*charit.\*|.\*punish.\*|.\*protect.\*"]|enlemma=".\*better.\*|fair.\*|.\*good.\*|justice.\*|right.\*|.\*respect.\*|.\*discrimin.\*"]|enlemma=".\*certification.\*|claim.\*|.\*formalize.\*|.\*inevitable.\*|intention.\*|.\*label.\*|.\*norm|model.\*|.\*standard.\*|.\*strength.\*|.\*tenacity.\*|.\*withdraw.\*"]>@enlemma ≥20 ≤9,489,733 /9,489,733/@enlemma ≥20 /9,489,733



**Figure 93 Correspondence analysis with four dimensions of legitimacy**

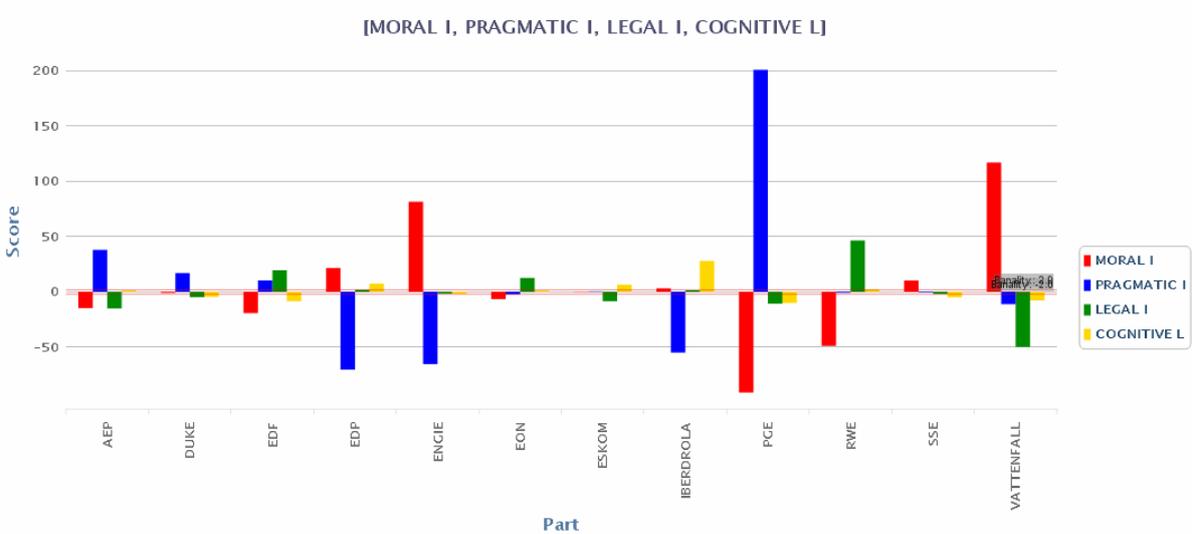
On the same figure we then show company and their proximity to each dimension. Figure 94 is identical to previous one, just enlarged to better see details. There are three marked groups of companies, close to “pragmatic, moral, legal” and a soft middle around “cognitive”. Visually we have:

- Pragmatic legitimacy is dominant for: AEP, DUKE ENERGY, PG&E.
- Legal legitimacy is dominant for: RWE, we will see that EDF and E.ON can be added this group.
- Moral legitimacy is dominant for ENGIE, VATTENFALL, SSE, EDP.



**Figure 94 Correspondence analysis four dimensions in legitimacy by companies (similar to Figure 93, enlarged for easier reading)**

Visual proximity of Figure 94 is analysed together with the specificity scores on Figure 95 of each company on the different components.



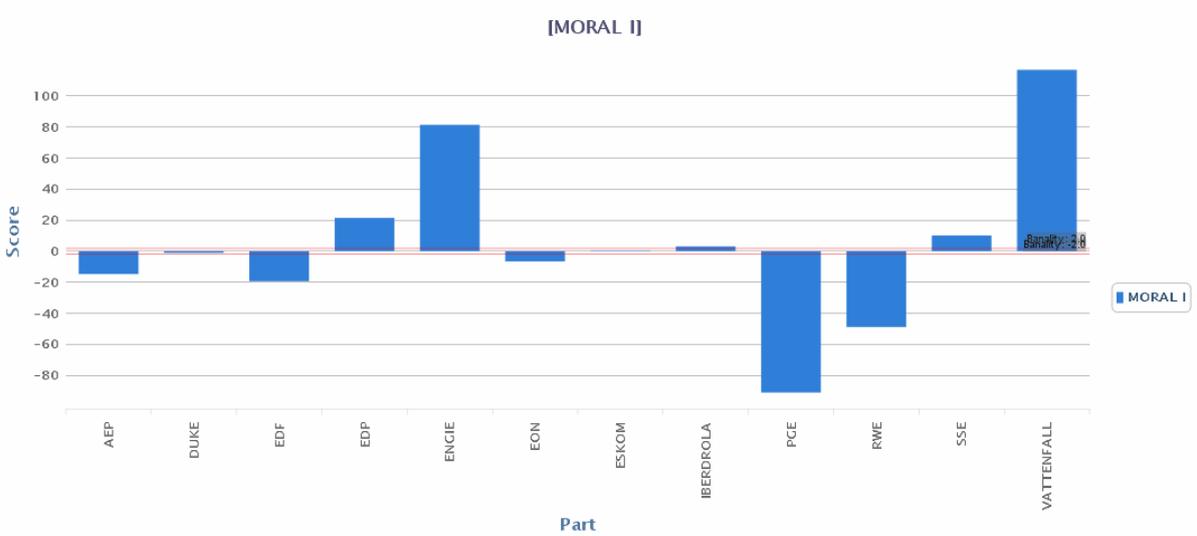
**Figure 95 Specificity calculation on moral, pragmatic, legal and cognitive legitimacy (inside the vocabulary of legitimacy around 50 000 words, not against the whole corpus)**

The “pragmatic legitimacy” dimension is very marked for all three American companies. There is probably a cultural part, completed by a regulatory and business environment towards words like “safe, easy, clear”. PG&E ranks so high (specificity score 201) that AEP and DUKE are less visible despite marked specificity (scores 37 and 16 when the usual statistical criteria is above 3). On the contrary EDP, IBERDROLA and ENGIE have an underemployment of pragmatic legitimacy.

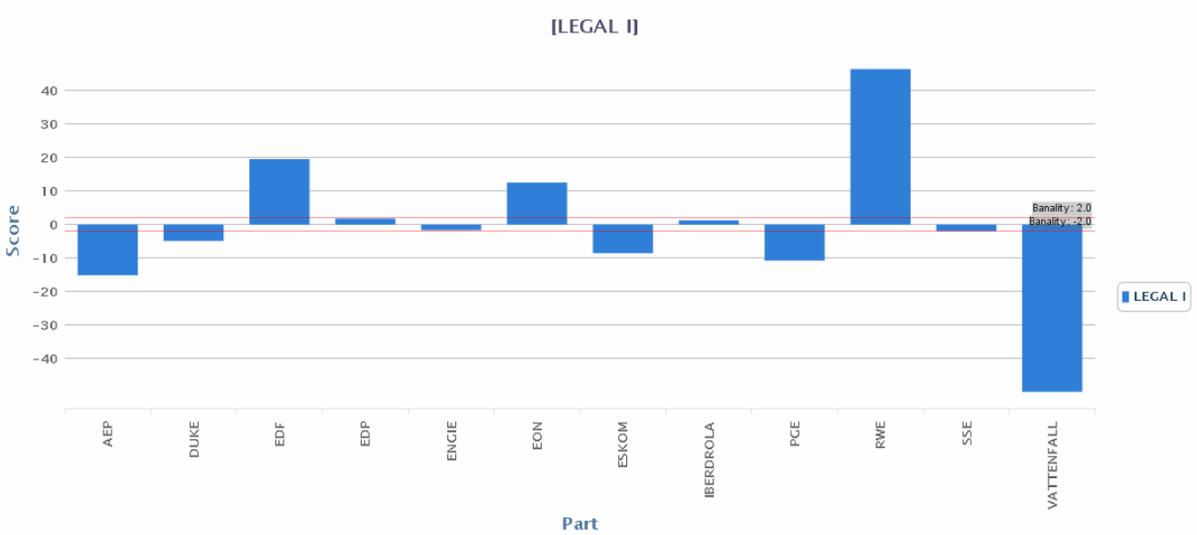
Next, the “moral legitimacy” dimension is specific to VATTENFALL (score 119) and ENGIE (score 81) detailed on Figure 96. Both companies place emphasis on “fair, respect, right”. The underlying statement is that working with these companies means being treated with respect and in all fairness. EDP (score 22) and SSE (score 10) are also giving priority to moral legitimacy, to a lesser degree. On the contrary PGE and RWE have very low specificity scores (-91 and -49) which we could interpret as a focus on facts and numbers rather than values included in the moral legitimacy vocabulary.

Last dimension on “legal legitimacy” corresponds to RWE (score 46), EDF (score 20), E.ON (score 12) detailed in Figure 97. When RWE and E.ON put “protection” first, EDF is using more “civil”. The promise to respect of legislation is dominant here. For negative specificity scores, VATTENFALL (score -50) and AEP (score -15) it should not be considered as

indifference to regulation, but rather communicating much less on this theme in proportion of the total use of legitimacy vocabulary.



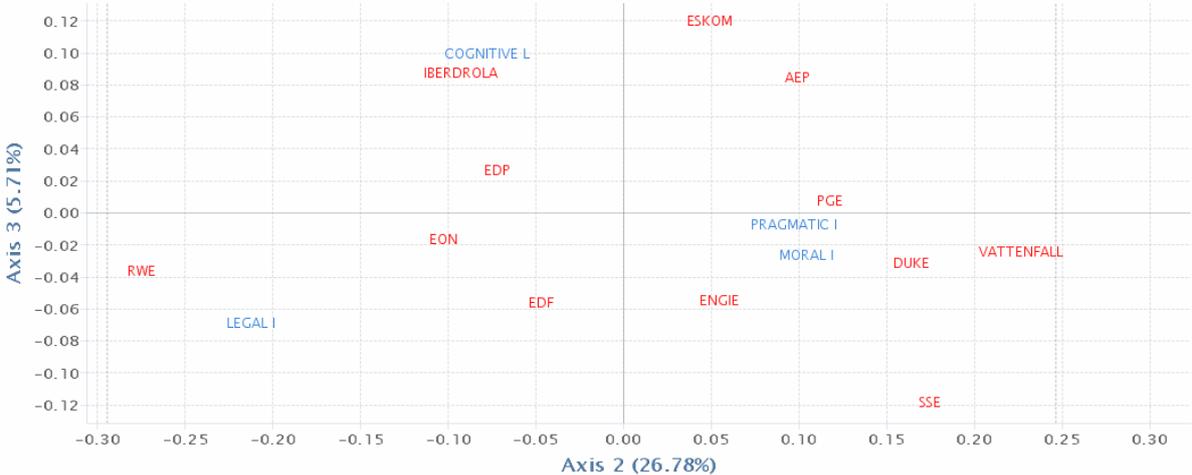
**Figure 96 Specificity calculation of moral legitimacy**



**Figure 97 Specificity calculation of legal legitimacy**

There remains the dimension of cognitive legitimacy, in the centre of Figure 94. If this dimension is only visually corresponding to ESKOM, IBERDROLA and E.ON, we can select other axes in the correspondence analysis to make them clearer. This is performed on Figure 98 where “cognitive legitimacy” is contributing to the vertical axis as opposed to legal. IBERDROLA and ESKOM are confirmed in the cognitive legitimacy. ESKOM is putting emphasis on “strengthening, strength, norm, model, standardise”, as affirmation of why it would be obvious to work with them. For IBERDROLA it is “model, withdrawal” which have

relatively high specificity score; it is a mix of business model on one side, and divesting on the other side, which contribute to an undecided position of IBERDROLA on this legitimacy dimension. Then AEP and EDP are also high on cognitive legitimacy. These four companies correspond the most to the core value of utilities, as obvious players in electricity which need no efforts to stay legitimate.



**Figure 98 Correspondence analysis of types of legitimacy, with other axes (same than Figure 94 with axes 2 and 3 selected)**

The ending point of analysis along these four types of legitimacy is that most companies have a dominant focus on legitimacy, although this is always a subtle mix. If some companies put a strong accent, like VATTENFALL on moral legitimacy (“fair, right”), there are more examples of efforts to appear legitimate on all dimensions.

The main findings of each section were presented before each analysis to spare readers who want to save the time reading visualisations and comments. They are now synthesised at the beginning of part 5 conclusion.

## PART 5 CONCLUSION

We comment the findings on legitimacy in discourse analysis. Then we discuss the limits of this research, such as whether corporate discourse could be only a greenwashing exercise, or the possibility to measure implementation of what companies pretend doing. Potential contributions of this work are presented along the different research communities connected to our research question.

