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The Making of Energy Futures

Future Energy Scenarios in Videos and Documents of Multinational Companies

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1- INTRODUCTION

We live in a time when a single decision about our future can make a huge impact on all of us and on our planet. The question of energy futures is more relevant day by day, as we are facing different and huge challenges (e.g. peak oil, rising carbon emissions leading to climate change, depletion of resources, widespread deforestation, destruction of animal species). This topic is a relevant and perhaps fundamental one, since even the choices and decisions made in the present influence the mid- and long-term future in the field. The importance of oil and gas is vital for the economy, industry and even for our civilization as it stands. The impact they may have on the environment is the topic of heated debates all over the world.

Modern fossil fuel-based civilization is increasingly looking for something that could be cheap, efficient and less contaminating and that still can fuel our transportation, heat our homes, and light our cities and villages. Is there an answer to the so-called fossil fuel (i.e. coal, oil, gas) dependency, which is one of the key features of the contemporary world? We must take into account that our future is someone else's present (Adam and Groves 2007). The energy future is important, not to say crucial, for many fields, and it could be examined from different angles and disciplines, including technology and engineering, sociology, economy, politics, geology, mass media and communications. Of course, considering all of these aspects would take entire volumes, therefore the topic will be narrowed down by research questions and subquestions.

Why is the future in this case so important? Because, among other things, contemporary culture is marked by a much more intense future-orientation than ever before (Brown and Michael 2003). Most of our way of thinking about society and technology is interwoven and entangled in relation with time, which will be considered extensively in this thesis. Future oriented scenarios of the big companies are focusing on the idea of time, even as it varies (forecasts to 2035, even to 2050 and beyond, considering a 50 year time span in Shell's case). Additionally," futures play a political strategic role in arguing for and justifying technoscientific choices and in requesting compliance and support from citizens. "[1] These choices are essential in current uncertain times, with tough energy and environmental issues. Thus, it makes the future something that should be looked at as much as possible.

1-Taken from the Seminar "Techno-Science and Society: Communicating and Interacting.", Prof. dr. Ulrike Felt, University of Vienna, 2013

Since this topic is global (as are these corporations, being present in a large number of countries worldwide), its impact, both positive and negative consequences, is of concern to the whole planet. Living in a globalized world, different aspects of the energy sector are entangled and intertwined with society and societal processes in a number of ways, which are also examined in this master's thesis. Energy futures are seen differently by various actors, entailing a number of facts that play a role (geography, natural resources, politics, economy, technological development, and culture).

However controversial oil and natural gas companies might be from the environmental point of view, the fact is that they keep the world running, and will do so for many years to come. Not to mention the influence this fact exerts on other fields, for example on politics or the economy. This is why this master thesis is based on companies' forecasts and predictions, their scenarios and expectations. There are always a number of oil and gas companies in the ranking lists by revenue, many of them among the top ten in the world, with unprecedentedly high profits. According to Fortune magazine's Fortune Global, an annual ranking of the top 500 corporations worldwide measured by revenue, in the year 2013 Royal Dutch Shell ranked first, with $481,700 million in revenue, while British petroleum (BP) ranked sixth, with $388,285 million. If we consider oil and gas companies alone, according to the same source, then Shell ranked first and BP fifth. [2]

This thesis is devoted to seeing how our energy future is described by two of the world's largest companies: Shell and BP (formerly known as British Petroleum). The main research question is how is the energy future imagined, framed and presented by some of the world's largest companies? It is mostly concerned with looking at long-term future expectations and claims; namely how are the scenarios regarding the faraway future framed and produced. These companies (as well as many others) can have different views and strategies regarding the topic, however, when boiled down some questions are common to all of them: How can we go on knowing that fossil fuels will not be there forever and what should we do about it? How can we improve our energy performance and use some other resources, which are also environmentally friendly?

Coming back to this thesis, the main idea is to investigate two future scenarios based on information that is available from the corporations mentioned above. It is important to

2- http://fortune.com/global500/2013/royal-dutch-shell-plc-1/

remember that the main function of scenarios is to “help explore the main uncertainties lying ahead, by making them more explicit” (IEA 2003, p.24). Oil and gas companies have relevant experience in working with scenarios; they go together with their everyday activity, being rooted in the choices they make. The selected companies have their particularities in dealing with future forecasts. Royal Dutch Shell has long-standing experience in developing energy scenarios as a tool for better business decision making: its first scenario that looks out over 50 years was produced in 1995.[3] BP’s outlook, and the videos based on it, extends to 2035, which might be far enough to see some essential turning points, as well as some basic future trends as this company depicts them. The relevance of this topic is such that it is becoming inevitable in any contemporary discussion, and there is a wide range of authors writing or reflecting on it, including Nobel award winners from other backgrounds.[4] [5]

Following is a short outline of the sections of the thesis, clarifying its different parts and the general direction taken within the work. The next chapter is “State of the Art,” and it aims to give an overview of the debates and a brief literature review of what has been written recently (and not so recently) on energy and energy transitions, on time, future and space. It is followed by theoretical framing and sensitizing concepts, which presents the theoretical framework used for the analysis. In this case, it is crucial to examine the relationship between technology and society and the interplay between the two of them. Techno-political and economic backgrounds play a key role in defining energy policies. Therefore, the idiom of coproduction (Jasanoff 2004) will be the main theoretical base, while the notions of sociotechnical imaginaries and anticipation will be considered as sensitizing concepts. Ideally, coproduction will give insights into how technological and social orders are mutually affecting each other. Particularly, the future as site of co-production will be brought into analysis.

Afterwards, there is a section containing the main research question and the subquestions

3- http://www.shell.com/global/future-energy/scenarios/40-years.html

4- http://www.nytimes.com/2014/04/18/opinion/krugman-salvation-gets cheap.html?ref=paulkrugman&_r=1

5 -http://www.nytimes.com/2014/05/30/opinion/krugman-cutting-back-on-carbon.html?_r=0

as well as Material and Methods used in the elaboration of the thesis, which explains the research process behind the writing of it. The materials and methods employed will be different, according to the sources companies offer. The main focus will be on video analysis, since videos and motion pictures have a lot of visual information which makes a topic seemingly easier to follow and understand and they certainly try to make an impression on the viewer. Videos will be coupled and complemented with summaries, with the document analysis of official publications. Documents are important as they also present the data companies have and frame scenarios of energy futures that this work is after.

The empirical analysis consists of two parts: Part I is devoted to the Shell energy future scenario and Part II is devoted to the BP energy future scenario. Both parts are divided into smaller units, examining particular videos and one official outlook (BP's). Finally, the Conclusion chapter will elaborate the most important findings and develop conclusions from the empirical analysis conducted previously. It will reflect on the main topic, but it will also disclose the limitations of current energy future scenarios and some of the questions that may remain open in the field.

2- STATE OF THE ART

This section aims to map literature related to the main topic and give insights into different debates on the matters related to my research question. In order to get a better understanding of the literature regarding the main research question, it is necessary to divide this chapter into three subchapters. The first one will be on time and future relations, including expectations, because my research question ("How are energy futures imagined, framed and presented by some of the world's largest companies?") basically deals with time and it is certainly future oriented. It is also important to examine the role of expectations concerning different technologies and energy sectors, namely, which are the main expectations in the field and by whom? By examining expectations, it will be possible to identify imaginaries and attitudes that people hold regarding the development of certain technologies.

The second subchapter will focus on energy and energy transitions and how they are seen and examined, mainly within the Science, Technology and Society (STS) studies, but also from other disciplines. This context is especially relevant to my project, since energy and energy transitions play a fundamental role in the making of companies' future scenarios. The field of STS is also rich in literature regarding this topic.

The third subchapter contains literature review and debates on spaces, places and (geo) politics. The importance of spaces and places is fundamental in the making of energy futures because of the resources one country or region has. At the same time, geopolitics and politics definitely play a role in the making of energy futures, since the companies are influenced by specific geographical, political, economic, societal and cultural conditions, which are, explicitly or not, in one way or another, quite present in the making of future scenarios and forecasts. These conditions (geographical and political) could frame the way of thinking of people involved in working with scenarios and future imaginaries, and this is why focus is also being placed on them.

2.1- ON TIME, FUTURE AND EXPECTATIONS

Much of our way of thinking and rethinking society and technology is interwoven and entangled in relation with time, another essential constitutive part of this thesis. But what is time? How is it defined in the life of society?

Helga Nowotny (1992) sees time in the life of society as having "many faces," assuming various shapes and forms of expression. Yet, it is a basic component of social phenomena which permeates every aspect of social life (Ibid, p. 449). However, the exact definition of time is hard to give in a simplistic and straightforward way. In modern times, man registers time in a series of different contexts, relating to questions of thought, nature, society or technology (Šubrt 2001). Time is applied worldwide today as the standard unit of measurement, co-ordination, regulation, and control (Ibid.). It is taken for granted that we all know or assume to know what time is, although its precise meaning is still elusive to us. Time is so "deeply rooted in our existence that it is almost invisible" (Adam 1990, p.9).

Norbert Elias (1992) basically views time as a tool for orientation. This tool is used based on comparison between continuous actions. To have time measurement involves the necessity of having action on a continuum arrow, thus entangled and interwoven. Some particular events serve people as socially standardised orientation points. These points could be the seasons, tides, movements of the sun and moon, the birth of Christ. (Ibid.) Therefore, "time is determined through the ability to interconnect two or more sequences of continuous changes" (Ibid. echoed by Šubrt 2001, p 213). One sequence serves as a unit of measurement for another. In addition to that, "the word time is a symbol for a relationship that groups of humans set between two or more courses of events, of which one is taken as a relative framework or measure for the standardisation of the others" (Elias 1992, p. 12). According to this definition, it is possible to observe that in order for time to be registered as a phenomenon, there are certain requirements, such as: groups of humans, their relationship to two or more events and precise definition of the framework for measurement and standardisation of events.

In her book "Timescapes of modernity," Barbara Adam (1998) claims that, following the traditions of the industrialized West, we learn and relate quite frequently to a multidimensional space, while at the same time neglecting the also fundamental temporal dimension of social and environmental life. The knowledge about time and its distinctive relationships stops with clocks and calendars (Ibid.). Comparing the different standards of space and time, space is connected to visible matter and sense data, but time is the "invisible other, which work goes outside and beyond the reach of our senses" (Adam 1998, p. 9). The temporal dimension of social and environmental life is essential to the construction of energy futures, regardless of the time span (be it 15, 20 or even 50 years ahead).

The modern idea of time often entails a relationship equated with money and profit (Adam and Groves 2007). Once this happens, it is obvious that speed provides not only evolutionary and cultural, but also commercial advantage. Suddenly, as saving time also saves money, "acceleration becomes an economic imperative" (Adam and Groves 2007, p.103). It is hardly surprising then that some authors suggest that "the idea of saving and compressing time has been stamped into the psyche of Western civilization and now much of the world" (Rifkin 1987, pp.3-4). The large oil and gas companies have a specific vision of time. The interesting thing to realize is that their idea of time is a particular one, which is apparently mainly bound up to production and consumption, to buying and selling of goods and commodities. It will be interesting to see if the technologies and technological developments described in isolation and fragmentation, without reference to society or environment, without concern for the life cycle of the product, follow the logic of "Newtonian

time" (Adam 1998), or are these technologies and developments interacting with society and environment, taking into account opposing structures where time has context and content and it is deeply embedded with meaning.

Since the main research question entails future events and developments, it is necessary to look at the definition and nuances of this term more closely. There is a lot written about future in general, and certainly those accounts differ in a range of ways: by whom are they produced, when and where are they created, how are they constituted.... However, in the social sciences the future is not considered in depth and it has been left to futurologists since long ago. The prevailing understanding is that the study of society is conducted in the present or extended present (Adam 2005). This fact is surprising given that the interest in the future is to be found at the very beginnings of sociology as an academic discipline. While the future has always been uncertain, the question of causal relations ("why" questions), which were dominantly focused on futures, appeared as far back as Greek antiquity and the work of Aristotle. During the period of industrialization and afterwards, the future was not a mere continuation of the past, "but became increasingly a consequence of actions in the present" (Ibid. p. 3). In the twentieth century, the future became a topic of interest beginning in the 1960s. It was developed differently in Europe and the USA, with its specific characteristics. While in the UK and continental Europe, Research Councils were the ones in charge to fund social scientists to think about the future and to provide social sciences' contribution to one of the central aspects of social existence, in the USA the social context for emergence of interest in the future was entirely different. It was shaped by the Vietnam War and the technological promises of space travel, computers and nuclear power. The American version of "Sociology of future" had a focus on not only what is but also what society could be (Ibid. p.5).

At this point, the values were central to social scientists, who saw themselves as agents for change. Their aim was the betterment of human conditions. This enthusiasm did not last, since there was a shift to a more evidence-based science and the funding reverted to sociological research which was more grounded on facts. Once again, the study of this social domain has been left to futurologists and foresight experts in business. (Ibid.) It spread out again in the last two decades, with the focus of sociological attention increasingly turning to social and socio-environmental issues, which are often producing unpredictable, long-term outcomes (Adam 1998, Adam et al. eds. 2000, Beck 1992 and 1999). In the field of Science and Technology Studies, it has been taken up more in a way of "Sociology of Expectations," which will be discussed later.

Authors such as Adam and Groves (2007) seek to contextualize the efforts to anticipate and traverse the future, giving a historical account that goes back some 5000 years into antiquity. One of the basic arguments is that contemporary societies, constantly dedicated to innovation and progress, need to achieve competence in futurity and to hone their tools for anticipating and taming the future (Adam and Groves 2007). Authors claim that in the modernity much stronger human influence is exerted in shaping the future according to human will. As Brown and Michael (2003) have argued, contemporary culture is marked by a much more intense future-orientation than ever before. However, this future orientation does not entail many aspects, either related to content or context. One of the main issues is that the "modern" futures are depicted as "emptied of content and extracted from historical context (...) We would like to go as far as to suggest that the emptying of the future and its subsequent equation with money were central preconditions to the progress enjoyed by industrial societies, to the economic growth experienced by those societies and to their colonial ventures" (Adam and Groves 2007, p.13). These empty futures are amenable to control, and unfortunately can be used in a number of ways by many without feeling guilt. Those futures, disembodied from social, economic, political and environmental contexts and depersonalized at the same time, quite probably could become sites of potential risks and hazards, of pollution and disasters.

Another big issue with the contemporary understanding of the future is the relationship between elements separated during the industrial way of life. That is, the connection between the production of futures, knowledge of futures and our responsibility for future outcomes. To sum it up, this means relating action, knowledge and ethics, and this is one of the central points of Adam and Groves' book "Future Matters". The authors establish that these elements do not play an equal role in our relationships with the future, often being treated quite separately. This is something that cannot continue, and neither can our general relationship to the future. Future certainly should not be seen as a no-man's-land where everything is possible and acceptable. This approach to the future makes possible, for instance, that poisons are deposited for thousands of years, or that resources, which have evolved over centuries, are suddenly used up or depleted in a single lifetime, producing a significant alteration to our atmosphere (Ibid. p. 167).

The solution according to these authors is seen as a fundamental change of the relationship between action, knowledge and ethics. The colonization of the future (Brown and Michael 2003) can be done in a very different manner from the one people are used to. On the one hand, our future-creating actions become embedded and contextualized. On the other, still considering the future as open and basically uncertain, some authors such as Michael

Jacobs argue that we should accept a duty of care that entails our commitment to look one generation ahead. “As long as each generation looks after the next (say over a period of 50 years) each succeeding generation will be taken care of” (Jacobs 1991, p. 73). That is one of the possibilities a more proactive and constructive vision of the future opens up to society.

Thus, environmental concerns are surely one of the aspects that must not be overlooked in any given future scenario. The importance of oil and gas is vital for the economy, industry and even for our civilization as it stands. The impact that these fossil fuels may have on the environment is a topic of heated debate all over the world. Even in the best of cases, not everything is so bright. “In addition to projecting optimistic scenarios, firms advance much more pessimistic images of futures that they wish to avoid: possible failures, disappointments and financial losses” (Tutton 2011, p. 411). Moreover, there are many situations and circumstances that seriously challenge the dominant Western belief system and the vision of eternal progress, unlimited growth and continuous improvement of living conditions for people around the globe (Leo Marx 1994, Tutton 2011). Surely, events such as environmental degradation give a lot of background to these types of imageries.

One of the key statements, which explains why some choices on certain energy futures are made, while at the same time others are excluded, is that “every future is predicated on others to be avoided” (Tutton 2011, p. 412). Energy futures are seen differently by various actors and stakeholders, entailing a number of facts that play a role (geography, politics, economy, culture, technological development) and it will be examined how this diversity plays a role in framing particular futures, whether they are based on fossil fuels, renewables or some other sources. It will be possible to determine which futures are favoured and which ones are neglected.

While the future, as examined from previous examples, is basically open, at the same time it is uncertain. In constructing energy futures, some aspects must be considered, like the so-called sideswipes: “surprises or disasters, such as breakthrough technologies, wars, extreme natural disasters, pandemics or the breakdown of the climate systems” (IEA 2003, p. 30). It will be interesting to see how different events (e.g. wars in Iraq and Libya, Arab Spring, the global financial crisis) influence companies’ visions of the future, not only in terms of production and consumption, but also on a broader social and political level.

Since one of the subquestions seeks to assess how futures are constructed, it is necessary to pin down the way in which certain representations of the future are constructed so that they perform in such a way. As with other projections, here it must be asked “How do the

specific contents of the future imply particular subject positions, identities, relations of power, and visions of community and so on?" (Michael 2000, pp.22-23) Perhaps these features (identities, relations of power, and visions of community) are not explicitly mentioned or presented by companies, but nonetheless, in order to have a proper and complete analysis, they should be examined.

Political and economic systems of the world are diverse and so are their relationships to many aspects of life, the future certainly being among them. For instance, there is a clear discontinuity between modern neoliberalism and some previous modes of governance and social order, such as classical and social liberalism This can be observed in their relationship to the future as well. While social liberalism extended calculative rationality into the empty future, mapping potential risks, the logic of neoliberalism is quite different: it is not fixated on calculable risk and therefore is untroubled by uncertainty (Groves 2014). Instead, "radical uncertainty is seen as liberating, with subjects dealing with uncertainty through speculative bets on particular outcomes" (Pellizzoni and Ylonen 2012, p. 52). Further, the difference between neoliberalism and some previous socio-political orders is crucial, since for the former the free market fundamentally shapes society and its aspects, even the future. "Neoliberalism differs from liberalism insofar as it rationalizes the law of the market through a future imaginary in which it is envisioned as a goal, a reality that must be artificially constructed through political power. In the process, this legitimizes further marketization as a remedy for market failures" (Groves 2014, p. 284).