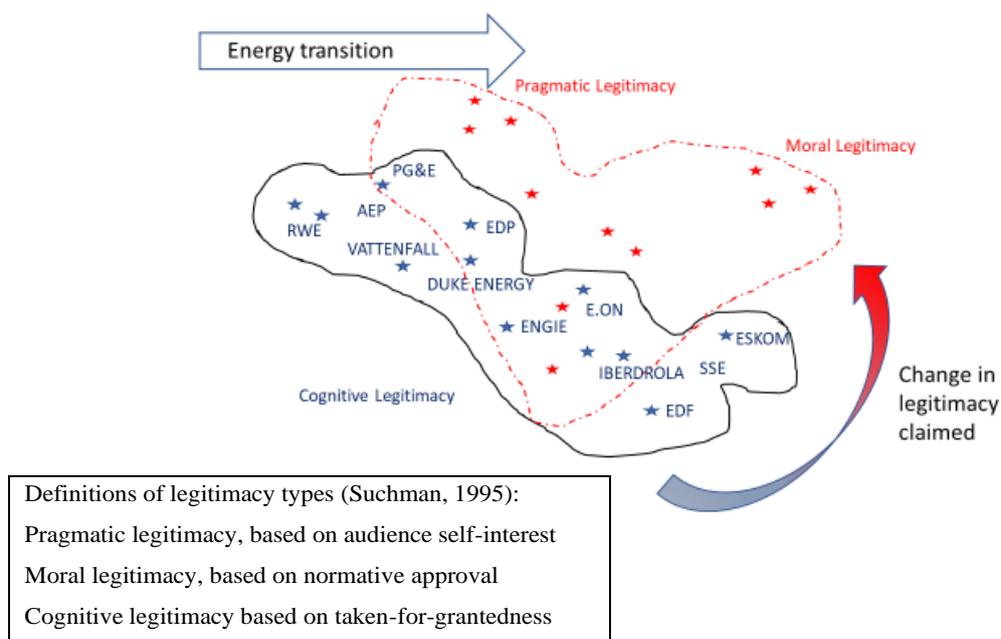
### 5.1 RESULT FINDINGS

#### 5.1.1 Neither trivial information nor hidden jewel

At the end of all our textometry analysis and visualisations, there is no magic formula allowing to compare, in simple terms, the legitimacy of to that of Pacific Gas and Electric, and their evolutions. Nevertheless, our findings are not trivial information, and go far beyond reading with an educated eye each CSR report.

**Visible transformation of legitimacy in the discourse.** What we have achieved is identifying changes in the discourse on legitimacy and energy transition. Companies have been, are and, undoubtedly, will continue to adapt their discourse to insure their legitimacy.

The opening figure in problem formulation part was assuming that a series of characteristics of legitimacy are changing with energy transition. And this is the case. This evolution is represented on Figure 99.



**Figure 99 Visual shift on legitimacy claimed**

We have seen how clean energy emerged, and the use of renewable energy spread to become used by all companies. And we also saw how the focus on energy described as supply and demand changed into energy efficiency, and then into energy transition (result section 4.1). There is also a shift from production of energy to a broad offer of energy services.

**Validation that results answer research question.** We have demonstrated that our whole corpus was suited to our research question.

Textometry analysis have shown in this research that discourses from companies are moving into new directions. Of course, as all companies are not heading to one single direction, nor is the entire vocabulary changing in the same way. This result was far from obvious in a large corpus made of a series of self-affirmation.

Transformation and legitimacy cannot be observed directly in wording used, but we analysed them both with new vocabulary emerging, and with concept from the literature.

### **5.1.2 Energy transition hits legitimacy of every company**

The second main finding is that energy transition is so powerful that no utility can rely on its past legitimacy without adopting a different discourse. These unprecedented challenges to utilities are present in the discourse with the risks of stranding assets, moving from valuable to liabilities (result section 4.3.4); they also reduce lifetime of some power plant discontinued for climate protection among other reasons.

**Each company translates into its own language.** There is not a common use for “energy transition”, or another term, such as “clean power” more appropriate in America. Nevertheless, no company can stay out of the way of this transition, either in a minimal adaptation approach, or late adopter. (result section 4.3.1)

This is illustrated in the progressive change in meaning of “carbon”. Metrics and measure carbon were a large theme at the beginning of the period studied, but progressively reducing carbon has become a growing theme. We also observed apparition and propagation of “carbon footprint” among electricity companies. (result section 4.3.2). The carbon content of discourse has changed with the years, and carbon becomes a question of transition.

**But not always in a homogeneous manner.** If the emergence of energy transition can be observed in all companies, it is not transforming each company in the same way. In fact, there is no opposition in the discourse between clean or dirty companies, slow or fast movers. On some dimensions like focus on finance or on environmental issues, some companies address one much stronger than the other. This does not necessarily mean that some companies do not

consider finance, but that it is covered in another kind of report (E.ON as typical example) Or on an opposition local or corporate most company clearly insist on one aspect, with anticipation of centralised or decentralised energy markets. In these two examples, companies have translated energy transition into their own vision. For other companies, we have identified how close energy transition was related to business model in one case, and reputation for another one (result section 4.2.2).

### **5.1.3 Identifying trajectories**

**A shorter lifetime for utilities' assets.** Time dimension is surprisingly present in observation of corpus, with changes in energy mix, in priorities of investments or divestments observed within few years. Utilities manage their assets up to a 40 to 60 years lifetime. In this research, we see that the timeline is sometimes shrinking to a 10 to 20 years maximum. This change from long cycle assets to a shorter range indicates threats on existing assets, and probably some hastiness to invent new models.

This is also present in the emergence and transformation of stranded asset concept. Up to 2010-2011 it was not apparent in the discourse, then the concept appeared in the issues to cover, and turns into a threat at the end of the studied period. (result section 4.3.4)

**Convergence in corpus or not, and how it changes in 2016-2018.** We identified a much stronger convergence in 2016-2018 than before (result section 4.3.3). Some could say we have only found out that the Paris Agreement took place in 2015. But we have rather demonstrated how large events imprint on the discourse, and that the words of energy transition take a different direction after the Paris Agreement.

**Core business is moving from operations to sustainable operations.** We see a shift in the way companies affirm their legitimate core activities. At the beginning of the observed period maintaining a good operational level was and remains a constant concern, relatively to overall discourse. The content of operations and performance has changed and widened into sustainable dimension. We observe a shift from asset operations into sustainable operations (result section 4.4.1).

This goes together with a switch from electricity supply chain to service activities, which we interpret as production is no longer the main competency of the company, but includes knowledge of operations and maintenance, even of assets not designed or operated by the company itself.

#### **5.1.4 Legitimacy no longer granted but acquired**

For a long time, utilities have been considered as taken for granted companies. Then opening electricity markets to competition in Europe has changed this. What we demonstrated is that utilities are shifting the ways they affirm their legitimacy. It is as if legitimacy granted by status has now to be demonstrated. In the typology from Mark Suchman, it could be simplified on one main dimension chosen by each company (result section 4.4.2)

Companies relying on pragmatic legitimacy: a core group of companies demonstrates their legitimacy based on numbers. A cost benefit approach is sufficient to ground their behaviour. And other patterns around behaviour (IBERDROLA, Spain) safety as guiding principle (PG&E, USA) or simpler operations (ENGIE, France).

Companies relying on moral legitimacy: here mainly the case for IBERDROLA and E.ON (Germany) overrepresented in moral legitimacy compared to all other companies. But taking a more legal approach, compliance to legal environment, adaptation to its changes is only advertised as a legitimacy argument by both German companies in the sample, RWE and E.ON. Last, for companies relying on cognitive legitimacy: strong cognitive legitimacy is referred to when it has been lost. When ESKOM longs for “commitment, tenacity and resistance of all stakeholders”, it is an objective of repairing cognitive legitimacy.

## **5.2 DISCUSSIONS**

### **5.2.1 The distance between saying and doing**

The main point for discussion is probably that observing changes in discourse does not mean that companies act accordingly. Looking at CSR reporting merely as a greenwashing exercise has been debated over a long time. Our argument is that this question cannot be solved inside the discourse, which is this the object of this research.

CSR report may well be a simple communication exercise. There is a large literature exploring how responsibility reporting can be disconnected from reality, or a simple exercise of repainting the reader’s glasses green. We do not underestimate this potential gap, but it is also the case in other form of corporate communication. Even annual reports with standardised financial forms tend to put numbers forward which look better than others.

Another debate on degree of transformation is to compare company C1 presenting itself as “green” and company C2 as “green, green, green”. Can we value the latter three times “greener”

and, consequently, more concerned than the other? This is a rhetorical argument; one could argue that issuing a lengthy report increases number of occurrences of specific words. This is why our analysis were mostly on frequency ranking of terms and specificity calculation, with very marginal use of occurrences numbers. This cautious approach avoids over-emphasis on communication, but may also minimise sincerity of willingness to persuade developed in CSR reports.

### **5.2.2 About heterogeneity of data and sampling**

Why not start from a different set of data? It could be argued that our data is not a direct access to strategy on transformation and energy transition. When we take CSR reporting, it could be incidentally dealing with energy transition. Other data source would be also questionable. Probably interviews of key managers could be more focused. But the interest of our design is to have longitudinal data as well as several cases.

Could it start with a more homogeneous sample of companies? If we had taken only European utilities, maybe the implementation of European legislation would have been observable in the corpus. The difficulty is that European energy is not homogenous at all. Between countries relying as much as possible on gas, on coal or on nuclear, path dependency is weighing a lot in the discourse. Another possibility would have been to take the same number of European utilities and American ones. This is a renewed design of opposition American to Italian press (Bassi, 2010). Here the focus would have shifted on a rhetoric discussion, and we chose to go for a typology of changes, not merely an opposition, like slow movers and fast ones on energy transition.

Or starting with a much wider company sample? Another critic could be to question why no Asian companies are studied, and just one from Africa. Our criteria were to take company with a strong legacy of power plants. This increases the questions of adaptation (substitution of energy) and diminished issue of additional production capacity. The second criterion was to take companies very exposed to the question of global warming (like ESKOM running mostly on coal in South Africa). But it is obvious that, even if we had to make choices according to the criteria that have just been mentioned (and because of time limits, obviously) the extension of this type of approach to other actors seems to us to be of interest (as explained later on).

Could we achieve a better homogeneity? In an ideal world, text of same size and same structure would be much better to compare... unfortunately, they cannot be found. What we saw is that the type of vocabulary chosen, down to dry facts for EDF, or very literary style for EDP creates

an important heterogeneity. Instead of searching for more homogeneity, the direction chosen was to accept heterogeneity inside the design and use it to refine analysis (Pincemin, 2012).

### **5.2.3 External validation of discourse**

CSR is a one-way communication, where company advertise their legitimacy with no risk of being challenged. As such, it can be considered as manipulation (Scherer et al., 2013) meant for some stakeholders who would take it for granted.

A solution would be to take an external validation, and there are many specialised firms and consultancy issuing reports on this subject. But, then, it is replacing one-way communication by another one, from the evaluator point of view. And the second issue is that these reports tend to give marks, ranking which insists on how much the companies change, not how, and definitively not how their evolution contribute to a legitimacy.

In order to have a discussion and different points of views, press articles or analyst reports would provide critical reading of corporate communication. This is a regular design of textometry studies to capture rhetoric argumentation (Blanc & Huault, 2011). We believe that collecting 15 years of press across several countries would have been quite a challenge, with a risk of inconsistency of data.

## **5.3 CONTRIBUTIONS**

This thesis is contributing to academic research in strategy, in energy studies and in applications of textometry. On a management perspective it is contributing to benchmarking companies, to be used to assess how to improve adaptation to energy transition.

### **5.3.1 Contribution to research on strategy**

The first contribution is an application of neo-institutional theory into energy transition. In the stream of research of discourse analysis of legitimacy, we have extended existing fields of research to questions of energy transition and Multi-Level Perspective, at company level.

Then our research design both longitudinal and in variation is an original way to study legitimacy. On one side, we have 12 different case studies with 15 years changes in discourse. On the other dimension, a comparison of how companies affirm their legitimacy at the

beginning and at the end of the period. It is an attempt to unify research on change in legitimacy and comparison of different companies.

The last contribution is on the debate between CSR and greenwashing. The question of how strategy as declared has any performativity is a large stream of research. What are the differences between telling strategy and implementing it?

It would be too imaginative to consider that CSR reporting, even with best intentions, mirrors reality and action taken. Yet increasing demand for mission statements, for purpose of companies beyond making profit compel our electricity companies to transform. If it is not to avoid negative impact of “name and shame”, CSR participates in efforts to attract and retain those who will be the most eager to invent the energy world that we need tomorrow.

### **5.3.2 Contribution to energy transition studies**

Research on energy transition is mainly looking at implementation of low carbon technologies with techno-economical analysis, and at capacity of society to transform its socio-technical environment. Taking energy transition from the discourse of utilities is an original approach, which opens a link between change and discourse on change in regard of energy transition.

In a working paper, Fuenfschilling, Geels and Raven (2017) identified streams of research for multi-level perspective including: “these could lead to new research questions for transition studies that are based on qualitative and quantitative methods, including discourse analysis, quantitative longitudinal studies or even experiments.”. We contribute specifically here to qualitative methods and discourse analysis. As such, this research also intend to belong to Sustainability Transitions Research (Köhler et al., 2019).

Next contribution is to study energy transitions from the point of view of legitimacy. Here the starting point was that energy companies might not be forever legitimate. Then, construction of power plants, maintain assets or facing accidents are not looked from a usual industrial perspective; but with a model of gaining, maintaining or repairing legitimacy. Considering legitimacy as an asset opens new possibilities for research in energy (Geels & Verhees, 2011). Lastly, it is an original design to look at legitimacy of utilities from a discourse perspective in the field of research on energy transition. Using a textometry approach to energy transition is a new development in energy economics and energy policy research field, which allows to analyse emergent patterns from corporate communication corpuses. This research links communication from companies with description of change and the multi-level perspective of innovation in energy field. We study the link between communication on change, declaration

on change and some measures of how it is implemented, which could pave the way for future research on what drives utilities to transform, and which factors lead them into a new direction.

### **5.3.3 Contribution to textometry methodology**

Lexical studies, and textometry among them, had been applied to many research objects before. The textometry community is lively and dynamic, with software development and exchanges with all tools dealing with statistical text analysis. Our research aims at increasing legitimacy of textometry by applying it to corpus in strategy and energy sector. From its core community of linguistics, history and geography research, TXM has then been progressively used in political science (Leterme, 2017) finance (Bédécarrats, 2012) energy (Shen, 2016). Here we have explored new objects with CSR reports, and new research questions in looking for legitimacy inside evolution of vocabulary.

This research consists in a bridge between disciplines, in putting together a corpus in economic and energy and analysing it with discourse analysis method.

### **5.3.4 Contribution in management**

The first target of this research is to provide tools for self-assessing company legitimacy. Examining for a company its past corporate communication can reveal typology of how companies claimed its adaptation to energy transition. Making this typology explicit can help or marginally improve diagnostic and decision to make for lower carbon footprint.

The second contribution is to benchmark with other companies. Managers in utilities can compare their own company to others confronted to the same experience of energy transition. This benchmark can reveal pattern on which companies change faster, or in different direction. Hence it could trigger for managers different actions in transformation. We have proposed a descriptive map, with a time dimension: between early adopters of energy transitions and companies that are followers. And a variation dimension: what are track records of different energy players: companies with a track record of quick adaptation, risk taking, decision to change can be translated into a transformation pace. This benchmark exercise can contribute to highlight what path to select.

We hope that a last contribution for management would be to help making better decision in transformation towards lower carbon footprint. Based on the panorama of possible strategies, managers can select a path forward. Not any path, as it could be “picking up strategy like flower

in a garden”, (Mintzberg, 2019) but as informed view on how to associate potential paths and their results.

If considered as a decision tool, we hope to use it as a mirror. In the sense that the company sees itself not only as it is but as the path that brought it to this point. Then, looking up from the mirror, comes the time to make the next step.

### **5.3.5 Potential future research**

We see four main directions for future research: changing the sampling of companies to generate more opposition, changing the corpus, changing the method to mix verbal and written input and last, attempting to bridge the distance between saying and doing.

Selecting different companies, especially in Asia and Africa, would focus on additional need for energy rather than substitution of one energy source by another. An interesting design would be to have a European group and an African group for example; this would also restate a rhetoric opposition between two groups.

A different corpus could be used as alternative to CSR reports. Independent energy reports, like World Energy Outlook by International Energy Agency (IEA), could provide an institutional discourse; published since 2005 and up to 800 pages it has longitudinal and potentially variation dimensions.

We think that a mixed method of interviews and statistical text analysis could be fruitful as well. Finding adequate interviewees for two or three years in a row would be associated to discourse analysis of their companies on the equivalent period. This design could show perception of change in parallel to discourse on change.

Last and most difficult direction would be to confront discourse on changes with actual measure. There are many independent evaluators providing external validation on non-financial aspects. Partnering with one of them could provide interesting data to study evolution of the discourse on one side, and evolution of some metrics on the other side. For example, Carbontracker.org calculates for some companies the percent of achievement of the Paris Agreement and its yearly evolution. We do not anticipate words and action to run in parallel, but that there could be a fruitful discussion between the two.

#### 5.4 FINAL REMARKS

At the end of this journey within 9.5 Mio words, we have explored how each company changed in its discourse, how concepts emerged and blossomed, like energy transition or clean power, both high up on the list. We found similar insight in last edition of the World Energy Outlook report “there is no single storyline about the future” (IEA, 2020). We observed how each company is moving on a trajectory while carrying its legacy, past infrastructure and current assets, legal and regulatory constraints...

We have observed how legitimacy was questioned by energy transition, with an increasing pressure (like the Paris Agreement 2015 as a strong push) and increasing speed. Changes in legitimacy happened in many directions. There is no cornerstone statement describing each company’s legitimacy, but rather initiatives and projects undertaken to gain or maintain legitimacy.

With all new concepts appearing along the years, we have established that energy transition is also a translation for energy companies, in a dual sense. First, a translation into vocabulary, into priorities, and into actions. As legitimacy of utilities is no longer obvious when energy production tends toward renewable, energy companies are changing and they translate these changes into their corporate discourse. It could apply to the second meaning of spatial translation. Here we can name the geographical footprint of renewable assets, smaller and more distributed, which partly replaces large power production units. Concepts of low carbon, carbon neutral, zero-carbon are good examples of association of numbers and words, setting one after the other challenging levels of carbon emissions. They represent a translation from current to new words to describe the energy world ahead.

Energy transition has eaten some legitimacy off utilities and it is no longer granted but acquired. When utilities relied yesterday on a cognitive legitimacy, it has changed into different types. Some companies now root their legitimacy purely on business transactions. Others insist on moral aspects, including respect of legislation and ethics. The overall move is out of cognitive legitimacy, strongly tied to traditional role of utilities, into pragmatic or moral legitimacy aspects.

The study of patterns from CSR report for 15 years has shown how transformations emerge in the discourse. Can we conclude that some of these transformations happen in reality as well? We saw that carbon footprint or sustainability appeared along the way, and became commitment taken by utilities. And repeating CSR exercise years in row towards a wide stakeholders' audience forces companies to do at least some of what they say. This contributes to demonstrate the performativity of CSR commitments; companies cannot keep saying without doing same targets ten years in a row. We looked at legitimacy as declared by companies, hence an objective view of who gains, maintain or repairs its legitimacy could not be observed. Even so, efforts by ESKOM to repair their legitimacy after governance issues could be followed in our CSR corpus.

The quest for legitimacy through lower carbon is shared by all companies studied. The evolution towards a low carbon economy is observed in words chosen and in the representation of evolution. It is not visible as a straight line but, rather with tipping points. There is one around 2011, when the risk of stranded assets began to be discussed. A second inflexion happened between 2016 and 2018 just after the Paris Agreement, when converging patterns between companies are much stronger. Probably adding recent years to the corpus studied would only make this convergence towards a zero carbon or carbon neutral clearer. Hence, with an optimistic point of view, we believe this convergence in words and acts is just at its beginning.

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APPENDICES

Illustrations of logos of the 12 companies in the sample



## **Table of Appendices**

Appendix 1 summary of key metrics for the 12 companies sampled

Table of the corpus

2 main dimensions

Table of company presentation

Appendix 2 label of CSR reports

Appendix what's in a name? how name and title of CSR report change 2003 - 2018

Appendix 3 mission and vision of companies in 2008

Appendix 4 mission and vision of companies in 2018

Words, and images in both years, gives an idea of the company

Appendix on mission vision value. statements issued in CSR reporting

## Appendix 1 recap of key metrics

### Appendix principal dimensions in the corpus

This appendix is the easy reference document covering companies sampled in the research corpus

In one short table each company is characterized by its place of headquarters and three numbers: turnover, number of employees, capacity installed.

Then we present a table with what CSR reports are incorporated into the corpus

And principal dimensions in TXM software by company and by year.

| company     | country headq.                | turnover (1)  | employees (2) | capacity (3) |
|-------------|-------------------------------|---------------|---------------|--------------|
|             |                               | B EUR equiv   | thousands     | installed MW |
| AEP         | Ohio, USA                     | B USD 15.6    | 18 000        | 26 000       |
| Duke Energy | Charlotte, North Carolina US  | B USD 22.74   | 28 798        | 58 200       |
| Edf         | Paris, France                 | B EUR 68.976  | 154 845       | 129 300      |
| EDP         | Lisbon, Portugal              | B EUR 15.746  | 12084         | 26 750       |
| E.ON        | Essen, Germany                | B EUR 38.958  | 42 657        | n.A.         |
| ENGIE       | Courbevoie, France            | B EUR 60.1    | 171 100       | 102 700      |
| Eskom       | Sunninghill, South Africa     | B RAND 179.8  | 46 665        | 37 800       |
| Iberdrola   | Bilbao, Spain                 | EUR B 31.418  | 34 000        | 47 500       |
| PG&E        | San Francisco, California, US | USD B 17.14   | 23 000        | 73 300       |
| RWE         | Essen, Germany                | EUR B 44.585  | 59 333        | 43 000       |
| SSE         | Perth, Scotland, UK           | GBP B 7.331   | 20 570        | 11 000       |
| Vattenfall  | Solna, Sweden                 | SEK B 166.360 | 19 814        | 30 500       |

**Table on key metrics for each company (compiled from company sources)**

Table above gives an idea of how company compare in the sample. It is not a one to one comparable table. (1) turnover in local currency of the company, retrieved from Wikipedia, 2019. (2) number of employees retrieved from Wikipedia, mostly values for 2017, (3) capacity installed from each company's report 2017.

| (years)     | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| AEP         |      |      |      | 54   |      | 68   | 72   | 56   | 54   | 56   | 115  | 145  | 155  | 112  | 101  | 111  | 129  |
| Duke Energy |      |      |      | 36   | 46   | 52   | 40   | 44   | 36   | 36   | 36   | 42   | 42   | 50   | 52   | 55   |      |
| Edf         |      |      |      |      |      |      | 508  |      | 532  | 496  | 524  | 313  | 510  | 538  | 508  | 532  |      |
| EDP         |      |      |      |      |      |      | 128  | 146  | 294  | 151  | 190  | 210  | 176  | 235  | 171  | 208  |      |
| E.ON        |      |      |      | 64   |      | 133  | 142  | 155  | 129  | 197  | 259  | 204  | 217  | 173  | 134  | 112  |      |
| ENGIE       |      |      |      |      |      |      |      |      | 484  | 412  | 404  | 408  | 388  | 52   | 56   | 52   |      |
| Eskom       |      |      |      |      |      |      |      |      |      | 166  | 140  | 96   | 128  | 76   | 80   | 80   | 95   |
| Iberdrola   |      |      |      |      |      |      |      |      | 255  | 221  | 202  | 266  | 246  | 272  | 336  | 414  |      |
| PG&E        | 99   | 104  | 77   | 84   | 86   | 96   | 123  | 203  | 225  | 188  | 199  |      | 163  | 165  | 167  | 187  |      |
| RWE         | 48   |      | 88   | 28   | 88   | 32   | 104  | 70   | 142  | 155  | 83   | 96   | 104  | 77   | 92   | 98   |      |
| SSE         |      |      |      |      |      |      |      |      |      |      |      |      | 19   | 20   | 28   | 31   | 39   |
| Vattenfall  |      | 94   | 86   |      |      | 90   | 90   | 80   | 37   | 125  | 137  | 162  | 174  | 186  | 192  | 184  |      |

**Table size of CSR reports in the corpus**

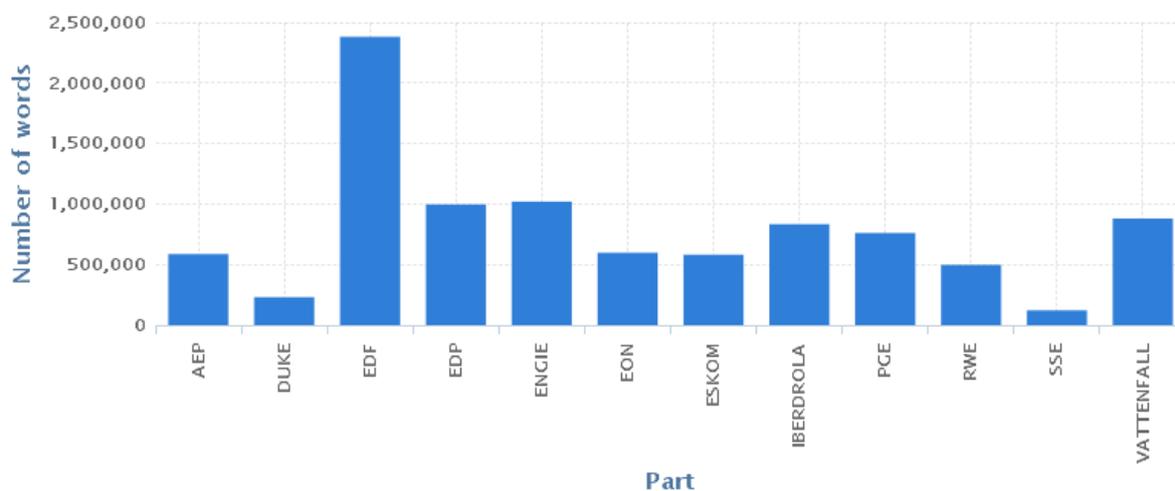
This table shows CSR reports collected for each company. It has been retrieved for as many years as available on the internet.

It makes a total of 129 reports, or 20 600 pages.

Some reports could be retrieved as early as 2003, sometimes reports could not be opened and exploited correctly. The 3 reports marked “2019” are for companies who close their books on end March, so that it represents a 1<sup>st</sup> April 2018 to 31<sup>st</sup> march 2019 period.