Going back to my research interest, the relationship between time and the future is essential because of a number of events which are taking place or will take place soon (some of them in the short-term while others in the long-term). This is mainly to consider the side effects of a society based on fossil fuels, such as global warming, ozone depletion, extinction of natural and animal species and depletion of natural resources, to mention a few. It must be taken into account that our future is someone else's present, implying our responsibility to future generations (Adam and Groves 2007). This requires a change of perspective in sociological understanding of the world as well. Barbara Adam sees this change in the role of the social scientist, who will shift his position "from external observer and analyst to implicated facilitator of a more just social world" (Adam 2005, p.14).

Given that future scenarios are the key tool Shell and BP use to frame the future in the consulted videos and outlooks, it is necessary to briefly address them. The role of scenarios in the making of energy futures is basic: they open up various possibilities, welcoming the relevant dialogue on the topic and making it necessary. The role of scenarios should not be

understood as dogmatic or entrenched, closed or inevitable. On the contrary, “scenarios are not predictions of what will happen; rather they enable the exploration of possible, probable and preferable futures” (Adam and Groves 2007, p. 202). The main function of scenarios is to make the main uncertainties lying ahead more explicit and thus help explore them (IEA 2003). Scenarios are relevant because they might open the debate about tomorrow, posing the “what if” question that sometimes is missing from the debate or taken for granted. By giving detailed description and analysis of videos and documents, it will be possible to shed light on which future scenarios are envisioned and by whom.

Another definition links scenarios and uncertainty again, essentially presenting them as stories. “Scenarios are stories about the way the world might turn out tomorrow” (Schwartz 1991, p. 5). Oil and gas companies have relevant experience in working with scenarios; they go along with their everyday activity, being rooted in the choices they make. It is important to mention that Shell has more than 40 years of experience in making scenarios, starting in 1972, a year before that Arab oil-producing countries imposed an oil embargo on Western governments in October 1973. According to Jeremy Bentham, Head of Scenarios, Strategy and Business Development at Shell, what scenarios actually do is to enable people to make “richer judgements and to be more sensitive to uncertainties” (Shell scenarios 40 years 2013, p. 2).

As in other fields, the sociology of expectations, which emerged in Europe in the 1990s, has growing influence on studies of scientific, technological and economic innovation (Borup et al. 2006, Brown et al. 2000) and plays one of the fundamental roles regarding energy futures, since there are many expectations regarding some technologies or natural resources (renewables, for example). More generally, expectations can be defined as the state of looking forward (coming from Latin exspectatio: looking, waiting for). Authors, like Borup et al (2006) see expectations as one of the main elements to understanding scientific and technological change because they can bridge and mediate between different levels and dimensions (which might overlap), coordinating different actor communities and groups. Specifically, technological expectations can be described as “real- time representations of future technological situations and capabilities” (Ibid. p. 286). What are the expectations in the field of energy? Which technologies are considered in future scenarios? These are some of the questions this work will look at attentively.

The role of expectations in the context of science and technological innovation is getting increasing attention from a wide range of disciplines, while the STS scholars look at expectations to see how they develop or fail and what the measure of success is (Brown et

al. 2003). Closely looking at expectations means recognizing their capacity to mobilize the future into the present, playing a role which is basically performative (Michael 2000) whilst at the same time it entails assessing the dynamic aspect of expectations. This means that, at the beginning, promises will be set quite high, and they have to be set quite high in order to be heard. At the same time, “it is almost inevitable that early hype will eventually give way to disillusionment, except for the cases when the emergence of new promises helps people forget their former disappointments” (Brown and Michael 2003, echoed by Brown et al. 2003, p. 3). Why is it the case that expectations have such a cyclical character, from initial hype to possibly later disappointment? Why do many expectations and promises look so optimistic at the outset and do not materialize or fulfil the assumed role afterwards?

Geels and Smit (2000) give a more detailed explanation of this phenomenon at the early stage: “The reason that initial promises and expectations are too optimistic is not that forecasters or futurists are ignorant or short-sighted. Instead, the promises are strategic resources in promise-requirement cycles. Initial promises are set high in order to attract attention from (financial) sponsors, to stimulate agenda-setting processes (both technical and political) and to build ‘protected spaces.’ Promises thus play a role in the social processes that are part of technological development” (Geels and Smit 2000, p. 881-882). In addition to that, these scholars also found that many expectations about technology were frequently “off” because they were made by biased vendors and promoters (Ibid. echoed by Sovacool and Brossmann 2014). Selin (2008, p. 1884) has also asserted that “emerging technologies rely on promising stories to garner support in the early stages.” She used the example of nanotechnology to support this claim.

Within the field of STS, the idea of expectation dynamics was originally set out by Van Lente (1993) and Van Lente and Rip (1998). Brown and Michael (2003) emphasized variation in expectations between different kinds of actors (basic researchers, entrepreneurs, potential end users). In addition to temporal variability already mentioned above (such as the promise-disappointment cycle), there is also spatial variability, with people attaching different levels of trust to expectations. Thus, actions based on future projections must take into account the individual position or placement within the knowledge economy of expectations – depending on whether one is involved in lab science, entrepreneurial activity, policy making or technology analysis (Brown et al. 2003).

The field of Science and Technology Studies is very rich with literature regarding general expectations, analyzing them in depth (Van Lente 1993, 2000; Van Lente and Rip 1998; Brown, Rappert and Webster 2000; Verganti 1999; Deuten and Rip 2000; Michael 2000).

The main shortcoming is that, while focusing on statements, discourses or speech acts which explicitly manifest future-oriented representations (namely visions, metaphors, promises and aspirations), the scholars became less sensitive to the expression of expectations that do not come accompanied by obvious speech acts and that are more implicit or tacit (Brown et al. 2003). “Expectations are often silent or mute when instantiated within technologies” (Ibid. p.8).

2.2- ON ENERGY AND ENERGY TRANSITIONS

The issue of energy is a hotly-debated topic by variegated stakeholders, including academia, politicians, entrepreneurs, scientists and NGOs. There are other groups highly interested in the topic, such as developers, suppliers, buyers, final recipients and users of technology, research development institutes and universities. Within STS, a number of authors have written about the topic. Different considerations include renewables (Miller et al. 2013, Raman 2013, Moore 2013), electric vehicles (Iles 2013), wind energy (Ottinger 2013) and solar energy (Mulvaney 2013), to name a few. Energy changes and transitions are crucial because, as many scholars in STS have demonstrated, the way in which we build and use infrastructure has an impact on everything, from political systems and working patterns to living arrangements, including health outcomes and environmental conditions (Hughes 1983, Nye 1990, Winner 1980).

All these considerations matter for this project because the corporations, as we will see later, foresee many transitions in making of the energy futures; some of them are even seen as fundamental. Such is the case with the probable change and transformation of the energy mix (including the increasing role of natural gas), the renewables, new and different vehicles, controversial technologies (including fracking), the position of communities and governments regarding new technological developments and the role of the fossil fuels in the future. Needles to say, the impacts of these transitions and its influence are of concern to all of us. One of the main issues is that social consequences of transformation of energy systems are not frequently appreciated (Miller et al. 2013). Most of them are not sufficiently covered by analysts, designers and policy makers.

Nevertheless, the future of energy systems is one of the main challenges facing countries around the world. Energy systems are among the largest human enterprises and they form the heart of the technological arrangements around which modern economies are organized.

(Ibid.) However, the contribution to the debate about energy systems is mainly limited to energy engineers, bureaucrats and economists. This needs to change. As argued by Abramsky (2010), echoed by Miller et al. (2013, p .136) "energy debates need to be informed by robust empirical and theoretical inquiries into what current and future energy changes will mean for diverse groups of people across the planet." These debates might prove crucial when including certain technologies which are highly controversial (such as hydraulic fracturing or "fracking," which will be discussed later).

To define energy systems, it is necessary to consider the human and non-human actors and their relationship (Latour 1987) because energy systems are complex socio-technological assemblages, involving not only machines, mines, refineries and pipes but also people (Miller et al. 2013). Humans are the ones who design and make technologies, develop and manage routines and eventually use and consume energy. In order to make visible important aspects of energy and energy transformation, which lay at the basis of today's industrial processes and developments, three strands must be analyzed: "the social processes that stimulate and manage energy transformation, the social changes that accompany shifts in energy technologies, and the social outcomes that flow from the organization and operation of novel energy systems" (Ibid. p.136). As seen from the previous definition, all dimensions of everyday life, routine and practices are affected by changes in energy technologies.

The same authors (Miller et al. 2013) consider a number of developments in the field of energy and their controversies, such as hydraulic fracturing; exploitation of unconventional oil sources, such as Venezuelan heavy crude and Canadian tar sands; the viability of nuclear energy, questioned by many communities after the meltdown at the Fukushima nuclear power plant, following a tsunami in March of 2011. Scholars in STS argue that the key choices in energy transitions are not so much between different fuels. Rather, they are also between different forms of social, economic and political arrangements which are built in combination with new energy technologies. "The challenge is not simply what fuel to use but how to organize a new energy system around that fuel" (Ibid, p. 139). One of the main contributions of STS authors in the field of energy and energy transitions is the reframing of the debate: it is not only a question of whether to build infrastructure for renewable energy systems, but how to approach such a task. Also, it is necessary to address which forms of intertwined social, economic, political, and technological arrangements get built into these new systems (Ibid).

Similarly, Jasanoff and Kim (2013) claim that analysts should pay more attention to the social dimensions of energy transitions. In their essay, the intention is to demonstrate how

social and technical imaginaries shape the way in which nations and states understand and distribute the risks and opportunities in large projects such as nuclear power. Several countries are included in the analysis, namely the USA, Germany and South Korea. The main difference is that while in the USA private developers reap technology's benefits and the free market ideology is dominant, South Korea has long seen the energy industry as vital to ensuring economic growth, and it has been systematically guided by the state (Ibid).

Nuclear energy history and imaginary scenarios in different countries have also been assessed by Sovacool and Brossmann (2014), although involving more countries, such as China, France, India, Japan, the former Soviet Union and the USA. The authors analyse the historic fantasies surrounding steam engines (1850-1930), automobiles (1910-1940), hydroelectric dams (1890-1965) and nuclear reactors (1970-2000). After the extensive analysis of these four energy transitions, they found four major rhetorical themes that frequently recur. Those themes are: mastery and control over nature; utopian social and technological order; cheap and abundant energy; and symbols of national pride (Sovacool and Brossmann 2014). For them, important elements of energy transitions are the "questions of equity (how energy resources are distributed), futurity (what energy systems we may be heading toward over time), and values (the things we deem important enough in order to put energy services to use achieving)" (Ibid. p. 3).

Another historical analysis, this time of coal canals, oil pipelines and electricity transmission wires, demonstrated that choices have financial, geographic, and environmental consequences (Jones 2013). In particular, the building of these systems has promoted unequal distribution of energy, money and environmental damages. Criticizing the assumption shared by many renewable energy advocates, that wind, solar and geothermal are more egalitarian than fossil fuels because no one owns these resources, the author points to the fact that energy has to be distributed to consumers and that the control over the means of distribution can be equally important as the control over production. (Ibid.) The conclusion is that energy transport systems indeed have politics (Winner 1980) and that history spurs us to consider geographic and material dimensions of technologies of the future when designing new energy transport systems. "We should seek to design systems that can provide access to a wide range of users, not simply the largest markets" (Jones 2013, p.160).

Looking at environmental injustices that energy systems create and perpetuate, Gwen Ottinger (2013) argues that renewable energy developments can have many of the same problems as those based on fossil fuels. Renewables are considered exhaustively both by

Shell and BP in their videos. To give the reader a better overview, the main renewable energy sources are biomass, hydropower, geothermal, solar and wind energy. When compared to the conventional energy sources they tend to replace, it is clear that the renewable energy sources produce lower or negligible levels of greenhouse gases and other pollutants (Demirbas 2008). Environment, economy, and consumers may have many benefits when using combustible renewable, which can be used as a substitute for fossil fuels to generate heat, power, and/or chemicals. (Ibid.)

Coming back to Ottinger, she states that there are two main characteristics that STS scholarship highlights regarding energy infrastructures producing environmental injustices. “Energy technologies are designed in such a way as to make them relatively incompatible with environmentally just social and political orders. Moreover, energy systems do not, for the most part, include mechanisms for producing knowledge about their environmental and health effects; instead, such knowledge is strategically avoided” (Ottinger 2013, p. 223). This statement is crucial when considering the consequences of (in) compatibility of energy systems with societal structure and order. Focusing on wind power, she reveals some of the less known facts, such as that many residents living close to wind farms experience the so-called wind-turbine syndrome (WTS)--a constellation of symptoms that includes nausea, vertigo, tinnitus, sleep disturbance, and headaches (Pierpont 2009). This is contested and dismissed by wind energy advocates, claiming that the noise produced by a wind turbine is not greater than that of household appliances (General Electric Company 2010), while at the same time some independent studies suggest that symptoms mentioned above are not the result of “wind turbines’ physical effects but of sufferers’ annoyance at them” (Knopper and Ollson 2011, echoed by Ottinger 2013, p. 226).

However, an epidemiological study to establish whether WTS exists has not been done so far, which goes in accordance with the critique from the field of STS that some science is systematically left undone. This explanation is grounded on the fact that this research could threaten the interests of industrial and military elites (Ottinger 2013). Research has shown that expert knowledge is privileged over the local knowledge of the so-called lay people (Fischer 2000), something persisting in the debate over wind energy (Aitken 2009). By marginalizing local knowledge, non-scientists are excluded from the debate and from participating in environmental decisions at an equal level with the experts. The author argues that one step to set this situation right is to give greater credibility to the “street science” of local communities in the debates about the health and environmental concerns of wind power (Ottinger 2013).

There has been a renewed interest in solar energy research and developments over the past decade. More substantial investments in solar energy technologies are demanded by publics all over the world, most notably across Europe, North America and Asia. It would broadly signify energy independence, green jobs, and a renewable energy economy (Hess 2012). When opening the black box of solar energy, which is given an important space by Shell as one of the most important energy sources in the future (e.g. Masdar City, “Oceans” scenario) Dustin Mulvaney (2013) points to three main tensions. The first of these tensions is that many photovoltaic (PV) technologies use materials and processes relying on toxic materials which are dangerous for workers' health. The principal controversy is that the semiconductors, which are basic for thin film PV technologies, are composed of cadmium and other toxic materials (Mulvaney 2013). Cadmium is known to be one of the most toxic heavy metals produced by the industry. The second tension is the so- called contract manufacturing, relying largely on migrant workforces. Here, the working conditions raise a number of concerns, which have already been seen in textile, electronics and food supply chain. Poor factory conditions are the main reason that electronics industry observers have called out companies, demanding monitoring of production conditions .This has been noticed particularly in the factories in Asia (Ibid. p 233). The third tension stems from the very nature of solar energy resources, “which means that technologies to harvest solar energy will require tremendous land use footprints” (Ibid p.231).

Thus, by revealing tensions that recent innovations in solar energy have with environmental justice and social order, the main argument is that solar energy does not have to be developed and used in such a way. Still seen as better than most other energy options, mainly because consumers can reduce greenhouse gas emissions and perhaps mitigate some climate change effects on human health, food supplies, and water availability (Shonkoff et al. 2009), the author claims that the PV use should not be eschewed, but rather that proper attention should be paid to the full range of environmental justice implications. “Too often the consequences of climate change render any criticism of solar energy moot. But there are many good reasons, if not obligations, to ensure solar energy commodity chains evolve in a just and sustainable way” (Mulvaney 2013, p.237).

This assessment is quite important since energy companies put a lot of emphasis on renewables in their materials, especially on solar energy (most notably Shell in the project city of Masdar in United Arab Emirates, but also BP). Although China inevitably constructs energy futures based on fossil fuels, depicted as a huge importing market, it is less known that this country has made tremendous investments in solar and wind technologies, in the hope of dominating world markets (Miller et al. 2013). However, the assumption that

renewable energy is intrinsically democratic and egalitarian was questioned long ago by Langdon Winner (1986), at a time when visions of renewable technologies were largely exempt from scrutiny by environmentalists and progressives. He asserted that social outcomes of renewable energy will "surely depend on the specific configurations of both hardware and the social institutions created to bring that energy to us" (Winner 1986, p.39).

Moore (2013) analyzes the process for the ambitious Desertec solar plan, the world's largest plan for a renewable energy system. Its aim is to supply the Europe-Middle East-North Africa (EU-MENA) region with sustainable and affordable power. Ultimately, the Desertec Foundation's vision is to power 90% of the world with renewable energy from deserts. The project's vision started 10 years ago (Moore 2013). Nowadays, there are detailed plans for grid integration and load management as the project has evolved from the initial concept to a more concrete plan to build numerous solar and wind plants in North Africa, with the goal to export energy to Europe. However, the project and its implementation are affected by the larger socio-political context, negotiations among stakeholders and unpredicted events like the Arab Spring. (Ibid.)

Although policy goals aim for energy independence, studies demonstrate that energy systems are becoming increasingly complex and interdependent (Sovacool and Brown 2010). The Desertec project would arguably enhance energy interdependence, as well as the probability of multilateral cooperation. However, while aiming for Mediterranean unity, this region is fragmented and constantly changing (Horden and Purcell 2000). Events such as the Arab Spring and its impact on the countries of the region (Bahgat 2012) show that optimistic visions sometimes face unexpected challenges. By linking Europe to ongoing turmoil in countries including Syria, Egypt, and Tunisia, a number of security risks and challenges for multilateral cooperation could emerge (Moore 2013). This is also taken into account by companies, for example in the BP's official Outlook (BP energy outlook 2014).

Moore shows that the benefits of solar power created in the Sahara Desert will probably serve countries to the north and east while excluding those to the south. The reality is that EUMENA's southern neighbours suffer from severe shortages of electricity (Moore 2013). Seventy-five percent of Sub-Saharan Africans do not have access to electricity, compared to 1% of North Africans (World Bank 2011). Not to mention that while elites in Europe and Morocco may benefit from the system, poorer Moroccans will be negatively affected or bypassed. Additionally, the construction of the grid may damage the local environment (Moore 2013). Therefore, in order to prevent unjust outcomes, it is necessary to shed light on the societal and political processes and dynamics in the region (and elsewhere). "This is

an ambitious, but crucial task for the system builders, decision-makers, and publics who are mapping our energy futures" (Ibid. p.187).

Iles (2013) argues that two possible transitions in our transportation infrastructure--the substitution of biofuels and electric motors for oil-powered automobiles--offer a myriad of implementation pathways that are more or less sustainable. The biofuels hold a special place in the making of energy futures from the two companies. This is especially the case with Shell's video focus on biofuel production and consumption in Brazil. Although less considered than biofuels, electric cars also play a role in the making of energy futures by the consulted companies.

Although today the transportation system is not as open as it used to be a century ago, when steam, oil, electricity, and ethanol were all potentially viable sources of energy (Mom 2004, Carolan 2009), electric cars and biofuels have been resurrected recently. Automobile manufacturers, policy leaders, and consumers are focused on achieving energy efficiency in transportation fleets as a result of elevated oil prices. This includes the growing availability of hybrid, electric and natural gas vehicles (Miller et al. 2013). Illes (2013) considers the advantages and disadvantages of two types of alternative travel choices (electric cars and biofuels based ones) to conclude that the large-scale debates are missing from the mass media, legislatures and community meeting places. Citizens and communities often have different perspectives on how, when and where to build energy systems than industry executives or policymakers. Nevertheless, technical experts are the ones who are primarily involved in the deliberations (Mees 2000).

One of the solutions could be for regulatory agencies and corporations to bring "knowledgeable publics" directly into the process of reshaping transportation and energy systems (Jasanoff 2003). At the same time, the debate should include various interested stakeholders, such as Brazilian food sovereignty activists and American farmers interested in conservation; they may contribute relevant evidence in order to identify the degree of just sustainability (Illes 2013). Furthermore, instead of urging the static introduction of alternative technologies, NGOs and academia should focus more on evaluating their genesis and changing design (Ibid.).

Whilst mapping the style of ethanol research, Sovacool (2010) argues that in Brazil open research encouraged flexibility and incentivized experimentation in the field. As we will see, Brazil and its ethanol production holds an important place in making of the energy futures by corporations, especially by Shell. The style of research in Brazil was relatively decentralized

and there were mechanisms developed to solicit feedback. Researchers worked on different sectors, on the scaling up of sugar cane harvests, fermentation techniques and ethanol blending. One of the key reasons why this particular style of research rendered results was an active partnership between Brazilian researchers on the one hand and sugar cane manufacturers and farmers, automobile companies, gasoline stations and electricity providers on the other (Sovacool 2010). Because of the huge success of this collaboration, ethanol is currently cheaper than gasoline and the government no longer needs to subsidize it (Ibid, p. 914). The Brazilian style covered both the supply and demand aspects of ethanol. Loans to sugar cane growers and ethanol distillers were provided, along with incentives and tax credits to drivers buying ethanol vehicles. In order to ensure favourable prices for ethanol, the state-owned oil company, Petrobras, inflated the gasoline prices. Further, environmental activists were invited to give feedback, and Brazilian carmakers were involved from early on and reached an agreement with the government in 1979 (Ibid.). Here, it is possible to observe a diversity of actors and groups involved in practical tasks, an ideal elaborated by Illes previously.

Since shale gas is one of the main buzzwords in modern energy systems (also very present in the documents of the companies), it is necessary to give a short overview of this source, the technology to extract it and the related debates. Although in the USA the so-called "shale gas revolution" created an oversupply of liquefied natural gas and exerted pressure on gas prices across the globe, the disappointing outcomes have reduced the hype about the prospects for shale gas in Europe (Stevens 2012). It is clear that, at least in Western Europe, there are serious obstacles to its development (Ibid. p.1). One of the key technologies relevant for shale gas is hydraulic fracturing or fracking. Hydraulic fracturing is the practice where, in order to fracture the shale rocks and release the gas, water, sand and chemicals are injected into the horizontal borehole of the well at very high pressure (Ibid.).

As a result of the advent of "fracking," gas prices were driven to extraordinarily low levels. Although there are other promising results, especially in the production of electricity (where expansion of supply has already led to the substitution of gas for coal), in the past few years, global protests have grown around "fracking" in the natural gas industry (Ferguson and Smith 2012). The main concern is about the short-term health hazards of chemicals used in the process, which are unknown to the public because of industry secrecy (Miller et al. 2013). In Europe, environmentally based opposition to shale gas operations is strong, while in the USA there is a growing concern about the negative environmental consequences of "fracking," expressed in opposition from local communities and NGOs (Stevens 2012). Additionally, there is a fear that shale gas may substitute not coal, as many had originally

hoped, but renewables. In spite of all the facts and concerns, the “shale gas revolution” is more likely to continue in the USA because energy self-sufficiency has increased in importance (Ibid.).

Energy scarcity and energy transitions are among the biggest challenges that humanity faces in the twenty-first century. If there is one thing noticeable from a number of discussions on energy and energy transitions, it is that this issue is far from being only scientific or technological; rather it is highly social, political, economic and environmental as well. Modern societies must make momentous and challenging decisions, like the ones concerning large-scale energy transitions, which has been discussed above. These transitions require changes for many communities, as they are complex socio-technological transformations (Miller et al. 2013). The importance of energy systems, besides providing energy, lies in the fact that they also link energy to a wide range of other systems such as water, transportation, food production, and housing. Thus, new energy transitions will seriously challenge current approaches not only held by engineers, researchers and policymakers, but also within the social sciences (Ibid.).

This is being increasingly acknowledged by policymakers, industries, communities, and non-governmental organizations (NGOs). Further, there is also greater attention being paid to societal concerns about existing energy extraction and production systems, as seen in the previously discussed “fracking” example. Public participation in technological change is getting increased interest as well. Many authors, such as Kleinman (2000), Iles (2013) and Phadke (2013), have focused their research on innovative and deliberative models of public engagement in scientific and technological decision-making. Thus, energy systems are increasingly moving to the forefront of the debate. Yet, the main task is that social dimensions of our energy systems should get more attention in order to better approach the challenge of governing an energy transition (Miller et al. 2013).

2.3- ON SPACES, PLACES AND (GEO) POLITICS

Having examined the importance of time, futures, and expectations, as well as energy systems and transitions, the concepts of spaces and places are next in line. Why is the

notion of geography, of how place and space matter, so important? What is the role of a specific place connected to energy futures?

In his book “Putting Science in Its Place,” Livingstone (2003) has convincingly demonstrated the importance of geography in the creation and acceptance of scientific ideas. The ways of doing science are certainly influenced by regional contexts and their social, cultural, spatial, economic and politic features. Thus, “science does not transcend our particularities; it discloses them” (Livingstone 2003, p. 180). By focusing attention on diverse technological and scientific issues in national or regional contexts, it will be possible to see how geography influences and shapes particular understandings, approaches and solutions to these issues. The notions of space and place have been historically important, as seen from the example with Darwinism, given by the author. It was welcomed by imperialists in New Zealand, because the local Maori could be portrayed as barbarians, while at the same time it was resisted in the South of the USA by proponents of racial theory. Darwinism was seen there as threatening traditional beliefs about the separate creation of different races and the idea that they were created with different capacities for intellectual and cultural excellence (Ibid.).

The importance of space is fundamental in the making of energy futures, among other things because of the resources one country or region has. Still, space should not be seen as a metaphorical entity, as something disembodied and separated from human action. “Space is not simply the stage on which the real action takes place. Rather, it is itself constitutive of systems of human interaction” (Ibid, p.7). These interactions entail political and legal processes, disputes and agreements over the production and consumption of natural resources, as well as subsequent social and economic endeavours in many ways.

The importance of places is crucial in the making of energy futures and it is very present in the ways in which futures are depicted by the world's largest multinational companies. All the energy futures envisioned, imagined and projected in the videos do have a certain place(s) in which the stories are developed. Therefore, it is quite different if we look at the case of ethanol production in Brazil, Masdar City in the UAE desert or the driving efficiency example in Scandinavia (the three principal cases constructed in Shell’s video “Earth 2050”). The resources and natural conditions in one country or region differ greatly from those in others. Needless to say, oil and gas reserves and potentials are important for politics and governmental decisions. Places are shaped in a number of ways by the companies, but all of them certainly matter, like recently Southeast Africa and the Eastern Mediterranean, which will soon become global sources of gas supply (Lukoil 2013, p. 35). Science and technology are indeed situated in time and space. Yet, the way in which spaces and places have made

a mark on science cannot be assessed universally, but rather by taking into account different locations, times and circumstances (Livingstone, 2003).

Livingstone points to another prominent aspect, namely the contemporary relation between time and space. According to him, the traditional boundary between here and there, now and then has been blurred. "Contacts between here and there became virtuously instantaneous. Space has been collapsed by time" (Ibid. p. 8). This is clearly the case with modern technologies such as the Internet or telecommunication systems.

The author is also contesting the term of scientific objectivity, promoted as a "view from nowhere," by stating that it is always a "view from somewhere" (Ibid. p. 184). The geography of science is a necessary addition to the concept of scientific enterprise, since human action always takes place somewhere. Although many people usually think that science is "placeless" and therefore not marked by particular location, "the impact of place on science is inescapable" (Ibid. p.186).

Writing about feminist objectivity, Donna Haraway (1988) claims that it is about "limited location and situated knowledge" (Ibid, p.583). She sees positioning as fundamental in grounding knowledge, because "positioning implies responsibility for our enabling practices" (Ibid, p. 587). According to her, morality and politics should be closely linked to our imagery and technology of vision. She makes the case for politics and epistemologies which will take into consideration the location, positioning and situating. Thus, partiality should prevail over universality when making rational knowledge claims. It is a view from somewhere as opposed to the view from nowhere in science (Ibid.), similarly to what Livingstone affirmed previously. This is one of the crucial statements, since companies locate the energy futures in particular places around the world.

In a similar vein, Wagner (2008) argues that geography retains an important, if changing, role in science and research. This is also the case with the distribution of scientific activity. The particularity of location is decisive for some projects, while others could be located anywhere but might require the co-location of many individuals and activities. The way in which research is done shows an uneven distribution, since most of the research across many fields is located in or near big cities in wealthy countries (Ibid. p. 72). Since the distribution of wealth and power in the world is highly uneven, the scientific activity is concentrated in a relatively small number of countries. Similarly, the institutions of higher education are highly concentrated in a few regions, clustered in the developed world. In

conclusion, it is discernible that the resources to create knowledge are far from being equally spread (Ibid.).

Although some fields of science still would be unevenly distributed even in a more just system, mainly because of the scale and scope of the investment necessary to advance knowledge, the real issue is the inability of certain places to integrate knowledge and direct it to solving problems. The author claims that this does not mean that policymakers should construct science according to a plan. What planners should do is “seek to create and locate incentives to encourage the kind of organization and investment that will prove to be locally sustainable” (Wagner 2008, p. 82).

One concept that definitely stands out in considering energy futures is geopolitics, being that the geography of natural resources and their distribution is one of the most important values behind many political decisions and processes. Nowadays, “energy policy is a highly politicised topic” (Kaveshnikov 2010, p. 585).The intertwinement between politics, economy, technology and geography is something that has been written about in STS. Sujatha Raman considered the importance of China in the production of rare earth minerals, being that these are the new point of division with many countries, most notably with the USA (Raman 2013).

Currently, there are profound structural changes in the oil and gas industry. The role of government in the energy future is assessed by both Shell and BP. Greater control over resources is exercised by the states that own them and the respective state-owned companies (Kaveshnikov 2010). This claim is supported by Tischy (2012), who sees the important role of the government not only in regulating the internal energy market, but also in supporting national companies worldwide. For instance, in Russia, the government does not allow foreign majority control in the energy sector, especially in projects developed at the Russian continental shelf. There are some exceptions, such as Sakhalin projects (Kaveshnikov 2010). At the same time, while this fact is often mentioned in the media, it is far less known that some developed countries, including Australia and Canada, have restricted access of foreign investments in mining. This process was already in progress in the 1970s, when they developed various mechanisms to prioritize economic expediency (Walde and Konoplyanik 2002).

China is seen as important, if not one of the key countries by both companies, in the energy consumption and production in the future; this fact is often mentioned in the videos. While writing about rare earth minerals, Raman (2013) also touched upon different geopolitical considerations. These minerals are crucial for making batteries and permanent magnets

used in wind turbines, electric and hybrid cars, photovoltaic thin films and fluorescent lights (Ibid.). In an analogy comparing rare earth minerals with Big Oil, China began to be described as the centre of a “new OPEC for green energy” (Indiviglio 2009) or a key player in a “new Great Game” (Mason 2009). The Great Game originally referred to the nineteenth century conflict between Britain and Russia looking for supremacy in Afghanistan and Central Asia. It was made popular in Rudyard Kipling’s novel “Kim” (Raman 2013). A new Great Game has been described by Rashid (2000) as taking place in the same region, with nation-states competing on behalf of major corporations for control of oil and gas pipelines. A new twist is offered by Paul Mason, a BBC journalist who argues that China’s new multi-resource strategy is reshaping the oil-centred global economy. Rare earth mining is now one locus of another Great Game, in which the USA and its allies are playing catch-up (Raman 2013).

To conclude, STS and other literature has shed light on scientific and technological issues regarding energy and energy systems which mainly can be reflected in the neglecting of social complexity, inadequacy of technical solutions and the selective ignorance of many scientific and technological researches. Two other major strands (time, future and expectations and spaces, places and geopolitics) were also considered in order to get a better overall understanding of the topic and its different constitutive features.

3-THEORETICAL FRAMEWORK AND CONCEPTS

The main theory that will be used is co- production. “Co-production is shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it” (Jasanoff 2004, p.2).The main aim of co-production is to show that there is a dynamic interaction between technology and society. In this case, it will be used to see how technological and social orders are mutually influencing each other. However, co-production is much more of an idiom--“a way of interpreting and accounting for complex phenomena” (Ibid. p.3). The complex phenomena regarding energy future are there: the vision of the possibility of being much more independent from fossil fuels, to somehow avoid peak oil, to avert further environmental degradation which might lead to an ecological catastrophe. Moreover, the idiom of co-production “might allow showing how the implementation of specific technoscientific projects and imagined preferred ways of living and social order are mutually

constitutive" (Felt 2013, p. 3). This work will assess which are the imagined energy futures by Shell and BP and how are they related to distinctive social orders.

Sheila Jasanoff also examined the relation between science and politics, politics and technology, concluding that they also co-produce each other, although “STS work has been less successful than political science in finding places for human beliefs and imagination” (Jasanoff 2004, p. 28). According to what has been mentioned so far, it would be hard to imagine an outlook of oil and gas companies which completely excludes societal needs, fears, accomplishments and failures, progress and decadence, as well as political events and processes. At the same time, modern society could not exist without technological and industrial knowledge and production coming from oil and gas companies, without the hardware they provide. Not only do they co-produce each other, but they also regulate and curb each other's excesses, socio-politically, legally and technologically. Thus, co-production does play a major part even in future-oriented scenarios. It asks one of the fundamental questions: how is change or introduction of specific technology or technological order going to impact on society and societal processes?

The relation of power, values and meanings is one of the crucial ones within the idiom of co-production. Mentioning Sheila Jasanoff’s (2004) claim that science and technology operate as political agents, the relation between policy makers (national governments) and multinational companies should be assessed. In some cases it might be more visible, in others much less. Sometimes technology apparently acts as an autonomous force that changes society in a number of ways and people have to adapt to it. However, companies definitely envision a kind of social order, just by the fact that they envision some kind of technological order and arrangement. BP considers different aspects of what they call the “shale revolution“ in the USA, including the possible response from the markets, the impact on global LNG (Liquefied natural gas) trade and change to the US gas trade picture. The estimation is that US shale gas output will continuously grow between 2012 and 2035, enabling US gas production to rise by 45% (BP Energy Outlook 2014, p. 61)! Surprisingly, the societal impact or ecological consequences of this dramatic change are not considered enough, since, just to mention some aspects, many analysts fear that shale gas may substitute not coal but renewables and the unforeseen consequences of the use of hydraulic fracturing to obtain gas from shale rocks (Stevens 2012).

It would be hard to claim that all these trends will not have any impact on societal processes. Further, it is unthinkable that any technological process, innovation or discovery could be socially isolated and completely black-boxed (Latour 1987).That is the biggest challenge and the point to reconsider from the co-productionist point of view: namely, the social dimensions

of energy transitions should not be neglected. One of the key phrases from the text (Miller et al. 2013), that “efforts to transform energy systems involve changes, therefore, not only to energy technologies and prices but also to the broader social and economic assemblages that are built around energy production and consumption” (Ibid. p. 135) is the guiding sentence to offer a more critical view on technological innovations and developments that the mentioned companies have foreseen. The analytical perspective is also grounded on the view that “co-production is symmetrical in that it calls attention to the social dimensions (...) Co-production can therefore be seen as a critique of the realist ideology that persistently separates the domains of nature, facts, objectivity, reason and policy from those of culture, values, subjectivity, emotion and politics” (Jasanoff 2004. p.3).

Indeed, many developments show that this differentiation or exclusion is hard, if not impossible, to perpetuate. A clear example is events that are essentially unpredictable, such as wars in Libya and Iraq, or political uprisings such as the Arab Spring, being that they are completely independent and free from possible estimation. These events have a huge influence on technological production and processes. Considering that the oil and gas industry is the dominant sector in several Arab countries, while projections affirm the deepening of global dependence on oil supplies from the Middle East and North Africa region (Energy Information Administration 2011a, International Energy Agency 2011), the Arab Spring can have a significant impact on the management of the most important industry (oil and gas), bringing strong regional and international implications (Bahgat 2012). This is an example of how a co-production’s call to include social dimensions (and tensions) is undeniably tied to making any given energy future.

One of the key sensitizing concepts is sociotechnical imaginaries, defined as “imagined forms of social life and social order reflected in the design and fulfilment of scientific and/or technological projects” (Jasanoff and Kim 2009, p. 120). As the energy crises of the new millennium ought to be addressed quickly, new energy futures will have to reconsider structures that were shaped by past energy choices. This may lead to a transformation of social infrastructures, which will result from radical changes in the fuel supply. This transformation will bring along changes in established patterns of life as well as a different allocation of burdens and benefits than before (Jasanoff and Kim 2013). How will policy makers react?

This is where sociotechnical imaginaries could guide energy policy towards a more sustainable future. It should be kept in mind that social responses to innovation are shaped by sociotechnical imaginaries, which are “powerful cultural resources” (Ibid, p. 190). This analytical approach aims to achieve a better understanding of the relationship between

political power and science and technology development (Jasanoff and Kim 2009). Regarding energy systems, this concept has always been there, tacitly or explicitly, bound up with political imagination, considering the costs and benefits of technological change. Although the origin of sociotechnical imaginaries can be traced to national states, it is not necessarily limited to its boundaries (Jasanoff forthcoming). Namely, these imaginaries can be articulated and promoted by organized groups such as corporations, social movements and professional societies (Ibid.). This is precisely why the concept of sociotechnological imaginaries is adequate for this thesis, since corporations do envision and perform certain kinds of imaginaries. Among them, oil and gas companies are at the forefront with the imaginary of energy future and it's framing endeavours. Thus, energy future is a concrete site of co-production between social and technological order, holding at the same time particular sociotechnical imaginaries, be they local or universal.