**Principal dimensions in the corpus – by company**

**Dimensions of the byCY partition in the CSRI 29 corpus  
12 Part(s)**



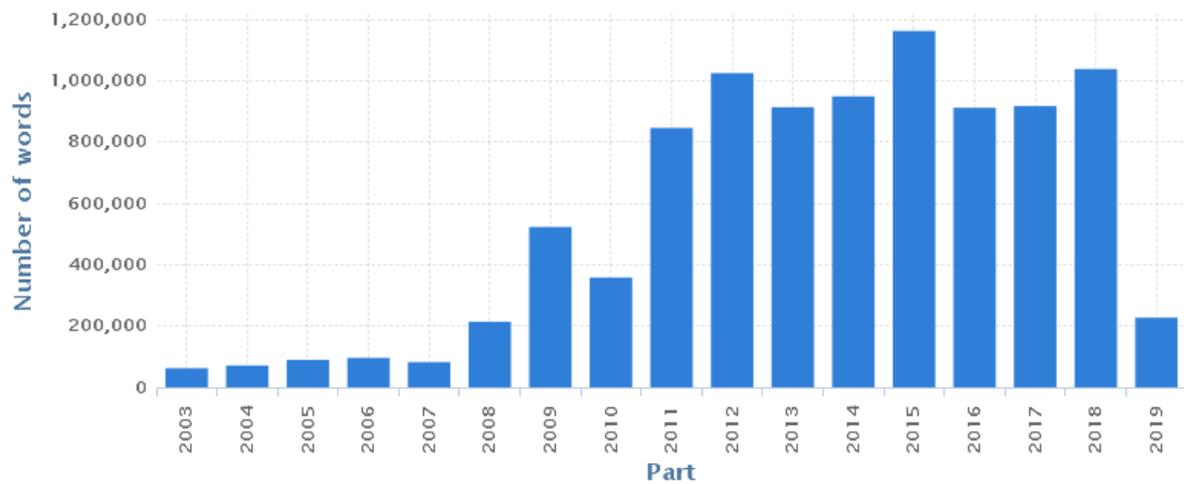
**Bar chart of corpus size by company (in words)**

table of numbers

|            |        |        |         |        |         |        |        |           |        |        |        |            |
|------------|--------|--------|---------|--------|---------|--------|--------|-----------|--------|--------|--------|------------|
| F          | AEP    | DUKE   | EDF     | EDP    | ENGIE   | EON    | ESKOM  | IBERDROLA | PGE    | RWE    | SSE    | VATTENFALL |
| 9489733    | 586678 | 230228 | 2382668 | 996847 | 1020022 | 597653 | 581456 | 833538    | 760819 | 497390 | 121662 | 880772     |
| in %       | 6,2%   | 2,4%   | 25,1%   | 10,5%  | 10,7%   | 6,3%   | 6,1%   | 8,8%      | 8,0%   | 5,2%   | 1,3%   | 9,3%       |
| in Ranking | 8      | 11     | 1       | 3      | 2       | 7      | 9      | 5         | 6      | 10     | 12     | 4          |

### Principal dimensions in the corpus – by year

Dimensions of the byYEAR partition in the CSRI 29 corpus  
17 Part(s)



### Bar chart of corpus size by year (in words)

| total     | 2003   | 2004   | 2005   | 2006   | 2007   | 2008    | 2009    | 2010    |
|-----------|--------|--------|--------|--------|--------|---------|---------|---------|
| 9 489 733 | 62 207 | 71 116 | 89 396 | 95 993 | 82 135 | 214 108 | 523 169 | 358 299 |
| in %      | 0,7%   | 0,7%   | 0,9%   | 1,0%   | 0,9%   | 2,3%    | 5,5%    | 3,8%    |

| 2011    | 2012      | 2013    | 2014    | 2015      | 2016    | 2017    | 2018      | 2019    |
|---------|-----------|---------|---------|-----------|---------|---------|-----------|---------|
| 846 415 | 1 025 173 | 914 077 | 949 240 | 1 162 799 | 912 198 | 917 574 | 1 038 659 | 227 175 |
| 8,9%    | 10,8%     | 9,6%    | 10,0%   | 12,3%     | 9,6%    | 9,7%    | 10,9%     | 2,4%    |

## **Appendix 2 what's in a name? how name and title of CSR report change**

### **AEP, American Electric Product, CORPORATE ACCOUNTABILITY REPORT**

- 2006 CSR report, working together for a brighter future (54p)
- 2008 CSR report, untitled (68p)
- 2009 CSR report, untitled (56p)
- 2010 from now on Corporate Accountability Report, untitled (56p)
- 2011 Transforming Our Business for Sustainable Growth (54p)
- 2012 transition accountability performance (56p)
- 2013 powering America's future (115p)
- 2014 building the utility of the future (145p)
- 2015 Powering the future (155p)
- 2016 the power of diversity (112p)
- 2017 the power to shape the future (101p)
- 2018 shaping a brighter energy future together (111p)
- 2019 boundless energy future (128p)

### **DUKE Energy, naming of Sustainability reports**

- 2006/2007 our path forward
- 2007/2008 Building bridges to a low-carbon future
- 2008/2009 Redefining our boundaries
- 2009/2010 What is simple about providing Affordable, reliable and clean energy
- 2010/2011 Delivering today. Investing for our future
- 2011/2012 well positionned
- 2012 – different format
- 2013 Lighting the way
- 2014 Connected
- 2015 generation/next
- 2016 bringing the future to light
- 2017 building a smarter energy future
- 2018 transforming the future

### **EDF naming of « document de reference »**

- 2007 no specific name (449p)

- 2008 Leading the energy change (484p)
- 2009 no specific name (508p)
- 2010 no specific name (524p)
- 2011 no specific name (532p)
- 2012 no specific name (496p)
- 2013 no specific name (524p)
- 2014 no specific name (555p)
- 2015 no specific name (510p)
- 2016 no specific name (538p)
- 2017 no specific name (508p)
- 2018 no specific name (532p)

But cover illustration of EDF 20reports from 2015 to 2018, showing change in focus.

#### **EDP, Energias de Portugal SA, titles of annual reports**

- 2009 all we need is earth, annual report
- 2010 smart energy world, annual report
- 2011 a better energy, a better future, a better world.
- 2012 a world full of energy, annual report
- 2013 neverending energy, annual report
- 2014 energy that makes a difference, annual report. With undertitle TRANSFORM, IMPROVE, MAKE THE WORLD MOVE
- 2015 energy with intelligence, annual report
- 2016 energy as the new art, annual report
- 2017 the living energy book, Sustainability Report
- 2018 we love energy, Sustainability Report

#### **GDF-SUEZ then ENGIE naming of integrated reporting**

- 2011 Registration Document including annual financial report. By people for people (484p)
- 2012 Registration Document including annual financial report. By people for people (412p)
- 2013 Registration Document including annual financial report. By people for people (404p)
- 2014 Registration Document including annual financial report. By people for people (408p)
- 2015 Registration Document including annual financial report (388p)

- 2016 Integrated Report A new vision of the energy world (52p)
- 2017 Committed to the energy transition(56p)
- 2018 Integrated reporting (52p)

### **E.ON naming of sustainability reports**

- 2004 energy efficiency engagement
- 2005 successful business, responsible choices
- 2006 changing energy
- 2007 part of the problem or part of the solution: addressing our energy challenges
- 2008 A New Path in CR Reporting (133p)
- 2009 E.ON CR report. committed to excellence. (142p)
- 2010 E.ON CR report. Taking responsibility and shaping the future. (155p)
- 2011 sustainability report. Shaping Sustainable Change (129p)

In May 2012, E.ON AG published its eighth Sustainability Report (the term “Sustainability” has been used in the title since 2012 – formerly “Corporate Responsibility”).

- 2012 sustainability report. Cleaner & better – Sustainability at E.ON (197p)
- 2013 sustainability report. (259p)
- 2014 sustainability report. (204p)
- 2015 sustainability report. (217p)
- 2016 sustainability report. (173p)
- 2017 sustainability report. (137p)
- 2018 sustainability report. Can we make energy more sustainable? The challenge is .on (112p)

### **ESKOM naming of integrated reporting**

- 2012 shift in performance, grow sustainable (166p)
- 2013, shift in performance, grow sustainable (140p)
- 2014 same, shift in performance, grow sustainable (96p)
- 2015 report with no name (128p)
- 2016 powering your world (76p)
- 2017 achieving sustained success (80p)
- 2018 same, achieving sustained success (80p)
- 2019 report with no name (95p)

### **IBERDROLA naming of sustainability reports**

- 2011 Sustainability Report. A comprehensive focus on IBERDROLA's economic, social and corporate governance performance (255p)
- 2012 Sustainability Report. A comprehensive focus on Iberdrola's economic, environmental, social and corporate governance performance (221p)
- 2013 Sustainability Report. A comprehensive focus on Iberdrola's economic, environmental, social, and corporate governance performance (202p)
- 2014 sustainability report (266p)
- 2015 sustainability report (246p)
- 2016 sustainability report (272p)
- 2017 sustainability report (336p)
- 2018 Statement of Non-Financial Information Sustainability Report 2018 (414p)

### **PGE naming of Corporate Social Responsibility reports**

- 2003 1<sup>st</sup> annual CSR report (99p)
- 2004 CSR report (104p)
- 2005 CSR report (77p)
- 2006 CSR report (84p)
- 2007 CSR report executing on our vision (86p)
- 2008 CSR report how we are creating a smarter foundation for a sustainable future (96p)
- 2009 CSR report working collaboratively to find the right balance for a more sustainable future (123p)
- 2010 CSR report recommitting and refocusing for the Journey Ahead (203p)
- 2011 CSR report building a stronger foundation for the future Sustainability Journey (225p)
- 2012 CSR report progressing through performance (288p)
- 2013 CSR report local people, long term commitment 199p)
- 2014 NA
- 2015 CSR report together building a Better California (168p)
- 2016 CSR report together building a Better California (165p)
- 2017 CSR report together building a Better California (167p)
- 2018 CSR report together building a Better California (187p)

## **RWE naming of CSR reporting**

- 1998 environmental report 1998 (104p)
- 2003 and onwards Corporate responsibility report. no specific title (48p)
- 2005 corporate responsibility report (88p); with: “The present report follows on from our Environmental reports of 1998, 2000 and 2001 and from the first report on “Corporate Responsibility”
- 2006 corporate responsibility report (28p)
- 2007 corporate responsibility report (88p)
- 2008 and onwards Our Responsibility report
- 2008 the energy to lead (32p)
- 2009 the energy to lead. Make good things happen for society (104p)
- 2010 embracing challenges (70p)
- 2011 the energy to lead sustainably (142p)
- 2012 empowering sustainable energy transition (155p)
- 2013 earning trust shift (83p)
- 2014 no specific name (96p)
- 2015 securing the future (104p)
- 2016 powering. Reliable. Future. (77p)
- 2017 same: powering. Reliable. Future. (92p)
- 2018 same: powering. Reliable. Future. (98p)

## **SSE PLC naming of sustainability reports**

- 2015 Meeting social, environmental and economic responsibilities. Being Responsible (19p)
- 2016 Providing energy in a reliable and sustainable way (20p)
- 2017 Providing more than energy (28p)
- 2018 Creating value in a sustainable way (39p)
- 2019 For a better world of energy (39p)

## **VATTENFALL naming of reports, from CSR report to annual and sustainability report**

- 2004 CSR – corporate social report, named expectations and performance (94p)
- 2005 CSR – corporate social report, named expectations and performance (86p)
- 2006 inside Annual results, named creating value for the future (122p)
- 2007 inside Annual results, named power for renewables (134p)

2008 onwards the name becomes CSR report

2008 what we want > what we do > what we have achieved 90p

2009 CSR, no specific name (90p)

2010 CSR, no specific name (80p)

2011 onwards both CSR report. performance report

2011 towards sustainable energy (37p)

2012 Annual report including sustainability report, a new energy landscape (125p)

2013 onwards Annual and sustainability report

2013 continued positioning for tomorrow's energy market (137p)

2014 towards a more sustainable energy portfolio (162p)

2015 energy you want (174p)

2016 power climate smarter living (186p)

2017 fossil free within one generation (192p)

2018 same, fossil free within one generation (184p)

### Appendix 3 mission vision statements as of first year available in the corpus

Many companies issue an identity card in the form of a statement on their missions, vision, values. While this is not systematic, and also varies across time, it is a good observation point of key elements declared in strategy by companies. It will serve as one entry point on discourse analysis, to see how close or diverse strategies energy companies declare.

Hereafter is a table of key concepts used across companies. followed by text in 2008 or before when available information of content about mission, vision, values as they are declared. There are first presented in a raw text format for easy comparison, then as they are presented in the report, to show evidence of layout used. The latter is a hint of how formal, inventive, specific they present these elements.

#### Comparison table

(11 companies, excluding SSE which has reports starting only in 2015)

|             |  |
|-------------|--|
| AEP         | operate, responsible, efficient, profitable  |
| DUKE ENERGY | “path forward”, operations, identity and culture, reliable, “cost management”, investment, “financial position”,                   |
| EDF         | Leadership, competitive advantage, energy efficiency, renewable, investment,   |
| EDP         | provider, leader, creating value, innovation, sustainability, EARTH  |
| E.ON        | Changing, integrated, competitive advantage, clear, strengthen, expand   |
| ENGIE       | Accelerate, development, strengthen, refocus, streamline, reinforce, secure, cash flows  |
| ESKOM       | performance, grow, sustainably, leading, partnering, reducing, securing, implementing, pursuing                                    |
| IBERDROLA   | Deploy, ensure, clean energy, development, renewable, improve environmental, downward trend in emission, fuel consumption, produce |
| P G and E   | deliver safe, reliable, and affordable Responsive, producer, provider, vital infrastructure  |
| RWE         | Supplier, operate, sensitive, markets, offer, maximize, performance, environmental, product, services                              |
| VATTENFALL  | leading, profitable, growth, create value,   |

**Main terms cited in the first elements of strategy, for each company.  
(no particular order)**

**AEP (USA) operate, responsible, efficient, profitable**

**Title of the report « working together for a brighter future, Corporate Responsibility report 2006**

Corporate vision: “Our corporate vision is to maintain our leadership as the largest generation and transmission company in the United States, as the largest electric distribution business throughout the regions we serve and to maintain our leadership in technical innovation of power systems, environmental technology, transmission systems and customer service”

quote : “operating responsibly, efficiently and profitably for customers, shareholders, employees and communities.

Detail on Climate change challenges p44 (2006)

## Climate Change

We are committed to reduce or offset approximately 46 million metric tons of carbon dioxide equivalent emissions between 2003 and 2010. This is a 6% reduction below our baseline (average 1998-2001 levels). Although legally binding, these are voluntary reductions and it is uncertain how they will be treated under anticipated climate legislation.

We will continue to take actions to meet our CCX commitment through 2010 through a broad portfolio of actions:

- Power plant efficiency improvements.
- Renewable generation such as wind and biomass co-firing.
- Off-system GHG reduction projects.
- Reforestation projects.
- Direct purchase of emission credits through our involvement with CCX.