STS scholars have examined in great detail and in a wide range of fields how nations set up their own ways of dealing with scientific and technological developments. The examinations include French nuclear power (Hecht 1998), comparisons of the politics and policy of the life sciences in Britain, Germany and the United States (Jasanoff 2005), citizens' perception on biomedical technologies in Austria, France, and the Netherlands (Felt et al. 2010), debates around the rejection of nuclear energy and agro-biotechnology as a basis for dealing with nanotechnology and its imaginary (Felt 2013), among many others. Therefore, science and technology play an active role in the shaping of national identities. "Science has thus been actively engaged in the shaping of regional cultures even as it has been shaped by them." (Livingstone 2003, p.134).

Sociotechnical imaginaries have the following characteristics: they are collective, durable and capable of being performed. Further, sociotechnological imaginaries break disciplinary boundaries, building on a wide range of aspects coming from anthropology, history, sociology, political and cultural theories (Jasanoff forthcoming). Pulling them together with the notion of the future(s), being the topic of this thesis, sociotechnical imaginaries can be defined as "collectively held and performed visions of desirable future" (Ibid. p. 27). Which future is desirable and which is not is certainly rooted in the social, political and cultural parameters, values and meanings material things achieve through their incorporation in the society.

Moreover, imaginaries go beyond the state actors. For instance, multinational corporations also act upon images of how the world is and how it should be, playing on the noticed hopes and fears of their customers and clients. Coalitions between corporate interests and the media "(...) are increasingly likely to play a pivotal role in making and unmaking global

sociotechnological imaginaries" (Jasanoff forthcoming, p. 39). The concept of sociotechnical imaginaries will let us observe the relevance of global imaginaries, on the one hand, and their concrete materialization in the local contexts, on the other. Perhaps the best example is Shell's video "Earth 2050," where different pressing global matters and issues can be attached to local efforts and solutions (e.g. Brazil's ethanol production or Masdar City in the UAE desert). Further, this concept allows the examination of the interplay between imaginaries and discourses of large multinational corporations and how these imaginaries play out in various contexts.

Another sensitizing concept used will be anticipation. Technological and societal choices are made rooted on specific perceptions of the future. As the future(s) move to the forefront of the debate, becoming key actors in modern governance of technological processes and society, there are increasing societal investments into developing methods and techniques of anticipation. This is not something new, but we are witnessing a growing number of such undertakings.[6]It is seen as fundamental for a society that seeks development, progress and change to include elements of future anticipation. As explained by Adam and Groves, "contemporary societies dedicated to progress, innovation and change (...) need to hone their tools for anticipating, taming and transforming their futures" (Adam and Groves 2007, p.1).

Other authors within the field of STS also examine the role of anticipation and its pertinence. According to Cynthia Selin, anticipation and other "creatures of the future tense," such as promise, expectation, speculation, vision, hope and prophecy, became the subject of analysis within STS in the last two decades (Selin 2008). Further, as the future orientation is the main constitutive feature of anticipation, this looking forward is active rather than passive; thus "anticipation is not just a reaction, but a way of actively orienting oneself temporally" (Adams et al. 2009, p.247). It is understandable that many different versions of the future can be evoked. Through the analysis of companies' videos and documents, it will be possible to observe which features of the future are favoured and by whom, including at the same time anticipatory stances. Next, we will see how large corporations deal with the projected future challenges, expectations, promises and hopes and how they anticipate future developments in the field of energy (and not exclusively there, but also encompassing broader societal concerns that certain energy choices bring with them).

Several forms of moral responsibility characterize anticipation. Anticipation offers an opportunity to be informed about the future(s) and stand ready for it; to make choices about

[6] Taken from the Seminar "Techno-Science and Society: Communicating and Interacting.", Prof. dr. Ulrike Felt, University of Vienna, 2013

courses of action in the face of incomplete knowledge and to secure the best possible futures for oneself (Tutton 2011). In that sense and properly understood, anticipatory modes conceptualize the future not as an inevitable but instead as something that can be negotiated, prepared for and changed (Rieder 2013). Summing it up, anticipation is given as a possibility, asking societal actors to take hold of the “not yet” (Adams et al. 2009). Anticipation as a possibility to actively orient and situate oneself is a starting point for corporations, because of the huge number of scenarios that could be included, based on diverging characteristics (geography, energy sources, visions of a preferred future, political and economic facts and influences and so on). The appealing fact to consider in the thesis is how is the discursive practice of anticipation portrayed by large oil and gas companies?

In this thesis, anticipation will be considered in a specific context--as a part of energy future scenarios. The constructive work of scenario making will focus on addressing and anticipating the yet unknown within the realm of energy futures made by two of the world’s largest companies.

4-RESEARCH QUESTION AND SUBQUESTIONS

The main question this thesis asks is “How is the energy future imagined, framed and presented by some of the world’s largest companies?” In order to answer it, firstly it is necessary to describe and point out how these companies present energy futures, in which ways do they construct them, although that does not mean that this thesis will stop with the descriptive part. Rather, analytic and critical methods will be employed, especially when using video analysis. Given that there is a large number of ways in which the main research question may evolve, it is necessary to delimit the field of interest with some sub questions, even though the analysis will be exhaustive and overarching, encompassing many different fields companies touch upon (from renewable to hydraulic fracturing, from utopian cities in the desert to sound economic and statistical data). This is one of the most appealing points of this master's thesis: the variety, both in energy sources and technologies, and both in economic and geographic aspects.

1) How is an energy future constructed and described in the videos?
These companies were also chosen because of the variety of material they have on the topic, including a wide range of videos and documents. The central focus will be on videos from Shell and BP, because videos, diagrams, images, charts and tables have a particular function. Namely, they can help people to develop a better, even more vivid sense of what it might be like to live in any given future. Moreover, videos are different ways of making energy futures than the documents or brochures because they work with motion pictures, allowing more innovative and imaginative approaches to be developed. Thus, the analysis will encompass many sides of video production; it will analyze both the content and context of the videos, as well as how and which videos are produced by these companies. Ideally, this will permit more analytical depth when considering energy futures envisioned by companies. Further, it will make it possible to contrast the visible with what is not so visible at first glance.

2) How is the relation between the visual and narrative in the videos presented, also involving documents and brochures as complementary sources? How are the energy future's sources represented in the videos?
With this sub question, the aim is to see how the visual (images) and narrative (texts) go together in the video or do they perhaps differ. Moreover, for some parts of the scenarios it will be possible to assess which data or facts from companies' official documents or brochures the sequences are grounded on. An examination will be made as to which futures are at the forefront and which ones are excluded, not only in regard to energy sources. The unique setting videos offer will hopefully provide a better understanding of this issue and its different segments.

3) How do places matter for making energy futures?
Given that these companies are global, operating across the entire world, the way in which they portray the global picture is not less interesting. Certain places and countries (e.g. China and India, as emerging economies) are given especial importance and space. Thus, the term of techno political culture (Felt et al. 2010) gains its full significance here, considering concrete local settings and their arrangements. Consequently, one of the most prominent sub questions will consider geographic locations and how place matters (Livingstone 2003) in making distinctive energy futures.

As these multinational corporations look for a broader picture, a fact also noticeable from the videos, it will be interesting to see which places are chosen for particular stories and based on which factors (e.g. Brazil's ethanol production, accounting for almost 50% of the country's

needs in the transportation sector). After that, it will be possible to observe whether these examples are global, national solutions or imaginaries of a particular kind, based on certain unique characteristics, such as climate, oil and gas reserves, good market deals and positions.

4) How are society and environment brought in in a particular energy future?
This subquestion seeks to answer how society and environment are depicted in energy futures and what is projected to be the impact of certain energy scenarios on them. Technology does not stand alone and neither do technological innovations, but rather they are always accompanied and intertwined with social processes and social innovations, with the following characteristics: social innovation is above all "democratic, citizen- or community-oriented and user-friendly: it assigns significance to what is personalized, small, holistic and sustainable" (Murray et al. 2010 echoed by Godin 2012, p.40). It will be possible to analyze to what extent there are elements of hype, fear or disappointment regarding technological innovations and processes. Given the intertwinement between technology and society, this is where coproduction (Jasanoff 2004) fits the best. The main focus will lay on both aspects, namely on technological and on social orders, which are coproduced. Technological determinism, claiming that technology influences society, but society does not influence technology, is hardly a model to follow. And yet, it is a model that is very present in modern times (Wyatt 2008). Is it somehow present in the making of energy futures?

At the same time, environmental damage and climate change are surely two of the most hotly debated contemporary topics. Terms such as "green" and "sustainable energy sources," although contested (Hess 2013) have become buzzwords, and these companies have also introduced them on a large scale. By asking how environment is affected by a particular energy scenario, it will be possible to observe how much attention these companies pay to environmental problems and in which ways.

5) What are the conclusions from the material and which solutions are presented?
This subquestion will be answered lastly, after the thick description and analysis including the overview of the resources, structures and strategies used in the thesis. As previously mentioned, the main focus will be on videos, their imaginary and facts, which inevitably lead to some conclusions, be they explicit or not. The futures, besides stating and exposing challenges, problems, expectations, hopes and potentials, also intend to give solutions or answers to what they see as troubling in the midterm or long-term future. Knowing that it is very difficult to accurately predict a distant future, it will be interesting to see which conclusions Shell and BP come to and how they frame and stage them.

5- MATERIAL AND METHODS

"*The postmodern is a visual culture*"

Nicholas Mirzoeff

Different methods will be used in order to answer my research question, "How is energy future imagined, framed and presented by some of the world's largest companies? "The material that is planned to be used from these companies is the following: from Shell, two videos: "Earth 2050" (43 minutes, it is more of a promotional kind of movie, hence more general) and a much shorter (2 minutes) "Shell Energy Scenarios - Mountains and Oceans," which is giving the company's view on energy future(s); from BP, two short videos, (approx. 2- 3 minutes each): the new "BP Energy outlook to 2035," from 2014," as well as "US Energy Outlook 2035: America's Energy Future," since there is not any specific video about BP Europe's energy future (or from any other continent, as a matter of fact). Furthermore, a document called "BP Energy Outlook 2035" will be analyzed because it gives insights into the main trends foreseen by the company. Both videos are strongly based on and reliant on this document.

Summing it up, the material focus is on four videos and one official document, with the aim of drawing a comparison where these videos and papers converge or differ and to assess a variety of possible scenarios, technologies, problems and solutions. The videos vary a lot in length (Shell has longer videos, while BP has shorter ones), but still some main trends and visions can be traced. It was important to mention this part because those are the sources which were accessed. They give a clear picture of where these companies stand regarding energy futures and their framing. The selected material is adequate, since it expresses an official position by two of the world's largest energy companies on the topic. Furthermore, some additional documents like "Shell Energy Strategy 2014," "40 Years of Shell Scenarios," "IEA Energy Outlook to 2050," and "Shell Scenarios: An Explorer's Guide 2008," among others, were consulted, but only as additional and supporting material. "IEA Energy Outlook" and the relevant information from that organization was consulted, but it has a limitation to keep in mind: this organization consists of 29 member states, and some of the most important regions and countries concerning energy production and consumption are not among its members (The Middle East, Russia, China, India, OPEC countries). It is

necessary to remember that these videos and outlooks should be taken with caution because, according to some experts such as V.V. Bushuev, General Director of the Energy Strategy Institute in Russia, it is almost impossible to make accurate decade-long forecasts. A variety of factors might influence the outcome, as was already mentioned in the introduction by "IEA Energy Outlook to 2050," with the so-called sideswipes.

Regarding the availability of materials, in the case of the documents, they all are public and possible to access and to download, which was done. Concerning the videos, they are also available on YouTube, therefore presented officially to the broader public; Shell has produced many videos concerning future scenarios. Currently (August 2014), there are 47 videos in the Shell "Future of Energy" section on YouTube, although some of them address technological breakthroughs, such as carbon capturing, and subsea compression pilots or robots speeding up the development of new materials. They vary considerably in length, although most of them are between one and three minutes long. The movie "Earth 2050" is broken down into a number of small videos, such as "Searching for Utopia" (3m5s), "From Sugarcane to Superfuel" (1m14s), "Going further, using less" (1m18s), among many others. A number of extended interviews could be found there as well, with the people from the movie "Earth 2050" (Dan Kammen, Jeremy Bentham, and Paul Goldberger).[7]

BP also has an official channel on YouTube, and one of the sections is called "The Energy Future." There are 28 videos as of August 2014 comprising many interviews, most of them with its CEO Bob Dudley and with Chief economist Christof Rühl.[8] Thus, BP has a big video presence too, so the possibility that they could not be accessed does not exist. Even in the worst case, if the above-mentioned videos could not be accessed, there are other substitutes from which it is quite possible to work on the case and the research question.

5.1 VIDEO ANALYSIS

The importance of methods is that they do not just describe social or natural realities, but they are involved in creating them, as Law (2004) argued. Three methods will be employed in this thesis: video analysis, narrative analysis and document analysis. In the case of **video analysis**, it is crucial and the main one, because this work is mostly based on videos. "The

[7] https://www.youtube.com/playlist?list=PL1A4D83E7390B2A47

[8] https://www.youtube.com/playlist?list=PLaxBnE1Fli02KtWiWytAlTzKCYasFyFxw

postmodern is a visual culture" (Mirzoeff 1998, p.4). From this statement, it is obvious that in order to engage with the postmodern we must engage with the visual. Thus, instead of ignoring them, researchers should examine how exactly the visual is constitutive of different situations (Clarke 2005). We are surrounded by visual images. There are advertisements, movies, cartoons, television, Internet, pictures and photos all around us. But they have their function too: they tell us who we should be, what we should do and even how to do it and what products to use in the process (Ibid.).

One of the basic shortcomings can be that using films as data leads to problems of selection (which films, which scenes are analyzed more closely?) and of interpretation (what attention should be paid to in the material?) (Flick 2009). This is a difficult question, also combined with the one of transcription. This is something where collaboration with other people is welcomed and necessary, which was done, mainly with professors working with this kind of data.

Visual elements (visual language) relating to different aspects of the stories can be a powerful tool for communicating ideas. For my research question, it will be fundamental to see what the relations between images and texts are, which specific settings and scenarios are chosen to tell what kind of story. Videos can surely give a firsthand experience of what companies are exposing and talking about. The aim of researching visual images is to examine the "work that they do and to understand how they do that work" (Silverman 2004, p. 265). This is one of the main points of what can be done with video analysis, and this is why it is necessary in this thesis: it can lead to a better understanding and a more extensive answer to the main research question. Furthermore, the best thing that video recordings do is to allow us to capture versions of behaviour and human interaction in everyday settings and subject them to repeated scrutiny, for example by using slow motion facilities (Heath and Hindmarsh 2002). Thus, it is possible to get access to most minor details. In addition to that, "video recordings can provide the opportunity of developing a database which can be subject to a broad range of analytic concerns and interests" (Ibid. p. 103).

Another point to seriously consider is what many visual discourses actually do and produce. Unfortunately, many of them are put to work in a service for different entities, for the state or other forms of "powers that be," all these factors ultimately leading the social analysts to be highly critical of such representations and images (Clarke 2005). One of the main concerns is related to *realism,* which visual materials certainly claim to convey (Ibid.). It is also necessary and useful to take into account that "film-makers construct versions of reality by their own choosing. But it is the viewers who interpret the material in different ways" (Flick

2009, p.248). This is one of the crucial aspects that should be considered, namely, how is the story made, in which way and by whom. The question of interpretation of images remains open, and by no means is it the aim of this thesis to enclose the debate, but rather to foster it.

Yet, what attracts to this method, among other things, is that up to now looks as if there has not been established one exclusive method of interpretation for material dealing directly with the visual level. “Films are understood as visual texts” (Denzin 1989b, p. 228), so it is necessary, in a way, to unfold and unpack the whole story. At the same time, there will be transcriptions of some of the sequences from the videos. They were selected in order to highlight what these companies shed light on, what they see as problematic and what they see as a solution. It is not sufficient to ask what gets shown in the videos, but also how it is done, making possible the deconstruction of the narrative from the videos. Single scenes are “taken out” and analyzed. Yet, snapshots cannot be considered out of the context of the larger picture. Juxtaposing and analyzing them as short sequences without having supporting information does not make them comprehensible.

This is precisely why they go after the thick description of the entire videos or documents, which then can serve as relevant and complementary background information. The sequences are part of the more general story and follow the narrative pattern of the video. “Different transcription systems are available which vary in their degree of exactness. A standard has not yet been established” (Flick 2009, p.299). That is something that gives an analyst a lot of space to work on the method and transcribe and analyze the most important and useful parts from videos. The surrounding background, the lighting, music, technical elements and colours utilized will be included in the analysis as well. All of this analysis will be done according to the research question and its scope.

However, there is a departure from classical video analysis because most (if not all) of these videos are specific, namely they are promotional or marketing ones, therefore they have a distinctive approach to reality, which is something crucial to keep in mind while doing the selection and interpretation of their sequences. One of the most important changes that has happened in the analysis of visual materials is that, as opposed to the past, where it was assumed that an image merely reflected the world in which it was produced, today there is a much more critical stance towards visual materials (Clarke 2005). Namely, they are seen as “produced in and by” social actors for particular purposes (Ibid. p. 219). Thus, situating the videos must be necessarily part of the analysis. It is possible to do multiple readings as well as different analysis. To unpack the elements that might carry symbolic weight, to decode

them, is one of the most challenging, if not the most challenging, things about doing video analysis.

Furthermore, working with video materials presents a new challenge--the probable partiality. This means that parts or elements of the video, which an analyst knows are present in a broader picture, are de facto omitted or missing. While an analysis should not go beyond the evidence, it is also clear that these hidden, omitted or forgotten elements and clarifications do play a role (Ibid.). The videos enable analysis and open the debate in terms of what discourse is being projected, such as whether more attention is placed on the technological side of energy futures or whether it shows people and the social side of the story, with possible advantages and disadvantages.

To understand the relation between objects and images (in this case, technology, architecture, industrial production) Heath and Hindmarsh claim that “we need to examine the ways in which objects, artefacts and the like come to gain their particular significance at specific moments” (Ibid. 2002, p. 29). One of the tasks of social researchers regarding videos is also to maintain objectivity and neutrality. There is indeed a delicate balance necessary for researchers to keep between immersion leading to insight and distance to allow for critical reflection. Still, researchers will need to learn how to cope with affective responses to video data (Lemke 2007).

The transcribing focus will be on two parts from the Shell video “Earth 2050” (Brazil and Masdar), inevitably opening the question of the larger project from which the snapshots are taken; minute to minute views are just constitutive parts of a larger framework. This issue has been considered by authors in STS, especially by Bruno Latour (1987), but also by Lynch and Woolgar (1990), who look at scientists and how their work is done, from the basic steps (data collection and gathering) to the ultimate one (publishing). They use one analytic conceptualization referring to the notion of chains of translations of inscriptions. Following that view concerning videos, there is a continuous process of translating over long time scales: an inscription (any given social event in real time) is translated by technical practices into another inscription (video recording of the phenomenon) and then another (transcription) and yet another (summary, commentary, thick description) (Lemke 2007). The demand is to preserve the chain of logic and consequence supporting the argument of the researcher. Equally appealing is that, in this view, the video, the researcher, the camera, the transcript, the drafts of the article and so forth, are all parts of a network, having notable roles in producing a sustainable chain, so basically “Latour’s ontology does not allow a view from outside” (Ibid, p.47).

Sheila Jasanoff (2004) wrote about the role of environmental images and how images more generally construct visions on particular questions, like for example a picture of the Earth seen from the Moon. She claims that the image of the Earth is nearly an icon, a common property with meaning and even spiritual resonance for many people. It “has been appropriated by environmentalists as their image” (Ibid, p. 49). Kirby focused on the social actions of film makers and science consultants to show “how they construct cinematic scenarios.” (Ibid. 2010, p. 46) Popular cinema can give an opportunity to promote futures that could fulfil themselves, something for scientists, engineers and technological entrepreneurs to keep in mind. Possible futures for any particular technology can be contextualized by film makers and scientists and the public can be convinced of the validity of ideas and create enthusiasm for a new, using the narrative and visual framework that cinema offers (Ibid.).

Regarding the theoretical background for video analysis, it will be based on texts from Flick (2009), Heath and Hindmarsh (2002), Clarke (2005), Lemke (2007), Jayyusi (1988), Silverman (2006) and Goodwin (1994). The basic question of how the video story is constructed in the case of Shell’s “Earth 2050” videos will be answered by taking representative sequences from the cases constructed there (some of them are: ethanol-based transportation, driving efficiency, construction of new cities based on sustainability). In the case of the other videos (especially from BP), they are mainly based on numerical data, tables and stats, therefore it is necessary to see the cases examined and which possible scenarios are given as a solution or opening of the debate.

5.2 NARRATIVE ANALYSIS

The next method used will be **narrative analysis**. This method is useful for my work because it poses some of the main questions that this thesis is addressing and that will be further elaborated. When doing narrative analysis, the following questions are useful to ask (e.g. Cortazzi 2001, Riesmann 1993):

“What is the content of the story you are examining? How is the story told (structure and sequence)? What purposes does the story serve (functions)? In what setting is the story told (context)? (Silverman 2006, p. 166)

It was important to mention all of these questions because they are fundamental for this thesis and some of them will be used as a part of subquestions to the main topic, like the

one asking how the story is told. All these questions will be a guideline to finding answers to the research interest, and they could be looked at from the videos as well (especially the Shell ones). Specifically, one of the main aims of this thesis is to examine futuristic discourse offered by examined actors. “Narratives represent storied ways of knowing and communicating” (Hinchman and Hinchman 1997, echoed by Riesmann 2003, p.1). But what makes these texts narrative? “What makes such diverse texts “narrative” is sequence and consequence: events are selected, organized, connected, and evaluated as meaningful for a particular audience.” (Riesmann 2003, p.1). Once again, this is essential to see which events are selected and organized, by whom and in which way. Ideally, it will be possible to answer these inquiries from the videos, but also partly from the documents.

This approach, combined with the other two methods, will certainly answer my research question because they go in depth and analyze different ways of how stories are told, constructed, organized, enacted and performed. Regarding the theoretical foundation for narrative analysis, it will be based on chapters from the books by Barbara Czarniawska (2004) and David Silverman (2004), as well as Riessmann (2003). According to Czarniewska (2004), narrative can be understood by students of social life threefold: as a form of social life, as a form of knowledge and as a form of communication. A narrative in social sciences is seen more as an approach than as a method or having a paradigm. There is a number of things that can be done with it, from traditional criticism to deconstruction; however, it does not rely upon the prediction that “an applied procedure would render testable results” (Ibid, p. 136).

5.3 DOCUMENT ANALYSIS

In order to examine different documents from BP and others as well, **document analysis** will be introduced. The main aim is to see how the future energy scenario is made and constructed in the documents, acting as a complementary source of information. The content of documents will be analysed in both a qualitative and quantitative way, since it contains a lot of numerical data and tables. Therefore, a lot of quantitative and statistical data needs to be considered and recapitulated. “Organizations also produce (...) variety of materials concerned with their self-presentation. These might involve annual reports, prospectuses, financial accounts and the like. Many, though by no means all, of those documents, are produced for external, even public, consumption” (Atkinson and Coffey in Silverman 2004, p.57). Furthermore, official documents and reports are “often couched in language that

differs from everyday language use" (Ibid, p. 59). Indeed, the oil and gas companies use specific vocabulary and language to get to the public. There is a lot of important information in these documents regarding future scenarios, which needs to be carved out.

Most chapters, if not all of them, do construct some future scenarios, whether they are desirable, possible, predictable or otherwise. It is essential for this work to keep in mind that "documents are often used to create a certain kind of predictability and uniformity out of the great variety of events and social arrangements." (Ibid, p 61). Nevertheless, predictability and uniformity might be illusive to establish. Most of the documents are based on forecasts and predictions, which might be questionable, as shown by a number of events over the last decades (1973 oil crisis caused by OPEC oil embargo, 1979 oil crisis caused by the Iranian Revolution, 1990 oil price shock caused by the Gulf War, interruption or enormous drop in oil production and exportation in Iraq in mid-2000s caused by US occupation, fall of production and exportation in Libya following the civil war which started in 2011). Therefore, document's uniformity and specially predictability can be contested and disputed.

Based on numerous quantitative data and construction of future scenarios drawn from these documents, it will be possible to observe the work of standardization and categorization that these multinational corporations do through their projections and outlooks. Within standard categories present in the documents, included are the most important energy aspects (namely, oil, gas, coal, renewable energy), geographical aspects (e.g. in the case of BP, the division mainly goes through OECD, non-OECD countries, India and China), aspects of the prediction of the future (what are the possible and desired outcomes). It is important to recognize that these kinds of documents, although with many flaws, constitute the foundation of many aspects and routines of our everyday life (Ibid.). Policy makers might consult these papers and base their decisions on them, on the facts and stats that are exposed. However, from the STS perspective we should focus on which outcomes and scenarios are favoured and why, because it should be noted that by constructing one case scenario (based on fossil fuels, for example) some other alternatives are excluded (Iles 2013).

It will be interesting to see the temporal realities included in the outlooks (the videos work with temporal data, constraints and possibilities as well). Therefore, it is also useful for my master's thesis to look at some other documents (which will not be assessed and analyzed in detail), such as IEA's "Energy to 2050" or "40 years of Shell Scenarios." They are used as complementary and second-source data. Common to all these documents are considerations of different technologies in the energy sector, energy supply and demand, global environment concern, population growth, economic growth, globalization and degree

of market openness as well as the side effects. However, there are differences in many aspects from the above-mentioned parameters, as well as in the pace of technological development of countries or regions.

The document analysis is the key method to make possible an assessment of constructed realities. It is worth mentioning that Bruno Latour and Steven Woolgar wrote about the production of scientific papers, suggesting that they achieve an independence from their original site of production and take on an independent existence (Latour and Woolgar 1986). The conclusion is that documents, after being produced and written, present some kind of reality (Ibid.). Still, we should be careful when interpreting such realities. These documents cannot be seen and used as direct evidence about the social world, but “rather, they construct their own realities.” (Atkinson and Coffey in Silverman 2004, p. 73). Which realities do these documents construct?

Theoretically, document analysis will be grounded on David Silverman's book from 2004 and a few chapters from there, as well as from Uwe Flick’s (2009) book because they explain the method very precisely; if necessary, it will also include other available information. As one of the main aspects regarding the Methods and Material section is feasibility, it should be mentioned that these materials and methods will be used in two independent chapters, yet interconnected between them by the aspects considered and by the subquestions. Once a realistic estimation was made of how long it takes and how hard it is to juxtapose the consulted and reviewed material, it could be concluded that these methods and materials are adequate, considering feasibility and the time span projected to complete the master's thesis.

As the selected materials will be different (videos of different lengths, documents and outlooks), the methods and approaches will differ as well, and the purpose is to use the adequate ones, which the mentioned methods surely are. It should also be noted that the variety of methods will be able to answer the research question better than if only based on one method and material. In some cases, written documents are the best way to see the energy future scenario of a company (BP) while at the same time Shell energy futures are apparently more descriptively and exhaustively presented through videos than through documents. Further, the question of access and availability is easy to solve (all the videos are public, published and available on YouTube).

6- SHELL

Shell is a global group of energy and petrochemical companies. The company was founded in February 1907 and is headquartered in The Hague, Netherlands, while the parent company of the Shell group is Royal Dutch Shell plc, which is incorporated in England and Wales. It has around 92,000 employees in more than 70 countries and territories. While helping to meet global energy demand in a responsible way, Shell's strategy remains to drive forward with the investment programme, to deliver sustainable growth and provide competitive returns to shareholders[9]. The global network consists of 44,000 petrol stations, providing transport fuel to around 10 million customers each day, and it has 47 oil refineries worldwide. This company is one of the richest in the world, and these are some of the main numbers from the last year (2013): general revenue - $451.2 billion; income - $16.5 billion; net capital investment - $44 billion and investment in research and development - $1.3 billion.[10]

Shell believes that oil and gas will be an important component to the global energy mix for economic development for many decades to come, thus the objectives of the group are to engage efficiently, responsibly and profitably in oil, oil products, gas, chemicals and to participate in the search and development of other sources of energy. The relation to oil and gas is described as twofold: on the one hand, it is to ensure that the company extracts and delivers them profitably and on the other hand, it should be done in environmentally and socially responsible ways[11].

The next theme is the structure. Shell is organized into: Upstream, Downstream, and Projects and Technology. Upstream business searches for and recovers crude oil and natural gas. It liquefies and transports natural gas as well, while at the same time operating the infrastructure needed to deliver oil and natural gas to market. Shell also develops wind power as a means to generate electricity. There are two organizational units that Upstream businesses are grouped into: Upstream Americas, covering the Americas, and Upstream

[9] http://www.shell.com/global/aboutshell/at-a-glance.html

10- Ibid

11- http://www.shell.com/global/aboutshell/who-we-are/our-purpose.html

International, covering the rest of the world with major interests in Europe, Asia/Middle East/Russia, Australia/Oceania and Africa. The main role of Downstream business is to manage Shell's refining and marketing activities for oil products and chemicals. Refining includes manufacturing, supply and shipping of crude oil, while Marketing sells a wide range of products, such as fuels, lubricants, bitumen and liquefied petroleum gas (LPG)[12]. Moreover, Downstream monitors Shell's interests in alternative energy (excluding wind) and CO2 management. The last unit, Projects and Technology, manages the delivery of major projects and leads research and innovation to develop new technologies. It provides technical services and technology capability covering both upstream and downstream activities.[13]

Shell's main strategy is to reinforce its position as a leader in the oil and gas industry. There are a number of strategic themes which Shell is focused on, and each of them requires distinctive technologies and risk management: downstream engine, upstream engine, integrated gas, deep water, resources plays, and future opportunities. The company aims to improve energy efficiency in its operations. Furthermore, at the core of Shell's strategy is the commitment to technology and innovation.[14]

As the topic of this thesis is energy future, it has already been mentioned that Shell foresees an important role for fossil fuels in the decades to come. The future of energy is something thoroughly thought about in this company, as can be seen from the official web site, where Future of Energy is one of the main units, alongside Environment and Society, Products and Services and About Shell. There is another unit called "Shell for: Business customers, Jobs and Careers, Investors, Media, Motorsport fans, Suppliers and Motorists." Furthermore, Future of Energy is comprised of many subunits, such as "Shaping the energy future through innovation," "Innovation at Shell," "Shell Scenarios," "Natural gas," "Deep water," "Shell in the Arctic," "Wind," "Going underground" and "Smarter mobility."[15]

[12] http://www.shell.com/global/aboutshell/our-business.html

[13] Ibid

[14] http://www.shell.com/global/aboutshell/our-strategy.html

15 http://www.shell.com/global/future-energy.html

Shell forecasts that more people will gain access to energy and enjoy higher standards of living in the future, which can also have some side-effects, placing greater pressure on the world's resources, such as energy, fresh water and food. Additionally, climate change is a serious concern, even more so with the rise of global energy demand. The projection is that by 2050 there will be 9 billion people on the planet, which is equivalent to adding another China and India together (Shell Energy strategy 2014). One of the main trends in the future will be urbanization. It is projected that 70 million people will move into cities each year for the next 25 years. At the same time, global energy demand will grow by 15-20% between now and 2020 (Ibid.). Shell calls on government, industry and society to work together to address these developments, in order to have continued prosperity and development.. One of the fundamental changes in terms of energy sources should be the replacement of coal by natural gas in the power sector (Ibid).

At the same time, the company's main focus in renewables continues to be biofuels, since Shell has been involved in distributing biofuels for over 30 years. In 2011, Shell started producing biofuels. Raízen is a new company formed with Brazilian company Cosan. This joint venture is one of the world's largest ethanol producers, and the company makes the claim that Brazilian sugar cane ethanol is one of the most sustainable biofuels available on the market today. Regarding carbon emissions, it produces around 70% less CO2 than conventional gasoline (Ibid. p.4).

6.1-SHELL SCENARIOS

As considering different aspects from Shell's Future of Energy would be way too broad for this work, the focus will be put on Shell Scenarios. As has been mentioned previously, Shell has more than 40 years of experience in making scenarios, starting in 1972, and it is one of the few companies that regularly employs these alternative outlooks as core strategic tools. In order to succeed, scenarios should not just have an ability to provide strategic insights but also to develop and share these insights (40 years of Shell Scenarios 2012). Mainly, scenarios are stories considering the "what if?" questions. Scenarios are used by Shell to allow leaders to make better business decisions.[16].

[16] http://www.shell.com/global/future-energy/scenarios/what-are-scenarios.html

Moreover, scenarios challenge conventional wisdom by exploring plausible, as well as predictable, outcomes. Shell sees its position as stronger thanks to the forward planning capacity that scenarios bring, which may prove crucial in an industry often defined by uncertainty and volatility.[17] Scenario planning has also been assessed by Adam and Groves (2007), and they define it as a "plausible description of possible futures, based on coherent and internally consistent sets of assumptions about key relationships and driving forces (e.g. new technological developments, CO2 emissions, prices)" (Adam and Groves 2007, p. 202). As seen previously, all these factors are taken into consideration by Shell.

Shell produced a number of scenarios looking to 2020 from different starting years: from 1992, 1995, 1998 and 2001, trying to add some new moments and dimensions, be they political, economic or societal. There is also a global scenario that reaches as far as the year 2050, which can be downloaded in seven different languages (English, Arabic, Bulgarian, Chinese, French, Spanish and Russian).[18] It considers two plausible scenarios, named Blueprints and Scramble, which were published in 2008. The first one is called Scramble, where policymakers pay little attention to more efficient energy use until supplies are tight. The environmental concerns are not seriously addressed until there is a major climate shock. The second scenario, called Blueprints, foresees growing local actions starting to address some dramatic challenges of economic development, energy security and environmental pollution. The Blueprints scenario offers the best hope for a sustainable future, since it achieves lower CO2 emissions[19].

Clearly, the company favored one scenario over the other. Although backing the Blueprints scenario was controversial, signaling preference for one scenario over the other, Shell pointed to addressing greenhouse gas emissions and other environmental pressures from rising energy demand as crucial. Furthermore, as stated by the company "(…) Shell is part of the world and ultimately a more sustainable world is a better place to do business" (40 years of Shell Scenarios 2012, p.29).

[17] Ibid

[18] http://www.shell.com/global/future-energy/scenarios/previous.html

[19] Ibid.

Scenarios will increasingly have a say in the making of energy future, as there are tough challenges that will have to be addressed, some of them very soon: rising energy demand, tightening energy supplies and the growing impact of climate change. These challenges are considered as well, and Shell's scenarios team focuses on different aspects to build visions of the future: long-term trends in economics, energy supply and demand, geopolitical shifts and social change. The scenarios are increasingly being used by policymakers to help guide society into the future[20]. There are some concrete steps made by governments, for instance in China, where the scenarios team has made a partnership with government agencies in order to help develop long-term energy policy alternatives. The results of Shell's long-term energy scenarios are regularly shared with governments. Ideally, scenarios can help governments, societies and companies to be better prepared to tackle challenges.[21]

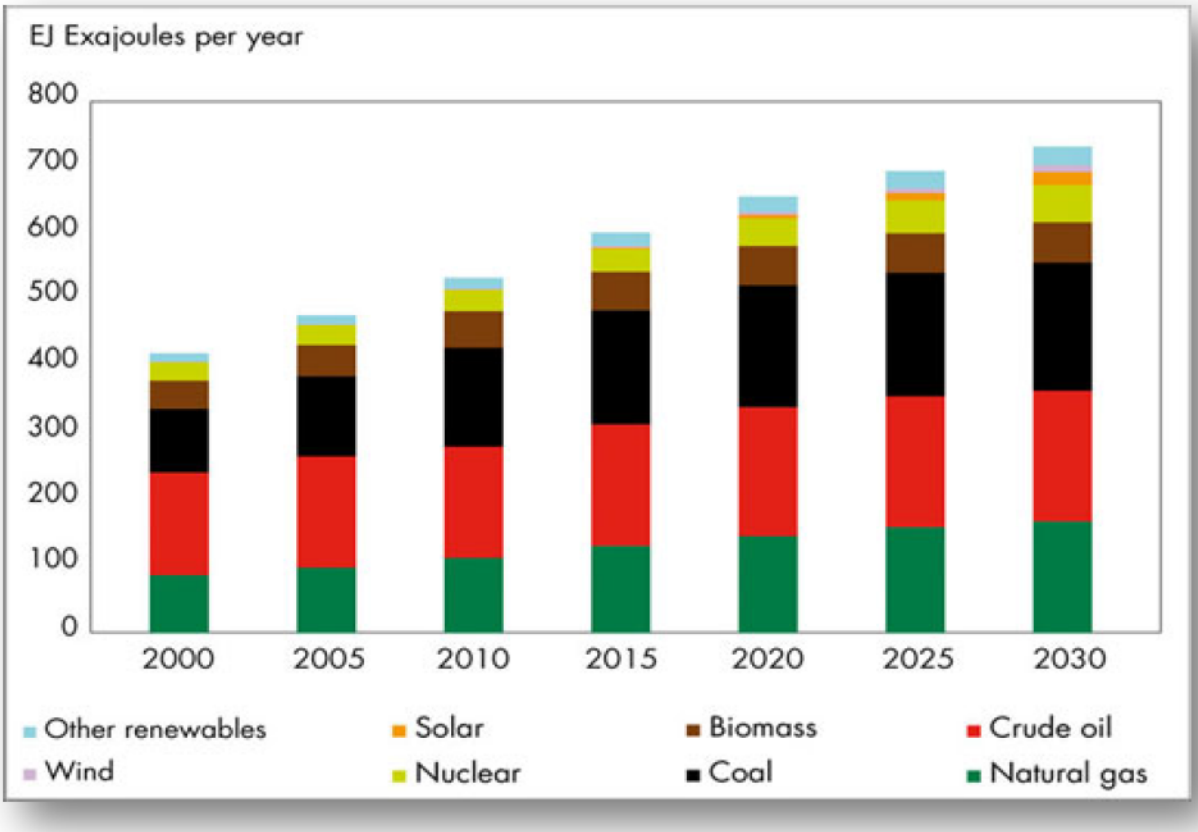


Figure 1: World-Total primary energy supply: A wide range of energy sources will be needed to meet rising global demand in the decades ahead (Source: Signals & Signposts, Shell scenarios publication 2011).