Through 2006, we reduced or offset CO<sub>2</sub> emissions of approximately 31 million metric tons through:

- Improving efficiency of existing power plants.
- Adding wind generation.
- Improving availability and capacity of the Cook Nuclear Plant.
- Retiring older and less efficient gas steam and coal units.
- Reducing leakage rate of SF<sub>6</sub> gas from transformers.
- Planting trees and reforesting land.

If no further actions are taken, AEP projects emissions will increase by approximately 10 million to 15 million metric tons between 2010 and 2020, as four new generating plants are built. With climate legislation on the horizon, we must be ready to address this emissions growth.

We will be actively engaged in the climate change policy debate.

We will be positioned to adapt to climate policy because of our investments in technology and in other actions to reduce, avoid or offset GHGs. These include:

- Bringing new carbon capture and storage technologies to commercial operation.
- Investing in other clean-coal technologies, including IGCC and USC.
- Increasing renewable forms of energy, including wind and biomass.
- Investing in offsets such as tree planting, methane capture and destruction, fleet and aviation offsets and market-based credit purchases.
- Working with regulators and policy-

AEP developed a strategy to reduce approximately 5 million metric tons of carbon dioxide equivalent emissions per year, as follows:

- 2 million from wind power purchase agreements.
- 2 million from domestic offsets.
- 500,000 from increases in forestry and other offsets.
- 200,000 from fleet and aviation offsets.

An additional 1.5 million metric tons will be reduced when carbon capture and storage is in service at our Northeastern Station.

### **DUKE ENERGY (US) path forward, operations, identity and culture, reliable, cost management, investment, financial position**

Name of the report is 2006/2007 SUSTAINABILITY REPORT, undertitle is “our path forward”. It is the first sustainability issued by the company.

Opening page contains targets for 2007

“To be successful in 2007 and beyond, we must:

Establish the identity and culture of the new Duke Energy, unifying our people, values, strategy, processes and systems

Optimize our operations by focusing on safety, simplicity, accountability, inclusion, customer satisfaction, cost management and employee development

Achieve public policy, regulatory and legislative outcomes that balance our customers’ needs for reliable energy at competitive prices with our shareholders’ expectation of superior returns

Invest in energy infrastructure that meets rising customer demands for reliable energy in an energy efficient and environmentally sound manner

Achieve 2007 financial objectives and position the company to meet future growth targets “

in the key terms p5, definition of greenhouse gas and obligation for the company. This verbatim is very interesting seen not with 2006 eyes, but today.

**Greenhouse Gases and Climate Change** The greenhouse effect is a naturally occurring phenomenon, keeping the earth hospitable to life by trapping heat. Carbon dioxide and many other gases exhibit “greenhouse” properties. Some of them occur naturally while others are exclusively man-made.

Recent research – accepted by a growing majority of scientists and policymakers – indicates that human activity has increased the concentrations of these greenhouse gases and contributed to the rise in global average temperatures. To avoid the worst effects of climate change, greenhouse gas concentrations in the atmosphere need to be stabilized, then reduced.

**EDF (F) Leadership, competitive advantage, energy efficiency, renewable, investment**

Name of the report is “document de reference” for year 2009

It is a translated report, part of obligation for listed companies in France .

French Document de Référence filed with the Autorité des marchés financiers (the “AMF”). It is about 500p long, and was cut in two for import into TXM by taking out the second part on financials.

| <b>Business overview</b>  |           |
|---|-----------|
| <b>6.1 Strategy</b>   | <b>38</b> |
| 6.1.1 <i>Reinforce its European leadership and long-term competitive advantages</i>                   | 38        |
| 6.1.1.1 In France   | 38        |
| 6.1.1.2 In Europe   | 39        |
| 6.1.1.3 Gas   | 39        |
| 6.1.1.4 Program for improvement of operational performance  | 40        |
| 6.1.2 <i>Promote energy efficiency, renewable sources, and environmentally efficient technologies</i> | 40        |
| 6.1.3 <i>Be a major player in the global revival of nuclear energy</i>                                | 40        |
| 6.1.4 <i>Investment policy</i>  | 41        |
| 6.1.4.1 Investments in 2009   | 41        |
| 6.1.4.2 Investments in 2010   | 41        |
| 6.1.4.3 Investments in the new nuclear program by 2020  | 41        |

Table content of the business overview (p36)

Together with an overall statement on investment : (p38)

“This global context and the priorities defined at a European level concerning energy security and reducing emissions of greenhouse gases require to invest both upstream (by giving priorities to technologies emitting little CO<sub>2</sub> or “low carbon”) and downstream (control of energy demand via more efficient use and shared development of decentralized renewable sources). Nuclear power, which can combine competitiveness with self-sufficiency and low CO<sub>2</sub> emissions, is now proving to be an essential element of the future energy

mix, both in France and in many other parts of the world, as demonstrated by the political will aiming at extending the operational life of nuclear power plants or the projects for building new nuclear plants.

### **EDP (Portugal) “all we need is earth”**

**Annual report for the year 2009 is titled “all we need is earth”.** EDP is often using very imaginative wording.

The introduction page, just after “All we need is earth” states:

“Mother Earth is the source of all our energy.

For her sake, we believe that the future is generating cleaner energy.

For her sake, we are at the cutting edge of sustainable development.

For her sake, we use the most advanced technologies.

For her sake, we are us.”

Vision definition on page 10 is: “A global energy providing company, leader in creating value, innovation and sustainability”

with 5 core values : “Trust of shareholders, customers, suppliers and other stakeholders.

Excellence In the way we implement.

Initiative Demonstrated through behaviour and attitude of our people. Innovation With the objective of creating value within the various areas in which we operate.

Sustainability Aiming at improving the quality of life of current and future generations. “

And together with vision and values come commitment list

“with commitments to : customers, values, sustainability, results”



EDP P10 of annual report 2009

### **E.ON (D) “changing energy”**

Corporate social Responsibility is labelled for 2006 “changing energy”

The labelling of the year corresponds to selection of a theme for E.ON on change and impacts is has :” The theme of this year’s report is “Changing Energy” to reflect the many ways in which our

industry is changing. Energy markets worldwide are tight, with energy resources becoming scarcer and the global competition for them fiercer. Energy prices have risen in the past few years. We believe that one of our most important tasks is to make a substantial contribution to securing Europe’s supply of energy at a fair price level. At the same time, climate change has become one of the biggest challenges of our time. That’s why we support the ambitious goals of the European Union, which has become a pacesetter in climate protection. »

corporate strategy is made of 4 elements :

Integrated power and gas business:

Clear geographic focus: Size is a decisive competitive advantage in the energy business

Clear strategic priorities: Our primary objective is to strengthen and expand our position in Europe

Strict investment criteria: (strategic and financial)

**ENGIE, former GdF Suez, “by people for people”**

First retrieved report dates from 2011. It is “registration document for 2011”. The under title is “by people for people”

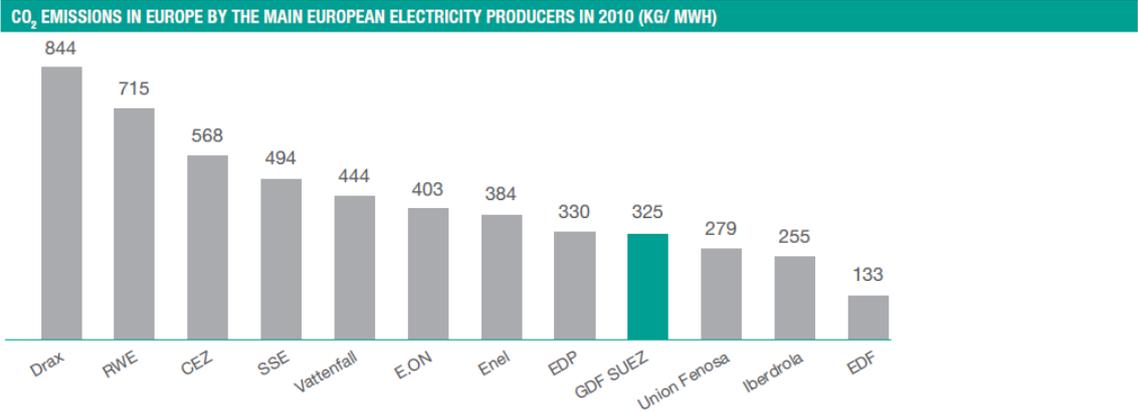
Strategy section p10 presents 3 priorities

“The Group’s strategic priorities include:

- accelerating its development in the emerging world, in both power generation and upstream gas (exploration-production and LNG);
- strengthening the integration of its electric and gas activities and
- refocusing and streamlining its portfolio of assets in Europe;
- reinforcing activities that generate secure yields and recurring cash flows (infrastructure, energy services, environment).”

GDF SUEZ presents itself as low carbon producer : in the key figures (p15) – graph included without analysis

“The Group’s centralized power generation fleet has a low carbon footprint, with an average 325 kg CO<sub>2</sub>/MWh recorded for Europe in 2010, below the 337 kg/MWh European average estimated by PricewaterhouseCoopers (PwC). Worldwide, at the end of 2010, the Group’s assessed power plant emissions were 351 kg/mwh.”



Source: climate change and electricity – European carbon footprint – PwC – November 2011 (European emissions from electricity production).

**P 16 registration document GDF SUEZ 2011 – comparison of carbon content for European utilities**

**ESKOM “Shift performance, grow sustainably”**

Title of the report “Shift performance, grow sustainably. Integrated Report” for the year ended 31 March 2012

## Eskom's purpose, values and strategic objectives



**the company structure is very organised (5 pillars like a Greek temple) :**

leading and partnering to keep the lights on

reducing our carbon footprint and pursuing low-carbon growth opportunities

securing future resource requirement, mandate and the required enabling environment

implementing Implementing coal haulage and the road-to-rail migration plan pursuing

pursuing private sector participation

to be noted that “triple bottom line” is not advertised by most of other utilities

to be noted that “sinobuntu” specially selected by South Africa is probably a hapax in the corpus without any other use.

**IBERDROLA (Spain) deploy, ensure, maintain, improve**

Report is labelled “sustainability report 2011”, with undertitle very factual:

A comprehensive focus on IBERDROLA’s economic, social and corporate governance performance

Three main priorities (p12) and table associated

1 Deploy clean energy development strategies, maintaining world leadership in renewable energy

2 Ensure that the Company complies with advanced corporate governance policies and recommendations

3 Maintain downward trends in emissions and fuel consumption per unit of energy produced, and further develop biodiversity plans

4 Improve environmental, quality and labour relations certification levels

5 Foster corporate responsibility measures in the value chain

6 Advance the development of measures fostering good labour relations, promoting the integration of persons, their training, and their sensitivity regarding diversity

Example for item #1 and #3 (p12)

| Deploy clean energy development strategies, maintaining world leadership in renewable energy   |   |
|--|---|
| Main Activities - 2011   | Activities over the medium term   |
| <ul style="list-style-type: none"> <li>Emission-free production: 48.8 %, compared to 47.8 % in 2010.</li> <li>Installed renewable energy capacity: 29.7 %, compared to 27.9 % in 2010.</li> <li>Offshore wind energy development strategy, with projects currently under development (5,580 MW), especially in the United Kingdom and Germany.</li> </ul>  | <ul style="list-style-type: none"> <li>Develop portfolio of renewable energy facilities.</li> <li>Develop hydroelectric facilities.</li> <li>Develop a methodology for eco-design in infrastructure elements (e.g., substations).</li> </ul>  |
| Maintain downward trends in emissions and fuel consumption per unit of energy produced, and further develop biodiversity plans   |   |
| Main Activities - 2011   | Activities over the medium term   |
| <ul style="list-style-type: none"> <li>Specific CO<sub>2</sub> emissions: 248 t/GWh, compared to 258 t/GWh in 2010.</li> <li>Emissions avoided due to efficiency initiatives: 37,462 kt of CO<sub>2</sub>, compared to 25,188 kt in 2010.</li> <li>Publication of the <i>2009-2010 Biodiversity Report</i>.</li> <li>Emissions inventory audited in accordance with ISO 14064 standard.</li> </ul> | <ul style="list-style-type: none"> <li>Goal to reduce emissions by 30 % from 2007 levels.</li> <li>Maintain commitment to energy efficiency at the global level.</li> <li>Inclusion of supplier chain in IBERDROLA's <i>Carbon footprint</i>.</li> <li>Development of a methodology to assign economic value to ecosystemic services and the impact on biodiversity.</li> </ul> |

**Pacific Gas and Electric (USA) safe, reliable, affordable**

“first annual corporate responsibility report” in 2003 (p1)

Introduction sentence: “Practicing corporate responsibility means understanding and balancing social, environmental and economic considerations in a way that allows us to meet business objectives, respect stakeholders, and stay true to our values.”

Very clear presentation of the company from a stakeholder perspective (p1)

Our company is:

- a producer and supplier of energy to about 5 percent of the United States population,
- a neighbor in thousands of communities,

- a provider of basic, essential services,
- a builder and custodian of vital infrastructure,
- a major employer, and
- a shareholder-owned company.

Overall statement p 5 :

PG&E's primary responsibility is to deliver safe, reliable, and affordable energy to the more than 14 million people that live and work in communities throughout northern and central California. We are mindful that we not only provide a vital service to these communities, but that we are also a part of them by virtue of our employees, our shareholders, and our customers.