[20] http://www.shell.com/global/future-energy/scenarios/shaping-vision-future.html

[21] Ibid.

6.2- SHELL VIDEO PRODUCTION

As this part of the thesis will mainly focus on Shell's video production (using documents and brochures as additional and complementary sources), it is necessary to examine how videos convey certain scenarios and how they make and produce new realities and based on which facts. One of the advantages is that they allow a broader and more in-depth analysis of the energy future, beyond its pure textual contents from the documents and websites. The importance of videos in Shell future scenario making is obvious already from the official website: namely, each of the sections within Shell scenarios ("What are Shell Scenarios?," "New Lens Scenarios," "New Lenses on Future Cities," "Shaping a vision of the future," "Meet the Shell scenarios team," "40 years of Shell scenarios" and "Past scenarios") comes accompanied by a video referring to the topic, except the last unit, "Past scenarios." Instead of videos, there is a variety of former scenarios that can be downloaded as documents or brochures from "Past scenarios," including the guide on how to make and use scenarios called "Scenarios: An Explorer's Guide." Further, there are also two selected speeches by Shell CEO Peter Voser, "New Energy for a Changing World" and "Energy Strategies for Sustainable Development." [22]

Going back to the videos, Shell's main video units are located in London and The Hague. Apparently, there are not hard rules regarding which team covers which project. However, generally the London team tends to be used for UK shoots as well as for coordinating international projects. Meanwhile, the Hague unit is mainly used for shoots based in and around the Netherlands, according to Jane Poynor, head of the London Film and Video Unit. The Hague team is generally used for projects such as high-profile interviews with the CEO, or other senior executives based in the Netherlands.[23] Additionally, there is a third video team in Thornton, England, which was established many years ago around the research laboratory Shell has there. This team is used for filming in the laboratories, working with scientists and producing 3D graphics. Still, all these hubs work together and use different editing facilities, depending on their capacity. Furthermore, there are filmmakers or

[22] http://www.shell.com/global/future-energy/scenarios/previous.html

[23] https://www.melcrum.com/research/harness-digital-technologies-create-high-impact-communication-plans/ensuring-most-effective

individuals who will coordinate external suppliers in the world on an ad hoc basis, as explained by Poynor. [24]

Video being an expensive medium, there needs to be a good reason to go ahead with the project, as explained by Susan Ross, Shell's director and producer. Although company executives can request the London team to produce a professional video, it is still the team who decides if the investment is worth making. A proposer has to state the message or aim of the video and who the target audience is supposed to be. In addition to that, there are two main parameters in deciding about the usefulness of shooting a video: which part of the company's strategy the video would support and how they would market the video and drive people to see it. This is something that is often forgotten when planning a film, according to Ross.[25] Shell often uses local production companies for filming shoots overseas, shoots that are coordinated from the London center. These local companies shall then provide both crew and equipment. Ross sometimes travels in person to coordinate projects of different kinds. Those projects might involve interviewing several people in different locations or conveying an important strategic message for the company. In order to produce a corporate video for Shell, production houses are asked to tender.[26]

Shell's official channel on YouTube is divided into different sections, such as: "Shell TV," "Corporate," "Future of Energy," "Shell Jobs&Careers," "Television commercials," "Shell Motorsport" and "Shell Eco-marathon." Thus, Shell videos cover a wide range of different areas such as the future of energy, innovation, technology, television commercials, Eco-marathon, motorsports, safety, engineering and corporate events. The channel started on September 5th, 2005, and has attracted 21,026 subscribers and more than 20 million views as of August 2014.[27]

[24] Ibid.

[25] Ibid.

[26] Ibid

[27] http://www.youtube.com/user/Shell/featured

The section called “Future of Energy” comprises 47 videos, which taken together as a playlist last for 2 hours and 11 minutes. Although the videos make one section, they differ quite a lot regarding their main topics. They talk about future cities; fuelling a future on Europe's waterways (a story from Norway); about the impact and influence of Shell scenarios; a well management system for efficient drilling; energy for the future (a more general overview); a sustainable energy future; capturing carbon to store it safely underground (the technology of Carbon capture and storage, seen as essential to help avert serious climate change in the future); the sun-lit jungle in Guatemala, based on solar panel kits, which are providing a better mix of energy; Shell Scenarios--imagining the future; tools for the future and computer modeling the future, among many others.

Surprisingly, the next video analyzed (“Shell Earth 2050”) does not form part of this section (“Future of Energy”), and it is not included in the playlist, although many of its constitutive parts are there, noticeably shorter in length. These are the videos with the title “Earth 2050”: “From Sugarcane to Superfuel” (1:14), “Going Further, Using Less” (1:18), “How Much Energy Will We Need?” (1:29), “Fueling the Future” (4:14), “Searching for Utopia” (3:05), and an official “Earth 2050” trailer (3:21). There are also extended interviews with some of the main figures from the movie, namely with Dan Kammen (Professor of Energy, University of Berkeley, California), Paul Goldberger (Architecture critic/Writer), Cliff Fox (Senior Vice President, Nokia Location and Commerce) and Assaf Bidermann (Associate Director, MIT Senseable City Lab). As an interesting fact, Shell’s “Earth 2050” trailer was uploaded in December of 2011, almost one year before the full-length version (August 2012).

6.3- VIDEO 1: “EARTH 2050”

The movie “Earth 2050” is composed of three different stories, directed by three acclaimed filmmakers. The topic is the future of energy. It presents three stories of innovative solutions: fuel, transportation and cities. The first story, “Fueling the Future,” is directed by Lilibet Foster. The second story, “Driven by Design,” is directed by Michael Epstein and the third one is called “Searching for Utopia” and is directed and narrated by Nathaniel Kahn. A more general introduction (as well as short intros to each of the three stories) to the movie is given by Thomas Goetz, executive editor at “Wired Magazine”. Regarding the duration, “Fueling the Future” starts at 1:15 and goes to 14:50, “Driven by Design” starts at 14:50 and goes to 29:00 and “Searching for Utopia” goes from 29:00 and stops at 43:15. Thus, we can see that

there is an equitable distribution between the three parts, as each of them lasts around 14 minutes.

On a more theoretical level, this movie is part of Shell energy scenarios to 2050, based on three aspects which this company labels “Three hard truths.” Energy choices, which are critical to the planet’s future, should look at these evident truths: scarce resources, surging demand and the impact of climate change. The conventional resources of energy are not endless and alternative sources are fundamental and will have to struggle to keep pace with the growth in demand. Finally, the world has to reduce carbon emissions to combat climate change (40 years of Shell Scenarios 2012).

This video was published on August 21, 2012; however, it was produced one year before, in 2011. So far, it has attracted more than 435,000 views on YouTube (as of August 2014). The reception by the viewers has been largely positive, since there are 1684 thumbs up, contrasted with 289 thumbs down. Firstly, we need to have all the facts from this innovative video. While starting off in a way that future can be threatening if we do nothing about the current status of energy, forecasts are that nine billion people will live on the planet by 2050. There will be vast megacities and the energy demand will double by then. How will we adapt?

This is the introduction and the main question from the video, which examines three different scenarios: the way energy demand is seen and tackled in Brazil (with ethanol production for transportation), the advice for driving economy (from Scandinavia to Australia) and the way future cities could look in a sustainable way (Masdar, a project city in the United Arab Emirates). As these are probable and possible scenarios, a definition should be introduced: “*Scenarios* are not predictions of what will happen; rather they enable the exploration of possible, probable and preferable futures” (Adam and Groves 2007, p.202).

The biggest challenge in the automotive industry is that we already have a billion cars on our planet and that number might double by 2050. The projection to 2050 is not as unusual as it might look, since, for instance, the EU has made a long-term commitment to cut emissions by at least 80% by 2050.[28] Jay Keasling, CEO at Joint Bioenergy Institute- US Department of Energy, affirms that if we do not reduce the emission of carbon dioxide, we might have climate changes that we could never recover from. However, there is not a mention on the current state of affairs in the field or ongoing climate change processes and events. In a way,

28 http://ercim-news.ercim.eu/en92/keynote/smart-energy-systems--a-european-perspective

we have the future seen as *open future* here*:* “The contemporary future is no longer assumed to be predestined but subject to human shaping and transformation. As such it has to be actively chosen and produced” (Ibid, p199).

Moreover, there are two different scenarios regarding the type of transportation we could move into considered by Dan Kammen, Professor of Energy at the University of California, Berkeley. The first one is that we would use more and more liquid fuels and the second one is that we will use electricity. Right now, more of the industrial activity is focused on biofuels, fuels produced from living organisms. According to Prof. Keasling (who also teaches at Berkeley, a fact not mentioned in the video), batteries are not sufficient and cannot power an air flight, for example. He sees a solution in using a transportation fuel that will directly replace the petroleum-based fuels that we are currently using.

Commercial production of ethanol started in Brazil in 1975, according to Isaias Macedo, Researcher at Energy Planning at State University of Campinas, Brazil. Brazil had become the world's largest exporter of ethanol by 2010, producing 24.9 percent of the world's total ethanol used as fuel. [29] The oil shortage in the mid-1970s made Brazil look for an alternative to oil, and they succeeded in finding it. At that point, CO2 emissions and pollution were not a dominant topic or a main concern, explains Macedo. Anyhow, the shift gave results because today more than 50% of the cars in Brazil use ethanol instead of gasoline. That was an original way to fight oil dependence, but one thing is crucial here: sugarcane. Brazil has a climate which is ideal for growing sugarcane.

The explanation as to how to obtain ethanol from sugarcane is also in the video, which is given in detail and exhaustively, as well as the explanation as to why Brazil cannot supply the whole world with ethanol, which both Kammen and Macedo are aware of. The success of sugarcane in ethanol production is stemming from a fact that the process of obtaining ethanol from sugarcane is extremely efficient--it is possible to get about seven times the energy put into growing the sugar cane. This is compared to the US, where ethanol is produced from corn, and for every unit of input of energy the result is the same amount of energy oil, which means nothing is gained, according to Keasley. It is interesting to observe that the comparison in biofuels production and efficacy is made only and exclusively to the USA, which can be seen as technoscientific imaginary being somehow reduced.

29F.O. Lichts. "Industry Statistics: 2010 World Fuel Ethanol Production". Renewable Fuels Association.

Jay Kaesling talks about synthetic biology and the possibility to engineer yeast in order to produce an antimalarial drug called artemisinin. Malaria is a big problem in some parts of the world. In 2012, there were about 207 million cases of malaria, and it caused an estimated 627,000 deaths.[30] Now, the video turns to the developing world, attempting to give a more global and universal picture, and its problems, surely health being at the top of the list. Small quantities of artemisinin are produced from yeast, and this drug will be on the market soon, and it will be cheaper than the other ones, says Keasling. The video touches briefly on this topic, not going into depth about the problem of malaria in Africa or elsewhere in the world. States that cannot make big investments in science and research often find it difficult to attract attention from other countries about their concerns (Wagner 2008). This explains why diseases like malaria, affecting a great number of people in the developing countries, have traditionally received little attention. Concentration of knowledge has its side-effects: areas and countries that generate more knowledge also decide what kind of knowledge is created and what kinds of problems are being solved (Ibid.).

The possibility of producing diesel out of hydrocarbons is also considered. “If we imagine that glucose is going to be our new petroleum, we need a source for that glucose. So the crops that we are looking at are the crops like switchgrass” (Keasling). However, it is interesting to see that switchgrass grows only in North America[31], so the narrative is confined to the USA. At the same time, Dr. Kammen considers the environmental cost of possible new solutions and assesses that evaluating all of the new fuels in terms of the land use impact that they could have is an additional part of the story of doing “good science.” Here, there are some essential questions that must be asked: What does it mean to do good science, since that is not elaborated in the video? By whom and for whom is that kind of science done? The video skips analyzing and assessing important parts of making science and the contrast between already made science and science in the making (Latour 1987).

The basic issue, as Dr. Kammer says, is that “If you think how long it’s taken for us to build up petroleum industry; we can’t hope to reverse that overnight. It’s a huge change in our infrastructure.” The critical part is that scientists should have been working on this for 30 years now--and they have not, according to him. The main analytic question is why not, what were the forecasts back then? What was the technopolitical background when deciding at

30 http://www.who.int/mediacentre/factsheets/fs094/en/

31http://plants.usda.gov/core/profile?symbol=PAVI2

that point? It would be interesting to see what the governments and corporations saw as a priority then, while at the same time almost completely neglecting this possible future. Which *scenario* did they construct and produce? As Adam and Groves consider in "Future Matters," which were their *possible, probable* and *preferable* futures? (Adam and Groves 2007)

Furthermore, it is necessary to introduce politics in a manner of *politics of posterity*, seen as "Political decisions that have the capacity to create major consequences that will affect countless future generations who are without voice or vote" (Ibid, p.200). That is something to keep very much in mind while making decisions regarding energy futures: the impact they will or might have on future generations. At the same time, Dr. Keasling argues that the solution is that basic research needs to be done now and by as many people as possible. As some expectations here are exposed, and by different actors, it is necessary to undertake a situated mapping of expectations, a specific one that recognizes variation in expectations between different actors (basic researchers, entrepreneurs, and potential end users) (Brown and Michael 2003).

The next part is called "Driven by Design." Now the focus is on cars and it is predicted that by 2050 there will be two billion cars on the planet and fuel consumption will have tripled. One of the possibilities given to curb the issue is that we will have to radically change the way we drive. This fits nicely into the idea of promises and expectations, namely that "expectations structure activities (…) A new social order is possible on the basis of collective projections of the future" (Van Lente 2006, p.386). So which roles and how are they allocated to drivers and to cars, to humans and nonhumans (Latour 2005)? The sequence starts by examining the advantages of cars in our everyday life. But, the disadvantages are there as well, as explained by Assaf Biderman, Associate Director at MIT. Nowadays, cars are using fuel in a very inefficient way, especially in congestion. The geographic place examined is the USA, and an average American spends nearly 300 hours a year in the car. One of the things that could help cars in this process are maps.

The good thing is that in this way information is going to help people achieve more efficient routes, with a lot of information about the road, much more information than it is possible to collect nowadays. The geographic site is the US (Chicago), while the method used by Nokia is digital mapping, and its main components are lidar (a technology that measures distance by illuminating a target with a laser), sonar and a 360 degree video. Probably within two or three years, 3D maps are going to integrate the traffic information into our routing and therefore we could make much better decisions regarding fuel efficiency. Although this

change could be enormous *per se*, there is not a mention of feasibility of this project, nor how much it would cost. As Borup et al. acknowledge, the articulation of an expectation does not automatically produce accountability (Borup et al. 2006), which is the case in the part of the video presented.

Another key to improving transport efficiency is building cars that drive themselves. The goal is a huge improvement of efficiency in driving. Suddenly, in this case, humans would be removed from the process of transportation (Why humans should be removed from the process is not explained); vehicles will be linked to modern 3D mapping systems. Driving will be safer and more efficient, argues the video. That next generation of vehicles is being built right now, by Swedish company Scania. Once again, innovation is described as a main driver towards the safer and more sustainable future. The link between innovation and future is given. “Innovation in science and technology is an intensely future- oriented business” (Borup et al. 2006, p. 285) and this case is not an exception. Completely autonomously driven vehicles are the aim to achieve in the future, which seems to be not so distant according to the video.

The next place in the video is Australia, focusing on the Taylor family, a man and woman who are driving efficiency educators. They give different hints on how to drive efficiently and economically, in order to save fuel. They are part of the official Shell program “Smarter Driving.” In contrast to the last example, here the drivers are still key figures in the process. On the Scania truck test polygon, near Stockholm, this company conducts their own experiments. The result is that they have been able to drastically reduce fuel consumption.

The last part of this video is called “Searching for Utopia.” *Utopia* is defined as an “imagined future state of perfection, attained by progress that overcomes current limitations on human potential.” (Adam and Groves 2007, p.204). We see the city rising out of the desert in the United Arab Emirates, and it is called Masdar, located near Abu Dhabi. This city is designed to be the most environmentally sustainable city in the world. Basically, in the movie, it is seen as the city of the future, even the role model for the world. It is carbon-neutral and powered by renewable energies. Masdar streets are totally free of cars. Many designs in it are taken from ancient Arabic towns. The comparison is automatically made to Abu Dhabi. The comparison goes in different directions, for example Masdar has a much lower temperature on the ground in September than Abu Dhabi does. It is stated that the design of Masdar actually cuts air conditioning needs by 60%. The roof panels there are constructed not only to provide shade, but they can also generate electricity. Power is generated by a 10 MW photovoltaic power plant located on site and 1 MW of rooftop solar panels.

Finally, Shell's future scenarios team is introduced, with people coming from different backgrounds, such as political scientists, economists, and geopolitical experts. Jeremy Bentham, head of the Shell Scenarios Team, says that they are putting a lot of attention into cities and city development. By current projections, 75% of the world population will live in cities by 2050. Consequently, there is a further urban sprawl. The basic goal of Shell's Scenarios Team is to find a way to bridge the gap between the demand and the supply regarding energy. At the same time, the forecast of oil in the UAE predicts that it will last for 150 years more.[32]

Masdar is a project-city looking for energy from renewable resources, from geothermal and wind, but especially from the sun, as it is located in the desert. A field of solar panels there produces more than enough electricity to run Masdar, and the excess power is sent to the Abu Dhabi grid. But these silicon panels are quite expensive, which is seen as the main drawback. Furthermore, there are other drawbacks to using solar energy, which are not generally taken into account (Mulvaney 2013). How is the future constructed in this case?

The future for Masdar energy supply is the prototype called the "solar beam down." It is based on highly reflective mirrors, which can generate power more cheaply and ecologically than silicon panels. With a temperature which is quite high (600 C), it is possible to generate steam to run turbines in order to produce electricity. The drawback is obvious: this technology does not work at night. So, at night, Masdar needs to use power coming from natural gas, which means that even this city cannot be powered entirely without fossil fuels. The main idea of Masdar is to be "a laboratory to develop things that can be applied in existing cities all around the world, because that is where it will pay off" (Paul Goldberger, architecture critic and author). And this is precisely the question that this part of the video does not answer, although it also poses the same inquiry: there is not a connection with the possibilities and conditions in other parts of the world. The value of such a project as Masdar is that, most likely, it gives us a clue about future cities, as is mentioned in the video, where it is left to time to decide about the possibility of the existence of such a city. The topic is open to evaluation as this is just a laboratory city. Maybe future cities will not look like Masdar, but they will have to consider the same concerns.

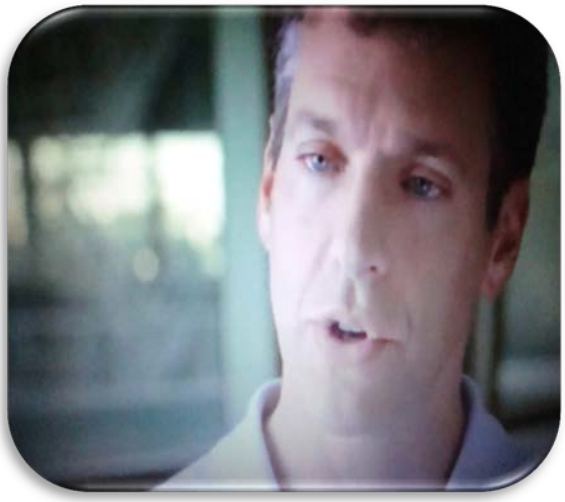
[32] http://www.emirates247.com/eb247/economy/uae-economy/abu-dhabi-s-oil-reserves-to-last-another-150-years-2010-03-31-1.100837

6.3.1- ETHANOL PRODUCTION IN BRAZIL

Snapshot1 (Source: YouTube 2014)

Snapshot 2 (Source: YouTube 2014)

2:51 (♫...) Isaias Macedo, researcher, Centre of Energy Planning (NIPE) at the State University of Campinas, Brazil: Commercial production of ethanol as fuel started in Brazil in 1975. When we started the ethanol program, nobody talked about reducing emissions. This was not an issue at that time. First, and most important, we didn't have money to buy oil anymore after the first oil short. We were importers of oil. And today, more than 50% of all cars use ethanol instead of gasoline



Snapshot 3 (Source: YouTube 2014)

Snapshot 4 (Source: YouTube 2014)

3:23 Dan Kammen, Professor of Energy at the University of California, Berkeley: Brazil made a very conscious choice to try to find a way to reduce their fossil fuel dependence. And they didn't have to look very far because Brazil's climate is ideal for growing sugarcane.

Snapshot 5 (Source YouTube 2014)

Snapshot 6 (Source YouTube 2014)

3:37 Carlos Dinucci, CEO Sao Manoel Mill: When you have sugar cane plantation, you have only two things to make: sugar and ethanol. My family has been in sugar cane business since 1955, and about thirty years ago, I thought, there is an opportunity to make more ethanol. Now, we are producing 120,000 cubic meters of ethanol.

Snapshot 7 (Source YouTube 2014)

4:07 Isaias Macedo: Brazil today has very close to 400 sugar mills. The overall sale is 30 billion dollars. And this number is increasing.

Snapshot 8 (Source YouTube 2014)

4:55 Dan Kammen: Brazil has gotten to a point today where they are using about 40% less petroleum than they would be otherwise, but Brazil cannot supply the whole world with ethanol because they would have to cut very strongly into food production and into critical natural areas like the Amazon to make that happen. This really boils down to the fact that there is only so much arable land, and growing fuel for our gas tanks is yet another demand on that landscape.

Snapshot 9 (Source: YouTube 2014)

Snapshot 10 (Source: YouTube 2014)

5:30 Isaias Macedo: I think we have to face the world in this way today. We have no oil in very large quantities anymore. We have no coal transforming in a clean way, in the meantime we have to do the best we can, and the best at the moment is that we can do biofuels

The first part of the video that is transcribed takes place mainly in Brazil (logically, because of ethanol production) and partly in the USA (when professors from there are interviewed, mainly Dan Kammen). It basically starts as a historical account of ethanol production in Brazil, as the first example that Shell wants to point to in answering the question "How do we replace the petroleum that we use today and rely on?" Some of the people interviewed (Isaias Macedo) are Brazilians working with ethanol production and research, while at the same time others (Carlos Dinucci) have been in the business for a long time; basically, Dinucci is talking about his personal and family experience with ethanol production. From Macedo's account, it is possible to deduce that although the ethanol program in Brazil started as a necessity after the first big oil crisis in 1973, it turned out to be a good choice later. The global picture here is presented based on one country, with enough arable land and auspicious conditions for growing sugarcane, but this can hardly be a model that could be used elsewhere, except for countries having similar conditions (e.g. some Latin American countries). Additionally, some authors (Sperling and Gordon 2009) consider that ethanol production in Brazil is a unique situation, not replicable elsewhere.

The character of social innovation is seen in the process of the invention as becoming a common good, and it also could be applied to science as public good (Callon 1994). This was a time (the one mentioned in Brazil, the 1970s) when study of technology needed to take social factors into consideration (Staudenmaier 1985). While technological innovation should be accompanied by the social one, the latter "has only recently come to be a conscious concern of policy discussions" (Murray et al. 2009, p.2).

This video tends to point out national diversity, including local scientists and researchers. Nevertheless, they are the ones at the top of the knowledge/scientific or business production. It starts with Macedo talking, introducing us to the topic, while the sequences are showing him and images of arable land (snapshots 1 and 2). Then it moves to Dan Kammen, Professor of Energy at the University of California, Berkeley, while the sequences are showing big tractors and the process of motorized harvesting of sugar cane (snapshots 3 and 4). These are the only sequences seen (although Kammen also talks about Brazilian climate, but this part is not accompanied by images representing it somehow). Langdon Winner (1980) wrote about the impact and consequences that mechanization can have on rural agricultural communities, with the example of the mechanical tomato harvester.

The next sequence introduces Carlos Dinucci, and his story is more personal because his family has been in the ethanol production business for a long time. The images are the continuation from Kammen's part, yet here the process is shown on a much bigger scale, as

we can see big trailers driving the harvested sugar cane (this image is seen when Dinucci talks about producing 120,000 cubic meters of ethanol--snapshots 5 and 6). As Macedo talks again about the size of production of ethanol in Brazil and the revenues it produces, he is not shown, but rather there are images showing trucks coming to a factory, where the entire harvested sugar cane is mechanically transferred to a warehouse or factory's depot (snapshot 7). Next, Kammen is explaining Brazil's choice of ethanol and the images are showing a factory, with tubes, funnels and ethanol production. Suddenly, Kammen is zoomed in whilst explaining the drawback of ethanol production in Brazil, considering the possibility of global supply (namely, that Brazil "would have to cut very strongly into food production and into critical natural areas like the Amazon to make that happen)." Here images of grass and pasture are shown, with animals (cows) feeding themselves with grass (snapshot 8). At the same time, there are not images of forests or the Amazon as Kammen also talks about that. However, there are shots of a natural landscape with a beautiful sunset contrasted with fields planted with sugar cane during his last sentence, which talks about another potential demand on our landscape.

While Macedo speaks about oil and coal in the last part of this transcript, it is possible to observe pollution created by oil and coal refineries, with dense smoke going directly into the air (snapshot 9). The last image is a recurring one, already shown before, showing trucks and the entire factory where ethanol is produced (snapshot 10), while Macedo talks about the best possible solution according to him (biofuels), leaving open the question of whether other sources could be equally successful (like wind or solar power). The pronoun "we" is continuously used, but it is not clarified who Macedo is referring to. The use of such a pronoun, which permits that a group (Brazil's or even the entire world's population?) may be considered together, can greatly change the meaning of a sentence. If it concerns all of "us," then the question is to what degree each member of the group agrees with this statement, even when boiled down to the scientific community alone. Remarkably, there seem to be no boundaries to this "we," so it can be extendible in time and space. The only thing that can be useful in identifying the meaning of which "we" is evoked is the context (Adam 1998).

The music (Brazilian rhythm) plays through the entire video. The light is bright and the images sunny, showing us the particular climate and weather typical of Brazil. Brazil is certainly the right place to talk about ethanol biofuel production, since it is the second largest producer of ethanol fuel and, until 2010, the world's largest exporter.[33] From the sequences, which were not all presented here for space reasons, it is possible to follow the entire process of ethanol production from the sugar cane fields to the factories and consumers on

[33] http://www.ethanolrfa.org/pages/statistics#E

the highways. There are scientists, researchers and CEO's interviewed. However, there is not an exact and accurate explanation of some issues: at what cost is ethanol obtained from sugar cane, what are the environmental and social effects of this practice (which must be assessed if images show arable land and animals grazing grass, as well as the claimed intention to decrease air pollution). Furthermore, it is not technology itself that matters, but the socio-economic model in which it is embedded (Winner 1980).

Brazil started a coordinated programme to promote ethanol production in the mid 1970s in response to the 1973 oil crisis. Collaboration with a diverse array of stakeholders was established and the focus was on early experimentation with different feedstock and on a gradual augmentation of the process (Sovacool 2010). Ultimately, it has made Brazil the largest manufacturer and exporter in the world as well as the country with the largest number of ethanol fueled vehicles. Biofuel business proved to be so successful that ethanol is currently cheaper than gasoline and the government does not need to subsidize it any more (Ibid.).

Profit-driven facts are exposed and covered in detail in the snapshots, while some other concerns, such as pollution from ethanol, are neglected. There is an apparent contradiction between Macedo ("we didn't have money to buy oil anymore after the first oil short") and Kammen ("Brazil made a very conscious choice to try to find a way to reduce their fossil fuel dependence"), although the former is focused on money shortage and the latter on independence. There is nobody from the "lay public" interviewed; therefore the public participation is limited to scientists, professors and CEO's. Additionally, there are almost no workers shown in the snapshots (except, just briefly, people with helmets walking in the factory). It is interesting to observe that the comparison in ethanol production is made only and exclusively to the USA, where ethanol is produced from corn and for every unit input of energy we get about the same unit out (in Brazil, the input-output energy relation is 1 to 7). This makes a technoscientific imaginary largely reduced, since other countries or regions are not mentioned.

The images are selected in such a way as to tell us a story of the solution, while at the same time ethanol production may raise other environmental issues[34]. One of the main questions that might be asked regarding why this particular scenario, could be answered if we consider that Shell has invested in Raizen, a biofuels company producing over 500 million gallons of sugar cane ethanol per year. At the same time, scientists and engineers at Shell are

[34] http://www.sfgate.com/health/article/Study-warns-of-health-risk-from-ethanol-2601178.php

hastening to try to find a solution to fossil fuel dependency or possible future shortage, as explained by Jay Keasling previously. The video is based on a particular technopolitical culture and imaginary (ethanol) and placing science and technology within clear national borders (Brazil), which can be concluded as going hand in hand with Livingstone's (2003) account of the importance of place for science making. Moreover, Brazil made a choice based on its energy sources and possibilities, including all the features of making an energy future situated both in time and in space. But the main drawback is already explained in the video, by Dan Kammen, namely that "Brazil cannot supply the whole world with ethanol because they would have to cut very strongly into food production and into critical natural areas like the Amazon to make that happen."

There is another point to consider: the logistics. Although this is not mentioned in the video, Brazil lacks large transportation and production infrastructure which is necessary for an increase in sugarcane cultivation. [35] The climate in Brazil is not in any way similar to the climate in Scandinavia or Eastern Europe, for example. That is one of the facts that goes back to the main research question and to a possible solution to peak oil and fossil fuel dependency. In this case, on the one hand we have the originality of the idea, which is not new but has already been in place for several decades, and its huge success, even considering environmental cost; at the moment, there are some programs, such as Bio Ethanol for Sustainable Transport (BEST), which is already implemented in nine regions and cities in Europe, Brazil and China, projecting to put into operation more than 10,000 ethanol cars and 160 ethanol buses.[36] Unfortunately, despite the success and its spreading, this solution can hardly be global at this point, as seen from the explanations above, considering arable land, logistics and auspicious conditions for growing sugar cane. It does represent a good start in opening dialogue and fostering public participation on the topic though (including scientists, policymakers, engineers, professors, students, and lay people).

[35] Daniel Budny and Paulo Sotero, editor (April 2007). "Brazil Institute Special Report: The Global Dynamics of Biofuels" (PDF). Brazil Institute of the Woodrow Wilson Center.

[36] http://www.best-europe.org/Pages/ContentPage.aspx?id=87

6.3.2- MASDAR

Snapshot 11 (Source: YouTube 2014)

Snapshot 12 (Source: YouTube 2014)

Snapshot 13 (Source: YouTube 2014)

30:26 (♫...) Paul Goldberger, architecture critic/author: The last half-century has been a pretty bad time for the making of cities, mostly. The natural tendency has been to accommodate to the automobile more than anything else. Try walking around Abu Dhabi, it's impossible, you have to take a car everywhere. Dubai, the same thing. They are among the least pedestrian-friendly places in the world, they are not green by any other measure either, and these are not easy things to fix.

Snapshot 14 (Source: YouTube 2014)

Snapshot 15 (Source: YouTube 2014)

Nathaniel Kahn, architect: Masdar is still under construction, and it doesn't look like much from the highway. But they claim it is going to redefine the way cities are designed, built and powered.

Narrator: Masdar City in Abu Dhabi will be the city of the future, and the role model for the whole world.

Nathaniel Kahn: Once you see what they have envisioned for this utopian city, it's very impressive. It's carbon-neutral, pedestrian friendly and powered by renewable energies. .

Snapshot 16 (Source: YouTube 2014)

32:00 Nathaniel Kahn: the first big move the architects at "Foster and Partners" made was to put all transportation underneath the city, leaving the streets of Masdar totally free of cars. The place reminded me of a medieval city. And actually, many design elements are adapted from ancient Arabic towns and villages.

Snapshot 17 (Source: YouTube 2014)

Snapshot 18 (Source: YouTube 2014)

32:27Austin Relton, Architect, “Foster+Partners”: There are some very, very simple ideas that have a huge impact. This is a pedestrian zone, there are no cars here. This has enabled us to push our streets together to take advantage of the shade, channel the cooling breezes through. The whole scale here is based on the human being; it’s not based on the motor car.

Snapshot 19 (Source: YouTube 2014)

Snapshot 20 (Source: YouTube 2014)

33:03 Austin Relton: What we must avoid is direct sunlight hitting any piece of glass. As soon as the sun hits the glass, the heat is transferred into the building and we have to use more energy to cool it down.

Interviewer: Can this really make all that much of a difference?

Austin Relton: Yeah, absolutely. For example, downtown Abu Dhabi…sixty-meter wide streets, black asphalt, mirrored reflective buildings, no relief from the sun. On a day in September, the air temperature in both places was 39 degrees. In Abu Dhabi, the temperature measured at the asphalt was 57 degrees. In Masdar, the temperature measured on the ground, 33 degrees, so we have actually lowered the air temperature. We are trying to do as much as possible with as little as possible.

Narrator: These simple design moves cut air conditioning needs by 60%. But this place is also, technically, very sophisticated. The roof panels not only provide shade, they also generate electricity. And the walls themselves are made of glass reinforced concrete, literally sand taken from the desert. Everything here is geared towards maximizing energy efficiency.

The second part of the video analyzed is about Masdar, the city in the desert in the United Arab Emirates. Firstly, there is an immediate contrast with images from Abu Dhabi and Dubai, which are seen as environmentally unsustainable cities from the 20th century. At the same time, Masdar, although not finished yet, is seen as the city of the future. This is somehow contradictory. At the beginning, the relation between city building, pedestrian zones and cars is given, something very current, since at the beginning of the 21st century "fuel-based motorised mobility has moved to the centre of scientific and political debates." (Manderscheid 2013, p. 284). This move was done not only because of the threat that climate change poses to human civilization, but also against the background of peak oil and increasing traffic problems in the cities. Writing about the so-called mobility paradigm, authors (Featherstone 2004; Sheller and Urry 2006; Cresswell 2006) started to pay more attention to social and cultural features of car driving. Other authors, such as Peter D. Northon, combine mass car driving with some definitions and powerful social values which have been revisited, such as progress and freedom (Norton 2008).

Paul Goldberger, architecture critic/author, examines critically how the modern cities were built, emphasizing the "tendency to accommodate to automobile". The images are showing cities in UAE such as Dubai and Abu Dhabi, with big highways going through the city, tall buildings and skyscrapers, traffic congestion, while Goldberger talks about walking in Abu Dhabi or Dubai (snapshots 11-13). Goldberger's critical reflection certainly makes a point and opens a debate about the modern cities and their infrastructure. The sequences show a

number of bridges, buildings, concrete constructions going parallel with the roads, tunnels; yet there are not any trees, parks or natural landscapes presented. The author criticizes this way of building cities in the modern time. Then, while the car is driving through the desert, it gets to the final destination: city of Masdar. Firstly, it is seen as a construction site where the work is in progress, but then the camera takes a completely different angle and takes snapshots from the air as the narrator talks about the “city of the future and the role model for the world.” Nathaniel Kahn, also an architect himself, watches the model of how the city will look when finished, while describing some of its main features such as carbon-neutral or pedestrian friendly (snapshots 14 and 15).

Then he examines the mode of transportation, which is electric cars underneath the city. This is something crucially emphasized: the city is car free. Regarding the city streets, different stakeholders are involved, with their particular interests. This is thoroughly explained by Peter D. Norton in his book “Fighting Traffic”, from 2008, making an argument that pedestrians might be angry and worrying about safety in moral terms, the police with an interest in order, and automotive interest groups fighting against speed restrictions and congestion. A more general conclusion on the topic is that considerable social and political work and power is necessary to weave car driving and speed with values such as freedom, individuality and progress (Manderscheid 2013).

As Kahn talks about the city’s architecture reminding him of Arabic medieval towns, with the modern interpretation of an ancient Arabic screen, there are snapshots from Masdar streets and buildings (snapshot 16). This is an introduction to Austin Relton, an architect from “Foster+Partners, who is on city streets pointing at the architectural design and describing the characteristics on which the city will be built. Besides buildings and the pedestrian zone, we can see trees and a park, while there is a windy climate (probably as a part of channelling the cooling breezes process). It is possible to see parts of the city and what they look like (snapshots 17 and 18). This is immediately contrasted with Abu Dhabi and its wide streets and buildings, it being much hotter there than in Masdar because of black asphalt and mirrored reflective buildings. Then, there is a map with the location of Abu Dhabi and Masdar, with a comparison in temperatures between the two cities in September. Once again, there are snapshots from Abu Dhabi’s and Masdar’s streets, where Relton is actually speaking from (snapshot 19).