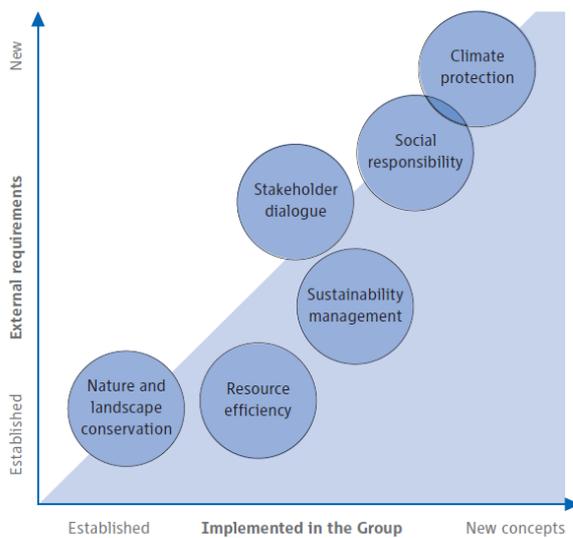
### **RWE responsibility supplier, operate, offer, maximize, product and services**

Report for 2003 is called “corporate responsibility report”. With the years RWE is relabelling it “our responsibility report” which then stands in this form.

Principal definition of strategy (p7) shows how the company defines its core principles:

“RWE is a world-leading supplier of energy, water and environmental services. As a result, the company operates in sensitive markets, seeking to offer secure supplies and maintain affordable prices, while offering environmentally-friendly products and services and maximizing performance. In the electricity and gas utility sectors, RWE focuses on Europe, where liberalization is rewriting the rule book. By contrast, the company conducts its water business in both industrialized and newly industrializing countries. Countries where the private sector is now involved in the delivery of services that were once provided by the State have opened up new windows of opportunity for RWE. However, any arrangements involving the private sector are naturally scrutinized to ascertain whether they are capable of ensuring secure supplies to broad segments of the population over the long term. Therefore, RWE must deliver goods and services required to fulfill vital needs affordably, while living up to its social responsibilities and meeting the capital market’s demands. »

Fields of activity promoting sustainable development at RWE



**Figure on (p8) defining how to achieve sustainability**

Here it is quite noticeable that climate protection is ranked in the new topics (2003); and also presented with climate protection sharing some intersection with social responsibility.

15 years later it would be very improbable that any company ranks climate protection in the new issues.

**SSE and its “SSE’s responsible house”**

SSE is for reference only; since the first report available was 2015. We consider that 2015-2018 cannot be used for observation on how the company changes focus, but can contribute to the diversity of the company sample.

Title of report is “being responsible. Report 2015” – with undertitle :“meeting social, environmental and economic responsibilities”

Summary of SSE vision is a “SSE’s responsible house” house (p4), where responsibility is declined into 9 dimensions :

- Responsible service provider Doing more to provide essential services reliably and affordably
- Responsible Operator Producing and delivering safe and secure energy in the best way we can
- Responsible developer Going further than we have to, for the benefit of local stakeholders
- Responsible employer Creating sustainable employment and a great place to work
- Responsible community member. An active contributor to the communities we are part of
- Responsible buyer Procuring what we need in the right way
- Responsible profit Earning profits that serve a purpose
- Responsible investment Focusing on the long term and accounting for all our impacts
- Responsible governance Transparent about doing what is right

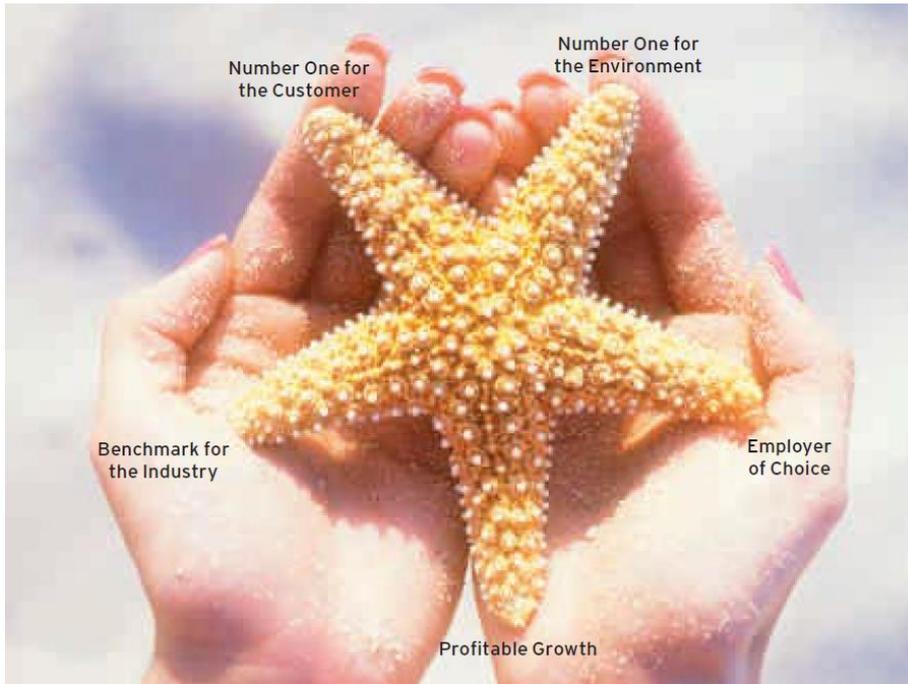
# SSE's 'Responsible House'



4

**VATTENFALL “creating value for the future”**

P5 summary of value creation “VALUE CREATION IS A PREREQUISITE FOR ACHIEVING OUR VISION TO BE A LEADING EUROPEAN ENERGY COMPANY



(p5) summary of strategy

To achieve our vision, we have embraced five strategic ambitions: Profitable Growth, Number One for the Customer, Number One for the Environment, Benchmark for the Industry and Employer of Choice. Achieving this vision requires that we continuously create economic value in our operations. These five strategic ambitions make up the core of Vattenfall's work on realising this value. At the same time, value creation is essential for Vattenfall's long-term ability to invest in new, sustainable energy production. In 2006 we continued to improve our earnings and are now focusing even more clearly on achieving our vision: to be a leading European energy company

#### **Appendix 4 mission vision statements in 2018**

Many companies issue an identity card in the form of a statement on their missions, vision, values. While this is not systematic, and also varies across time, it is a good observation point of key elements declared in strategy by companies. It will serve as one entry point on discourse analysis, to see how close or diverse strategies energy companies declare.

Hereafter is a table of key concepts used across companies, followed by text in 2018 of content about mission, vision, values as they are declared. There are first presented in a raw text format

for easy comparison, then as they are presented in the report, to show evidence of layout used. The latter is a hint of how formal, inventive, specific they present these elements.

**Comparison table**

| AEP         | Future                   | Change                | innovation     |
|-------------|--------------------------|-----------------------|----------------|
| Duke Energy | Safety                   | Affordable            | Climate action |
| Edf         | Responsible              | Proximity             | rebalancing    |
| EDP         | Value                    | Innovation            | sustainability |
| E.ON        | Decarbonisation          | Decentralisation      | digitalisation |
| ENGIE       | Ambition                 | Transformation        | Value creation |
| Eskom       | Financial sustainability | Drive economic growth | Social impact  |
| Iberdrola   | Sustainable energy       | Integrating force     | Driving force  |
| PG&E        | Affordable               | Clean                 | sustainable    |
| RWE         | Powering                 | Reliable              | future         |
| SSE         | Affordably               | Sharing value         | Low carbon     |
| Vattenfall  | Power climate            | Smarter living        | Fossil free    |

On this sample, only 2 issue a formal vision mission statement, and 2 other issue part of it. All other have strategy sections, business outlook, summary, or framework giving guiding principles.

**AEP no statement ; proxy is the conclusion of CEO’s message**

**Title is WORKING FOR A BRIGHTER FUTURE**

We are excited about the future and the promise it holds for our customers, employees and shareholders. We know it will look nothing like our past. The disruptive changes to our business are not unique to our company or even our industry. But we are embracing change because our future success demands it. Change creates new opportunities, transforms companies and ignites growth. All are either happening now or are at our doorstep.

Fundamental to our agility and ability to adapt to the seismic changes we face is to reimagine what a leading energy company of the future looks like. And that’s why we’re coming together with our customers and our communities to help define and shape it so we can all be successful. The spirit of innovation and ingenuity at AEP is stronger than ever. Our new Innovation Hub is a leading example of sharing knowledge, learning together in a relentless pursuit of making what seems impossible, probable – settling for nothing less than excellence.

Our attention to nurturing an engaged, open, collaborative and inclusive culture is foundational to achieving our goals. We are making good progress every year. We want a diverse workforce and an environment where everyone looks forward to coming to work every day and can contribute in every way possible. We will be relentless in our pursuit of Zero Harm because we truly care about each other. And we will always keep our customers at the center of every decision we make and action we take

We have laid a strong foundation for the future. We will continue to advocate for our customers, strengthen our relationship with them and deliver on our promise of an exceptional customer experience. We will not relent in our responsibility to provide universal access to the grid because that is how we contribute to improving quality of life for everyone.

AEP will be the model of what society should look like in the future. Much like an orchestra makes music by listening to each other and working together, we know that achieving harmony as we execute our strategy for the future requires constant coordination of diverse interests. I am confident that the men and women of AEP are up to the challenge and we will put boundless energy to work every day to build a brighter future for us all.

### **DUKE ENERGY “what matters most”**

No statement on mission, vision, but words are present.

A specific section (p10 and 11) named **What Matters Most**

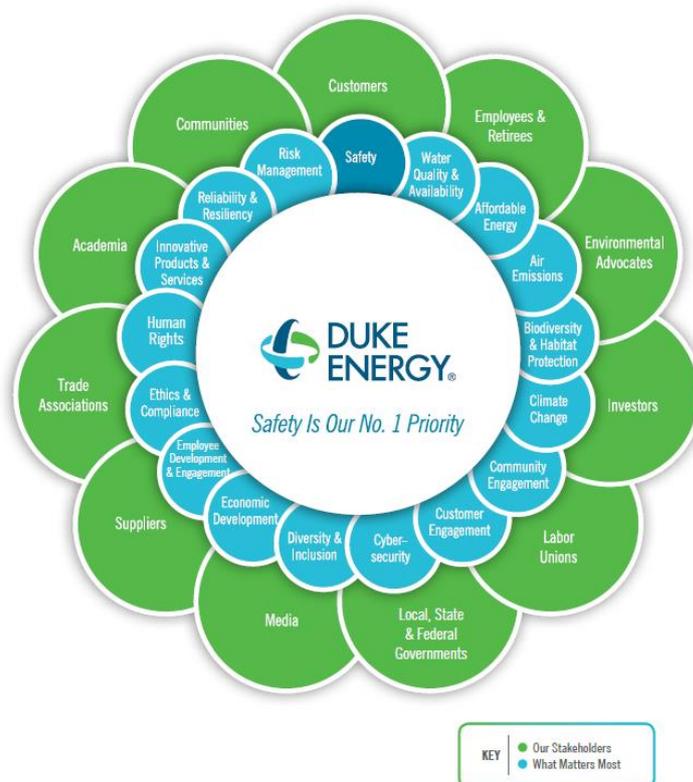
Duke Energy’s approach to sustainability focuses on the issues that are most important to our stakeholders and to us. We identify issues from a variety of sources such as stakeholder feedback, surveys, thought leader perspectives, social and traditional media coverage, and shareholder proposals in our sector.

We have mapped our priority issues to the United Nations Sustainable Development Goals (SDGs), which aim to “end poverty, protect the planet and ensure prosperity for all.” Since their development in 2015, the 17 SDGs have gained traction with stakeholders concerned about sustainability issues. While there was alignment between our priorities and several of the SDGs, goals “Seven: Affordable and Clean Energy,” and “Thirteen: Climate Action,” are especially applicable to our company.

The graphic depicts the relationship among Duke Energy, its stakeholders and the most important issues as overlapping circles within circles to show that they are interconnected. The stakeholders and issues are both arranged alphabetically to make it clear that they are all important while safety, as always, is our No. one priority.

## OUR STAKEHOLDERS AND WHAT MATTERS MOST

CONTINUED



P11 of DUKE ENERGY 2018 – in green stakeholders, in blue “what matters most”

### EDP vision and commitments

#### **edp vision, values and commitments (p10)**

commitments vision A global energy providing company, leader in creating value, innovation and sustainability. commitment with persons We join conduct and professional rigour to enthusiasm and initiative, emphasizing team work. We promote the development of skills and merit. We believe that the balance between private and professional life is fundamental in order to be successful. commitment with customer We place ourselves in our Customers’ shoes whenever a decision has to be made. We listen to our Customers and answer in a simple and clear manner. We surprise our Customers by anticipating their needs. commitment with sustainability We assume the social and environmental responsibilities that result from our performance thus contributing toward the development of the regions in which we are operating. We reduce, in a sustainable manner, specific greenhouse gas emissions from the energy we produce. We actively promote energy efficiency. commitment with results We fulfil the commitments that we embraced in the presence of our shareholders. We are leaders due to our capacity of anticipating and implementing. We demand excellence in everything

that we do. values of shareholders, customers, suppliers and other stakeholders. In the way we implement. Aiming at improving the quality of life of current and future generations. With the objective of creating value within the various areas in which we operate. Demonstrated through behavior and attitude of our people. Trust Initiative Excellence Sustainability Innovation

**vision**

A global energy providing company, leader in creating value, innovation and sustainability.

**values**



**commitments**

**commitment with persons**

- We join conduct and professional rigour to enthusiasm and initiative, emphasizing team work.
- We promote the development of skills and merit.
- We believe that the balance between private and professional life is fundamental in order to be successful.

**commitment with customer**

- We place ourselves in our Customers' shoes whenever a decision has to be made.
- We listen to our Customers and answer in a simple and clear manner.
- We surprise our Customers by anticipating their needs.

**commitment with sustainability**

- We assume the social and environmental responsibilities that result from our performance thus contributing toward the development of the regions in which we are operating.
- We reduce, in a sustainable manner, specific greenhouse gas emissions from the energy we produce.
- We actively promote energy efficiency.

**commitment with results**

- We fulfil the commitments that we embraced in the presence of our shareholders.
- We are leaders due to our capacity of anticipating and implementing.
- We demand excellence in everything that we do.

10

**EDF orientation under “CAP 2030” framework**

No specific statement on Mission, Vision, Values, but general statement on where the company is heading to. This is labelled as a framework, “CAP 2030”

**1.3.2 PRIORITIES OF THE CAP 2030 STRATEGY**

To be a responsible and efficient electricity producer that champions low carbon growth: this is the goal of the EDF group, driven by the CAP 2030 strategy. This is broken down into three priorities:

- proximity to customers and local communities;
- low carbon generation by rebalancing the mix between nuclear and renewable energy;
- international expansion.

Several strategic workshops have been conducted since 2015, translating each of these three strategic priorities.

This goal will also be achieved through a transformation programme based on simplification, innovation and digital technology, accountability and performance, human ambition and skills.

As a part of CAP 2030, the EDF group has made a commitment to six Corporate Responsibility Goals (see section 3.1 “EDF's commitments in the area of sustainable development”). In particular, engaged in combating global warming with one of the lowest carbon generations in Europe, EDF took the commitment in 2018 to reduce its direct CO<sub>2</sub> emissions by 40% by 2030 (with a target of 30 million tonnes in 2030 compared with 51 million tonnes in 2017) and to be in keeping with the goal of carbon neutrality by 2050.

#### **1.3.2.1 Proximity to customers and local communities**

In order to support customers and local communities in their energy transition, the EDF group aims to create new competitive decentralised solutions, new customised low-carbon energy services and smart grids, based on three levers:

##### **The development of energy efficiency solutions and new digital services for its customers**

EDF deploys and develops its “EDF Solutions énergétiques” brand, created in 2017, to promote its range of solutions offered by its specialised subsidiaries (Dalkia, Citelum, IZIVIA, Edelia, Netseenergy, Fenice). Low-carbon heating networks, smart lighting, waste recovery, electric mobility: the range is complementary, innovative and meets the new challenges of local communities and businesses alike. For example, at the local level, with the Citelum's intelligent platform MUSE©, the “Dijon Métropole” urban area will benefit from the centralised management of all its equipment and public services. In Belgium, the consortium led by Citelum with EDF Luminus, DIF and CFE was awarded a Public Private Partnership for the smart lighting of major motorways in Wallonia.

As for residential customers, the EDF group offers and continues to develop a range of digital energy services, marketed in France and in the “core European countries” (United Kingdom, Italy, Belgium). For example in 2016, the launch of Soweel (a subsidiary offering innovative connected home products and solutions, that was further diversified in 2017 and 2018) reflects the EDF group's commitment to meeting the new expectations of its customers, especially with regard to sustainable wellbeing in the home. Existing offerings and customer relations will also continue to be enriched by new digital technologies and features, facilitated in particular by smart meter systems deployed in several countries.

##### **Support to the development of new efficient uses of electricity to replace fossil fuels (electric mobility, self-consumption, heat pumps, low carbon housing, etc.)**

The EDF group aims to be a key player in self-consumption in the French market and is highly committed to the development of electric mobility with the announcement on 10 October 2018 of its Electric Mobility Plan, which sets out concrete targets for four of the Group's markets (France, United Kingdom, Italy and Belgium). Electricity storage is a key area of innovation for energy transition. The Group's Electricity Storage Plan, announced on 27 March 2018,

provides for the development of 10GW of new storage facilities in the world by 2035 (6GW of large-scale storage, 4GW of dispersed storage), increasing the Group's storage capacity by then to 15GW.

### **R&D and innovation**

The EDF group is intensifying research and development in storage, solar energy, electric mobility, smart electricity systems and sustainable local energy solutions (smart cities).

It is also increasing its innovation efforts to meet the expectations of its customers and offer solutions and services adapted to the new consumption patterns and based on increasingly digital means of communication. These efforts contribute to the development of the Group's projects. With “EDF Pulse Expansion”, an incubator for in-house and external projects, EDF is testing and exploring new business sectors, creating new growth drivers for the Group and offering customers a new range of innovative products and services.

Lastly, the deployment of the Linky (1) smart meters, the development of renewable energies and electric mobility, and the emergence of cities actively involved in their local energy choices, are putting distribution networks at the forefront of the transformation of the electricity system. The distributor thus plays a key role as facilitator of the energy transition. In this respect, Enedis and EDF have established with the national federation of licensing authorities (FNCCR) and the association France Urbaine, a new draft concession contract for the public distribution of electricity and the supply of electricity at regulated tariffs, in order to modernise relations with the concession contracting authorities. This contract integrates regional changes and the energy transition, while retaining the principles of the French concessionary model: public service, regional solidarity and nationwide optimisation.

#### **1.3.2.2 Very low carbon generation: nuclear and renewable energies**

EDF's nuclear facilities are already giving France a major lead compared to its neighbours in terms of curbing greenhouse gas emissions, while still ensuring a highly competitive electricity cost.

To remain the leader in very low carbon electricity generation, the EDF group is intensifying the development of renewable energies while ensuring the safety, performance and competitiveness of the existing nuclear facilities and New Nuclear investments.

#### **Consolidation of the asset base**

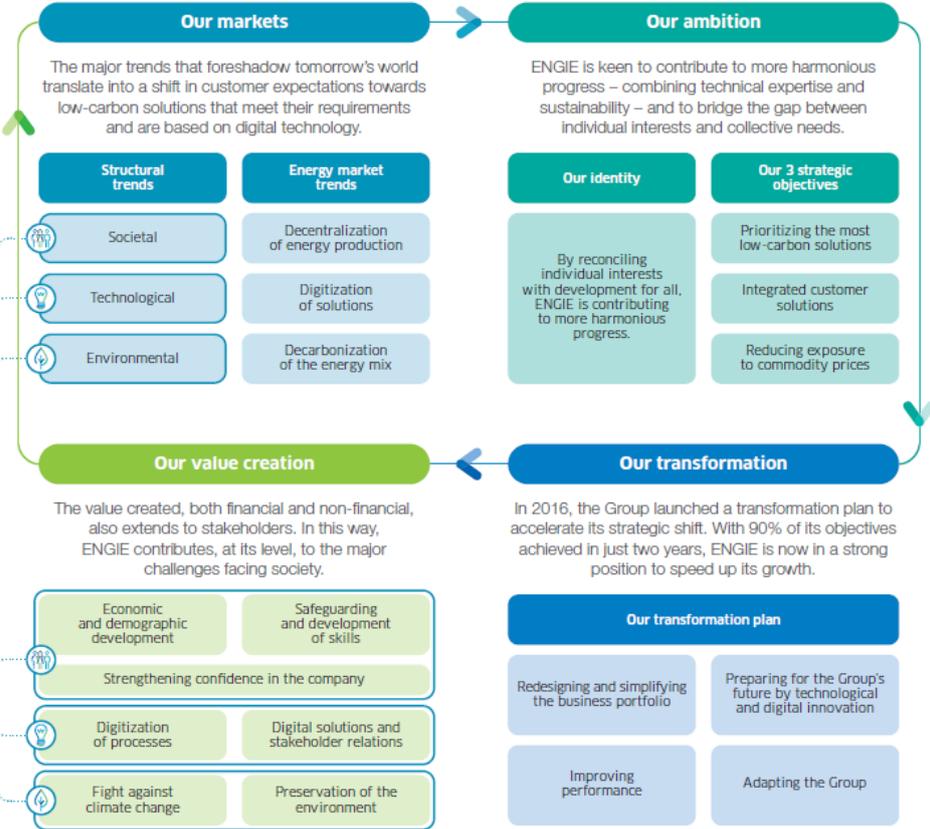
Achieving the very low carbon generation goal starts with the consolidation of the hydropower and nuclear asset base:

- EDF regularly invests in hydropower concessions in order to combine economic, energy and environmental performance, and will propose solutions to strengthen hydropower generation;
- EDF is investing in order to obtain approval to continue the operation, under the highest safety conditions, of the French nuclear fleet beyond 40 years, now that its economic and carbon competitiveness has been demonstrated. In this context, EDF has undertaken the “Grand Carénage” programme of continued operation, without prejudice to approvals which will be granted on a unit-by-unit basis by the ASN (French Nuclear safety authority) after each ten-year inspection. In the United Kingdom, investments are also being made to extend the operating life of the entire UK nuclear fleet. Lastly, the EDF group continues to invest in preparations for the decommissioning of the nuclear fleet and for waste management in France and the United Kingdom.

### **ENGIE no statement summary of group profile**

On p2 “summary “of where the group is : summary of group profile

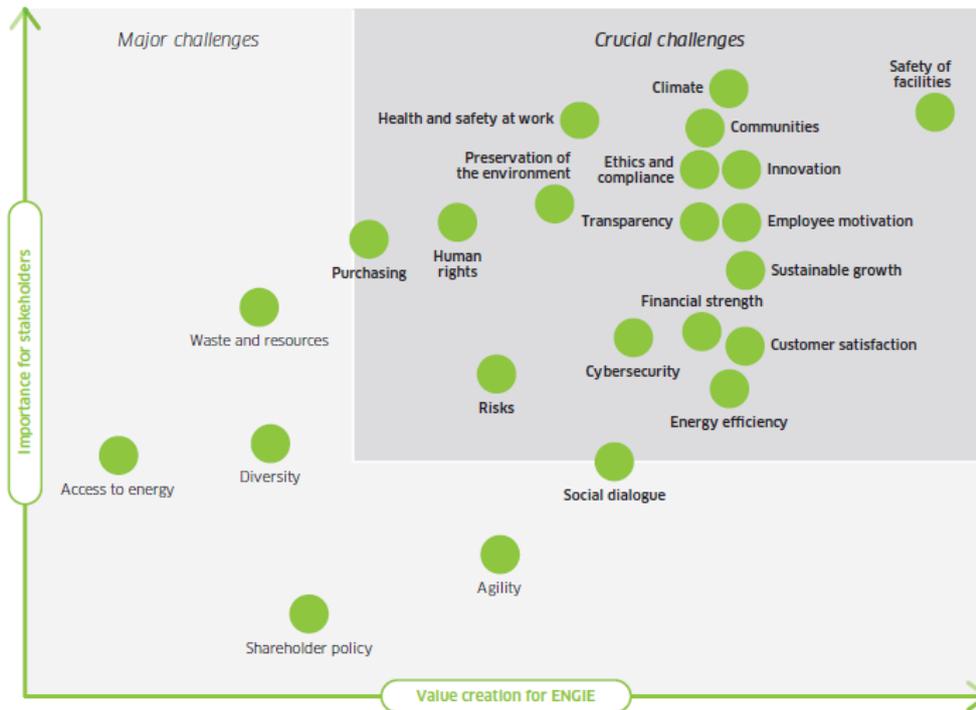
In a sector undergoing fundamental change, ENGIE has repositioned its activities to capture new opportunities and become a key player in the new energy world. More competitive and debt-free, the Group is entering a new phase of dynamic growth, as confirmed by its good performance in 2017.



And on p37 a table of key challenges for the group

## Map of challenges 2017

ENGIE pays particular attention to dialogue with its stakeholders, since the company's ability to connect with its local ecosystem across all territories where it has a presence gives it a fundamental competitive advantage.



### E.ON no statement

In the section “about E.ON” p13

E.ON SE is an investor-owned energy company based in Essen, Germany.

Our mission is to become customers' partner of choice by providing them with individually tailored solutions for a greener, more distributed, and more digital energy world. We have three core businesses and about 43,000 employees. In addition to our core businesses, we also have a nuclear power business in Germany, which is operated by our subsidiary PreussenElektra and is not a strategic business. Its assets will be decommissioned by 2022.

P2 overview of the report, header after the title : “can we make energy more sustainable ?”



### ESKOM vision and mission

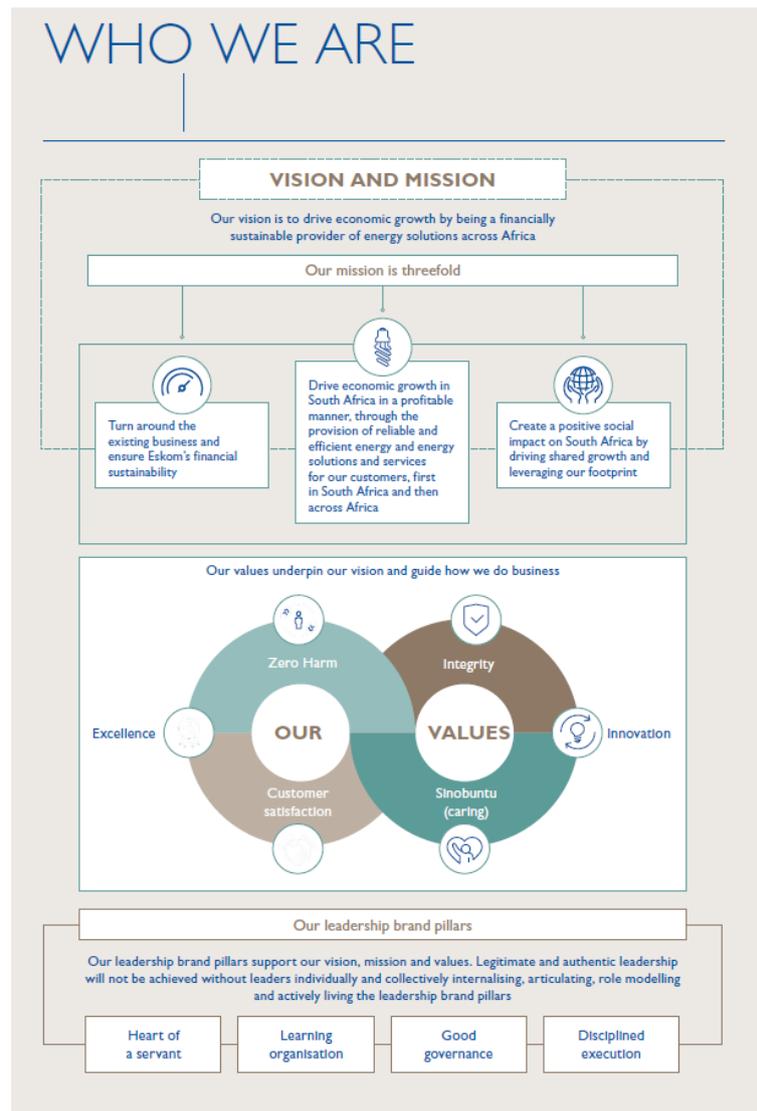
Strategic context ( 2019 REPORT p24)

In the prior year, we refined our strategy to respond to challenges being faced at the time.

We aimed to clean up governance issues, stop the bleeding and re-energise the business in order to set a firm foundation for growth. At the same time, we planned to continue implementing

cost containment initiatives, while focusing on strengthening our financial position through demand stimulation, cost containment and efficiencies, as well as striving to achieve a cost-reflective price of electricity.

(p2) of report



## **IBERDROLA purpose and values**

P 16 of integrated report 2018

### **Purpose and values**

In 2018 Iberdrola began a process of articulating a unique and relevant Corporate Purpose going beyond the traditional concept of mission and vision to describe its long-term raison d'être and contribute to the cohesion, differentiation and generation of trust among all the Stakeholders. The proposal reflects and confronts the main social trends, the major economic, social and environmental challenges and expectations of the Stakeholders, and also defines Iberdrola's role in society as an agent for change and transformation of the electricity sector. Iberdrola's Corporate Purpose has thus been defined as follows:

“To continue building together each day a healthier, more accessible energy model, based on electricity”. This Purpose conveys: – The Iberdrola group's commitment to what today

constitutes an urgent social need: the transformation of the current energy model towards a new model that prioritises the well-being of people and the preservation of the planet. – The Iberdrola group’s commitment to a real and global energy transition based on decarbonisation and electrification of the energy sector and of the economy as a whole decidedly contributes to the fight against climate change, and at the same time favours the creation of new opportunities for economic, social and environmental development. – The foresight of the Iberdrola group, spending more than a decade working to make this transformation a reality, driving the development of clean energy throughout the world, and continuing to invest its resources to reach the objectives of the Paris Agreement. – The Iberdrola group’s determination to continue building a more electricity-based energy model, which reduces dependency on the use of fossil fuels and generalises the use of renewable energy sources, the efficient storage of energy, smart grids and digital transformation. – The conviction that a more electricity-based energy model is also healthier for people, whose health and well-being in the short term depend on the environmental quality of their surroundings (air, water, food, biodiversity, etc.) and, in the long term, to the success of the fight against climate change. – The aspiration for the new energy model to also be more accessible to all, thus favouring inclusiveness, equality, equity and social development. – The desire to continue building this new model in collaboration with all involved players: governments, institutions, companies, tertiary sector, citizens, etc., because this is a tremendous shared challenge to ensure the present and future of the societies in which we live. This Corporate Purpose is aligned with the social dividend strategy, the principles of Sustainable Development, Corporate Social Responsibility, and thus the 2030 Agenda - Sustainable Development Goals of the United Nations.

(P 16 continued)

To attain said Purpose, the Iberdrola group condensed its corporate values into the following three concepts:

– Sustainable energy: because the Iberdrola group seeks to always be a model of inspiration, creating economic, social and environmental value in all of its surroundings, and with the future in mind. This value expresses the commitment to: • Responsibility • Ethics • Safety • Transparency – Integrating force: because the Iberdrola group works with force and responsibility, combining talents, for a Purpose that is to be achieved by all and for all. This value expresses the commitment to: • Diversity • Dialogue • Empathy • Solidarity – Driving force: the Iberdrola group makes small and large changes into reality in order to ease the life of people. And it performs this work while always seeking to continually improve, efficiently and

with high self-imposed standards. This value expresses the commitment to: • Innovation • Simplicity • Agility • Foresight

### **PG&E mission values and culture**

2018 Report (p4)

P G and E's commitment to sustainability has never been more fundamental than it is today. Our North Star of a sustainable energy future guides our mission to deliver safe, reliable, affordable and clean energy to our customers. We also recognize that our responsibilities as an energy provider go beyond the basics: we must act as a valued partner in our communities; as a force for economic growth, progress and equity in our state; and as a leader in combatting climate change.

With a steadfast focus on safety, excellence in our operations and environmental leadership, we are working every day to build a better, more sustainable California.

**Our Mission:** To safely and reliably deliver affordable and clean energy to our customers and communities every single day, while building the energy network of tomorrow.

**Our Vision:** With a sustainable energy future as our North Star, we will meet the challenge of climate change while providing affordable energy for all customers.

**Our Culture:** We put safety first.

We are accountable. We act with integrity, transparency and humility.

We are here to serve our customers.

We embrace change, innovation and continuous improvement.

We value diversity and inclusion. We speak up, listen up and follow up.

We succeed through collaboration and partnership.

We are one team.

### **then comes a statement on strategy and sustainability**

At its core, P G and E's approach to sustainability is to meet the needs of today in a way that creates a better tomorrow. As an energy provider rooted in California, P G and E confronts choices and challenges with environmental, social and economic dimensions that impact the 16 million Californians we are privileged to serve. Finding the right balance in the decisions we

make is essential to achieving our goals of providing safe, reliable, affordable and clean energy—today and into the future.

To guide these decisions, we have adopted a Mission, Vision and Culture framework, developed through extensive outreach and interactions with our employees, customers and other stakeholders. Importantly, it places a sustainable energy future at the center as our North Star.

**Our Mission**  
To safely and reliably deliver affordable and clean energy to our customers and communities every single day, while building the energy network of tomorrow.

**Our Vision**  
With a sustainable energy future as our North Star, we will meet the challenge of climate change while providing affordable energy for all customers.

**Our Culture**  
We put safety first.  
We are accountable. We act with integrity, transparency and humility.  
We are here to serve our customers.  
We embrace change, innovation and continuous improvement.  
We value diversity and inclusion. We speak up, listen up and follow up.  
We succeed through collaboration and partnership. We are one team.

 Together, Building a Better California

**RWE title of report “Powering. Reliable. Future.”**

No specific section on mission and vision of the company.  
From the report on p16 some values can be retrieved trust, passion, performance  
As values, principles and standards. They fall under ethics and integrity not exactly the equivalent to strategy and markets

## ETHICS AND INTEGRITY

### GRI 102-16 Values, principles, standards, and norms of behaviour

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At RWE, we are well aware of our role in the community and of our responsibility towards customers and business partners, as well as shareholders and employees. We therefore have clearly defined principles which form the framework for our corporate and community engagement. The focus of our actions is on the common values of trust, passion and performance. They ensure a unified, overarching identity in all the companies of the RWE Group. These values are supplemented by the RWE Code of Conduct and the principles for good conduct defined in the Code. The Code also establishes the benchmark for collaboration with contractual partners

and is intended to give a unified foundation for the contractual relationship.

Responsible management and supervision of the company rank among the cornerstones for long-term success. Our benchmark is provided by the German Corporate Governance Code, originally launched in 2002, in the relevant latest version. We comply with most of the recommendations of the code, see further details under ► **GRI 102-18, page 17**. This enables us to strengthen the trust placed in us by our investors, customers, employees and the general public.



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### SSE strategy

no statement on Vision, Values, but general statement on SSE business and strategy

introductory Text About SSE: SSE plc is one of the UK and Ireland's leading energy companies, involved in the generation, transportation and supply of electricity and in the extraction, storage, transportation and supply of gas. Its purpose is to responsibly provide the energy and related services needed now and in the future. Its vision is to be a leading provider of energy and related services in a low-carbon world. Its strategy is to create value for shareholders and society from developing, owning and operating energy and related infrastructure and services in a sustainable way. (report 2018)

Detail of values and target on p2 (report 2018)

| VISION  | TARGETS   |
|---|---|
| <p><b>SERVICE PROVIDER</b><br/>Doing more to provide essential services affordably.</p>   | <p>Provide sector-leading service to its household and business energy customers.</p> <p>Achieve the British Standard for inclusive service provision (BS18477) in SSE's Retail business and maintain the accreditation in Scottish and Southern Electricity Networks (SSEN).</p>             |
| <p><b>SOCIETY MEMBER</b><br/>To contribute positively to society through sharing the value SSE creates at all levels, from local communities to national economies.</p>   | <p>Achieve the Fair Tax Mark accreditation.</p> <p>'Best-in-class' delivery of SSE's community investment funds in the UK and Ireland.</p>  |
| <p><b>OPERATOR</b><br/>To support the energy markets in Great Britain and Ireland move towards low-carbon generation by 2050.</p>   | <p>Ensure the carbon intensity of SSE's generated electricity is halved by 2020, from its 2006 baseline.</p> <p>Enable low-carbon generation to connect to SSE's electricity network.</p>   |
| <p><b>DEVELOPER</b><br/>To develop and upgrade the energy infrastructure in the UK and Ireland in a sustainable way.</p>  | <p>Invest around £6bn between 2016 and 2020, of which around two thirds is in electricity networks and renewable sources of electricity.</p> <p>Increase SSE's renewable energy capacity, including pumped storage, to over 4.2GW by 2020.</p>  |
| <p><b>EMPLOYER</b><br/>To attract, develop and retain a sustainable pipeline of highly engaged employees, and in doing so help to address the lack of diversity and skills shortage in the energy industry.</p> | <p>Treat employees with fairness, respect and dignity, and create a highly-engaged workforce as a result.</p> <p>Support productivity by developing an inclusive and diverse workforce which meets future talent and skill requirements.</p>  |
| <p><b>BUYER</b><br/>To be a responsible buyer of goods and services and to work with suppliers to manage risk in SSE's supply chain and achieve long-term sustainable benefits.</p>                             | <p>Work with contractors to be 'best-in-class' on safety and keep them as safe as SSE employees. 2017/18 target for contractor Total Recordable Injury Rate (TRIR) was &lt;0.44 per 100,000 hours worked.</p> <p>Ensure a comprehensive response to modern slavery in SSE's supply chain.</p> |
| <p><b>DO NO HARM</b><br/>SSE's business activities are underpinned by an ethical business culture, and an ethos of 'doing no harm' with safety being its first priority.</p>                                    | <p>50by20 SHE (safety, health and environment) goal: reduce the Total Recordable Injury Rate (TRIR) by 50% from 31 March 2017 to 31 March 2021.</p> <p>Establish and maintain a healthy culture of 'Speaking Up' against wrongdoing.</p>  |

**VATTENFALL no statement – “Fossil-free living within one generation”**

No section on vision and mission, but a powerful message and clear direction in the title of the report.

The closest information can be found in strategy section. P17 of report 2018

Strategy Vattenfall has formulated a strategy with the purpose to Power Climate Smarter Living and enable fossil-free living within one generation. This commitment to our customers, stakeholders and employees provides clear direction, engagement and focus as well as significant business opportunities.

## Fossil-free living within one generation - a powerful message and clear direction

Vattenfall has been electrifying industries, powering homes and transforming lives through innovation and collaboration for over a hundred years, and we are now focused on the challenge of transitioning to fully fossil-free energy supply.

Vattenfall engages with customers, business leaders, governments and non-governmental organisations to define and visualise the road ahead – through R&D partnerships, policy discussions and innovative business endeavors. This brings a holistic understanding of customer needs, energy markets, the value chain and our social impact. Together with our partners we are taking responsibility for finding new, sustainable and innovative ways to power the lives of our customers and electrify the transportation sector, heating and cooling, core industrial manufacturing processes and other areas beyond our industry, to ultimately reduce or eliminate the use of fossil fuels in society.

We believe that electrification is a key enabler for reducing CO<sub>2</sub> emissions from heating and cooling, transportation, and the manufacturing industry, in turn leading to increased electricity demand. In combination with the phase-out of fossil-based electricity generation in our markets, this points to a strong, long-term market for fossil-free electricity generation. Therefore, a growing, sustainable and cost effective generation portfolio is strategically attractive. The build-out of our renewables portfolio and the CO<sub>2</sub> roadmap for phasing out coal in our heat operations are key components of the strategy. In addition, hydro and nuclear power generation play a key role in supporting the energy transition, stabilising the grid and supplying electricity based on fossil-free power generation. Electricity grids support the electrification of new sectors while ensuring reliable supply to our customers.

### New business opportunities

We also see significant new business opportunities in decentralised, integrated and customised energy and network solutions. This is our response to customers wanting sustainable, affordable and convenient energy solutions, combined with significantly lower costs for solar panels and batteries and a growing need for reliable power.

New businesses mean new ways of interacting with customers, technology and society. Additional skills and competences are therefore required. In a highly dynamic environment we foster an inclusive company culture that encourages individual and organisational learning and that is open to diverse viewpoints and



promotes active collaboration. We are also focusing on recruiting and retaining critical talent in a number of areas.

Cost and capital efficiency are prerequisites for success in an increasingly competitive environment. To increase efficiency Vattenfall is conducting a programme to cut costs of SEK 2 billion in staff and support functions by 2020. This is being implemented according to plan, and at year-end we had reduced the workforce by 400 full-time positions. Our existing businesses serve as our financial anchor for the period ahead while we invest in new opportunities.