In the next images, whilst the narrator is talking, quite different architecture in Masdar is presented from what was shown previously, which was similar to medieval Arabic towns. Here we can briefly see white buildings with roof panels, while the last sequences are

showing once again images from the beginning: Masdar buildings and the architecture that was previously described both by Kahn and Relton (snapshot 20).

The narrative in the video is largely complemented with images: sunny, environmentally friendly, car-free city of the future. The shots are taken from very different angles, even from above the city, trying to convey an impression that Masdar should give the audience: a brand new, original city based on innovative ways of architectural design and construction. The lights are bright and intensive during the whole video, not considering what happens when night falls (which is important for solar power). Everything about Masdar is presented in superlative terms, and the selected images enhance the overall impression. However, the role of the company "Foster+Partners" in building this futuristic city is unclear and it is not explained in any way, although the company is mentioned and officially presented by Mr. Relton. The architects and engineers from Western countries are the ones in charge and deciding, which is noticeable from the video, since they are the ones explaining all the details about this project. The language used is repetitive (e.g. car free) to emphasize some of the main features of this project. From Nathaniel Kahn's statement, it is not clear who is claiming that "it is going to redefine the way cities are designed, built and powered."

Furthermore, we must keep in mind that the United Arab Emirates have 8.1% of world oil,[37] and the energy there is very cheap. This *sociotechnical imaginary* as "imagined forms of social life and social order reflected in the design and fulfillment of scientific and/or technological projects" (Jasanoff and Kim 2009, p.120) is entirely different from the rest of the planet- few countries in the world have large reserves of oil. In this case, we should add technopolitical and economic background. UAE is a country which is very rich in oil; therefore the technology and the society there are framed by this fact. It is possible to have a ski slope in a shopping centre or to build the world's tallest skyscraper. However, even in Masdar people are aware that cheap energy will not last forever. Something has to be done and the video tries to solve that equation.

At the same time, not a single person consulted or interviewed in Masdar is Arabic, although there is a lot of Arabic architecture in the city and Arab music is played in the background. That shows a contrast and contradiction: all the people interviewed are Westerners, from English-speaking countries; nevertheless the music, images and architecture are strongly based on Arab civilization. Mainly, the whole part of the video is based on a future-anticipation project, which can be illusive (What kind of future is imagined and by whom?).

[37] OPEC Share of World Oil Reserves 2010". OPEC. 2011

The images are selected in a way to make the architect's claims plausible. That is also the role of constant comparisons with Dubai or Abu Dhabi, to convince the audience that Masdar is different, hence architectonically better.

Is it possible that a city lying in a desert, with the specific conditions that come with that (climate, geographic location, and UAE petroleum-based economy) could be a role model for the entire world? If it is claimed that this city is utopian, why does it have such an important part in the future of energy making? Furthermore, who are the people that can afford to live there? These are some of the main questions that should be asked regarding the video. Arabic architecture is seen as useful in building such a city, as long as it meets some requirements (e.g. to avoid direct sunlight hitting any piece of glass). Basically, by sequences of images we are introduced to a brand new city and a way of sustainable building and living, more according to the natural and national characteristics of a particular place.

Once again, this future making from Shell has all the necessary features that take into account geography, local possibilities and energy sources (solar power) to tackle greenhouse emissions and to change the way people think about infrastructure and city transportation. The advantages of the place and national sources are examined in depth and assessed in great detail. The images and the stories are quite complementary, giving an overview of what the architects are talking about and how it looks in practice, since the snapshots are directly from the streets of Masdar. What would certainly make the whole picture more convincing would be if some of the actual Masdar residents (like the students, whom the video claims are living there) had been interviewed.

This can be seen as a marketing or promotional video, if considering the genre; the images and the talk are arranged in a way to make us see "the city of the future," while at the same time, unlike in the first video transcribed and analyzed, drawbacks or difficulties in realizing the planned intention are not mentioned. It is a very positive visionary narrative about the future. Although the Masdar project is interesting and attractive to architects, urbanists, policymakers or potential dwellers, it is necessary to connect it to the reality and possibilities of other parts of the world.

6.4- VIDEO 2: "SHELL ENERGY SCENARIOS - MOUNTAINS AND OCEANS"

Firstly, there will be general information about the video and an overview including some main points, focusing on the introduction and conclusion (a call for dialogue). A brief summary of the video will be given. As one of the main points and aims of the video is to open and foster the debate on energy future , STS approach to public participation and dialogue will be explained more thoroughly. In the second part, there is a transcript of both scenarios, with illustrative photos, accompanied by deeper and more exhaustive analysis and with a short comparison between the two at the end. Regarding video analysis, it is important to mention that "there is no general orthography used for the transcription of visual and tactile conduct" (Heath and Hindmarsh 2002, p.110).

This short video (2:12), called "Shell Energy Scenarios - Mountains and Oceans", introduces us to a larger energy future picture, and takes us to a long journey into the distant future events (considered even until year 2100). The video was uploaded by Shell on August 29 of 2013 and it attracted around 20,000 views so far (July 2014). It is public and on YouTube. [38]This video looks further into the future than many other outlooks do. The making of video that looks into such a distant future might surely take into account that it is near to impossible to make accurate decade-long forecasts (V. Bashuev, General Director of Energy Strategy Institute in Russia). [39]

It starts with the recapitulation of Shell's work on energy scenarios (beginning in the 1970s), inviting experts from all over the world to develop the topic and join the debate. This designation (experts) might bring and involve concrete (and sometimes contestable) courses of action and interaction (Lynch 2004). Furthermore, it is entering the field of membership categories where the categories represent much more than a matter of employing a label, sign or symbol to assign status to someone (Ibid.).

Basically, Shell goes further into the future, even to the year 2100, to offer two scenario forecasts. They are labeled Oceans and Mountains. The role of these scenarios is to explore two possible future pathways for society. Both scenarios consider the pace of economic development, the types of energy we currently use and that we will use in the future and the

[38] https://www.youtube.com/watch?v=abOlRSb6teM

[39] http://russiancouncil.ru/en/blogs/casingpoint/?id_4=585

growth in greenhouse gas emissions. “These scenarios show how the choices made by governments, businesses and individuals in the next few years will have a major impact on the way the future unfolds,” said Shell’s Chief Executive Officer Peter Voser. The scenarios project that world energy demand could double over the next 50 years, as the world’s population is heading toward 9.5 billion by 2060 and there is a rapid growth of emerging economies. [40] What are the main issues and solutions taking into consideration given such developments?

Following is the short summary of two scenarios, which will be examined more in detail in the next section. It would be accurate to claim that the Ocean scenario is driven by market forces and it can bring strong social and political tensions. Some of the main global trends are presented in the video. The emerging economies flourish but CO2 emissions are neglected. Renewables are predicted to grow and by 2070 solar is the largest energy source. However, some other concerns (namely that solar and wind energy are hard to plan, being this one of their biggest shortcomings) [41] are not assessed.

In contrast, the Mountains scenario forecasts natural gas to be the most important energy source by 2030, ending a 70-year reign for oil. There is a major investment in carbon storage and capture forecasted by 2030. Electricity will be carbon neutral in 2060, but the social mobility may be thwarted, in tension with the free market. The video ends by saying that “these scenarios may ultimately prove inaccurate” so the main goal according to the narrator is to stimulate dialogue, something quite important in making energy futures. Since Shell has a 40 years history of using scenario planning to explore possible future landscapes, the main goal of the videos and publications is to share summaries of scenarios, thus contributing to the public debate. This debate entails ways to tackle some of society’s long-term challenges. [42]
The commitment to social inclusion, broader public participation and dialogue is essential in the making of energy futures, since it could include academia, politicians, entrepreneurs,

[40] http://www.shell.com/global/aboutshell/media/news-and-media-releases/2013/new-shell-scenariossharpen-focus-on-future-for-society--energy.html

[41] http://ercim-news.ercim.eu/en92/special/introduction-to-the-special-theme-qsmart-energy-systems

[42] http://www.shell.com/global/aboutshell/media/news-and-media-releases/2013/new-shell-scenariossharpen-focus-on-future-for-society--energy.html

scientists, NGOs and the so-called “lay people.” It might be of considerable interest to the field of STS due to the importance of understanding the ways in which information is communicated by organizations, institutions, companies and governments to the public. That is something widely considered by authors in STS (Bucchi 2008; Felt and Fochler 2010; Wynne 2007; Irwin 2006; Lezaun and Soneryd 2007), among others. The traditional conception of public communication of science has been highly criticized by the field of STS. In many countries in Europe, policy documents as well as funding schemes shifted from “public awareness of science to citizen engagement, from communication to dialogue, from science and society to science in society” (Bucchi 2008, p.68) Further, the critical version of public understanding of science shifts the priority from educating the scientifically illiterate public to the need and right of the public to participate in the discussion (Callon 1999). Since the public is generally interested in what energy source it will use and at what cost, it should be seen as an important stakeholder in energy future making and in the opening of the debate. But how does the public see the participation in debates? There is a necessity to assess the public uptake in participation, considering different technopolitical cultures which frame participation in technoscientific issues in fundamentally different ways (Felt and Fochler 2010). Authors such as Wynne (2007) and Irwin (2006) examine the hidden agenda of what is selected to be debated on and what is not. The dialogue can be used as a cover for some veiled interests. In the same vein, dialogue is often only useful as a “different means to avoid societal dissent on technoscientific issues believed to be of high economic potential” (Felt and Fochler 2010, p. 231).

However, looking into the past debates, this is not new. Going back into 1920s there are authors, such as Walter Lippmann, who in his books “Public Opinion” from 1922 and “The Phantom Public” from 1925, was highly critical of models of democracy and large public participation, which place faith and power in the hands of the public. According to him, people are not able to accurately interpret the world. The ideas of ordinary citizens are often manipulated by leaders. Thus, for Lippmann deliberative democracy is an unworkable dogma or an impossible dream.[43]

Going back to the video, it is structured in a way that the narrator talks (voice-over) about two possible scenarios while on the screen different facts appear which are not necessarily related to what is being said, but rather present additional or complementary information (e.g. Africa becomes the second largest energy consuming continent, fact not mentioned by the speaker). The role of popular films in technological development is examined by authors

[43] Taken from “Techno-Science and Society: Communicating and Interacting.” Seminar, Prof. dr. Ulrike Felt, University of Vienna, 2013

such as David Kirby (2010). Seemingly, there has been little attention paid to the production of science and technology in entertainment media, despite the fact that a number of studies show the importance of the topic. As is the case with many videos, “popular cinema provides scientists, engineers and technological entrepreneurs with the opportunity to promote visions of a shiny future” (Kirby 2010, p. 46).

The video is clearly forward looking, expressing future expectations. This forward looking stance is assured by the language used, with the words and phrases such as “will”, “could”, “possible”, “anticipating”, “may prove” or “might be”. The video structure and division (two different scenarios) is clear from the outset. It contains a lot of facts, stats and probabilities given in only two minutes. These scenarios deserve more time and space, since both options (“Oceans” and “Mountains”) are much more deeply examined in Shell’s brochure.[44] There is not any verbal interaction in the video, but rather only the narrator speaks. The facts are difficult to examine or to assess because this video, unlike other motion pictures or documents read and consulted previously, goes as far as year 2060, 2070 or 2100, making it impossible to compare it with other similar sources. Shell is referring to faraway technological advancements. The main division is basically easy to understand and follow: one is based on the promise of solar power and the other on natural gas. However, energy transition of this kind, envisioned to be long-term, should include many other considerations as well. The social dimensions of energy transitions should be taken into account, since all dimensions of everyday life, routine and practices are affected by changes in energy technologies (Miller et al. 2013).

However, the video presents an introduction to all these issues and potential questions that may arise. Its main goal is to open the debate, not to close or limit it, which is overtly stated at the end of the video by the narrator. It invites us to think on a very long-term scale, a generation or two ahead, and about what the world could look like then. The statistical information is important as well, given that data and stats are the bedrock for the making of any energy future.

Structure of the video

00:00-0:30 Introduction to the topic and Shell scenarios

0:30-1:05 The Oceans scenario (transcribed)

1.10-1:51 The Mountains scenario (transcribed)

1:53- 2:12 Conclusion (call for dialogue)

[44] http://www.shell.com/global/future-energy/scenarios/new-lens-scenarios.html

6.4.1-OCEANS SCENARIO

Snapshot 1 (Source YouTube 2014)

Snapshot 2 (Source YouTube 2014)

(♫...)

0:30-1:05 Narrator: "The Oceans scenario describes a future where, driven by market forces, the global energy landscape sees a surge in demand that brings strong social and political tensions. Emerging markets bloom, but profit-driven motives means that externalities such as CO2 emissions are neglected. Fossil fuels are important to the energy mix, but nonetheless renewables grow, and by 2070 solar is the largest energy source."

Background information on the screen:

2025 - China GDP reaches $20,000 per capita

Africa becomes second largest energy-consuming continent

Car fleet in India reaches 500 million vehicles

World air travel demand reaches five times 2012 level

2070- Solar PV number one energy source

The "Oceans" scenario is blue, tidy, with pictures of the ocean and oil platforms on it, strong currents, with clouds and wind turbines, with sun and solar panels. The main perception is one of volatile, changing and nature-friendly tones (as can be seen from the two snapshots above, snapshots 1 and 2), an overall optimistic picture in clear contrast with what the narrator is telling us at the beginning (involving developments such as "strong social and political tensions" or externalities such as "CO2 emissions being neglected"). Therefore, the

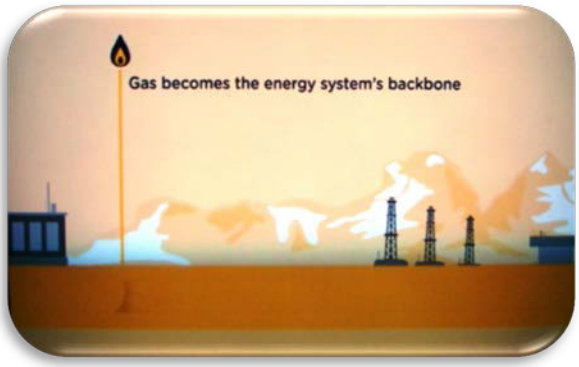
images and words, at least at the beginning of this scenario, are in stark opposition. The words explaining processes in countries and continents (transcribed as background information) flow throughout the video at the centre of the screen, emphasizing the importance given to the main trends. Later on, there is a harmonization between images and the text, offering both a more optimistic, renewable future (solar becoming a number one energy source by 2070), with strong societal consideration. This consideration includes emerging economies, enhancing the demand of energy, and possible side effects, such as the aforementioned political and social tensions. The video does not mention which tensions, but a clarification is made in the document, stating that "reforms raise aspirations and, when they are successful, also raise expectations for further shifts in welfare, social structures, and significant international institutions" (New Lens Scenarios 2013, p. 46).

The energy source is seen as a dynamic mix between fossil fuels and renewable; oil and coal play a leading role in the energy mix until solar overtakes in 2070. Regarding greenhouse gas emissions, they are neglected mainly because of the growing demand for coal and oil, a lack of support for carbon capture and storage and less natural gas development.[45] Background information is underlying future developments in some countries (China, India) and continents (Africa). This is explained by Shell as the way that "developing countries sustain their catch-up growth trajectories" (Ibid, p.46). Other information presented is mainly global (increasing world air travel demand and solar power).

One of the goals of video analysis is to illustrate not only what is observable, but also what is not observed. What cannot be observed is whether the growth of renewables and solar energy will almost completely replace and outcast fossil fuels by 2070 or not; how large carbon emissions will be in the considered period; what will be the impact of social and political tensions considering the growth of population, especially in emerging economies. This scenario also neglects some potential dangers of utilizing many photovoltaic technologies, which can use materials and processes that rely on toxic materials (Mulvaney 2013).

[45] http://www.shell.com/global/aboutshell/media/news-and-media-releases/2013/new-shell-scenariossharpen-focus-on-future-for-society--energy.html

6.4.2- MOUNTAINS SCENARIO



Snapshot 3 (Source YouTube 2014)

Snapshot 4 (Source YouTube 2014)

(♫...)

1:10-1:51 Narrator: "The Mountains scenario describes a future where, anticipating the switch away from oil and coal, global policy shifts to support compact cities and an overhaul of the transport network. By 2030, carbon capture and storage receives major investment and gas is the primary source. Such developments enable electricity to be carbon neutral as early as 2060. And yet, by interfering with the free market, global social mobility is thwarted."

Background information on the screen:

Natural gas number one energy source

10% of all passenger road km in Japan from electricity or fuel cells

2030- Carbon Storage and Capture worldwide reaches 1GT per year

Gas becomes the energy system's backbone

2060- Electricity decarbonised

2100- Global social mobility is restricted by market constraints

While the same music plays, we move to the second scenario, the "Mountains" one, which offers a different picture: the background is made up of mountains, with sporadic trees in the front of the shot, with big factories and trains running, with oil fields, refineries and big, modern cities. The first thing that can be noticed is the missing background information of

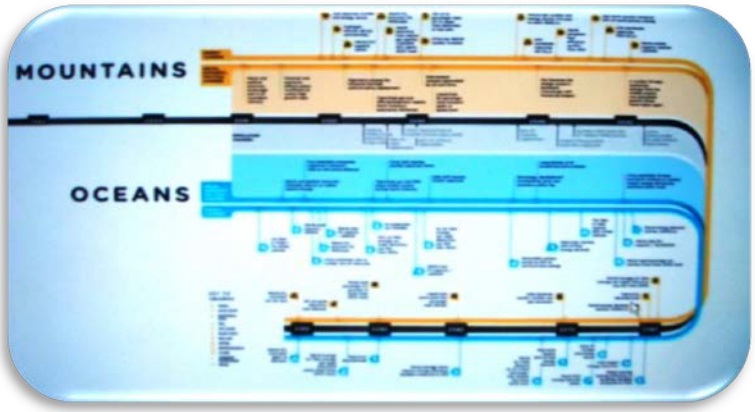
the year at the beginning of the “Mountains” scenario. Cars and trucks are there as well, suggesting to us somehow an energy “status quo”: namely, as opposed to the last scenario, which is mainly dynamic and changing, evolving, this one looks quite conservative, because there are few changes envisioned here and they are mainly technological ones.

The colours used are clearly contrasting the first two snapshots: different shades of yellow, with white clouds and mountains (giving an impression of snow on them, as seen from both snapshots). The way cities are presented is very similar to the modern metropolis, with tall skyscrapers (snapshots 3 and 4). The words and images are complementary, meaning that almost everything the narrator is talking about appears as information on the screen. Nevertheless, in the second Shell scenario, global policy and governments play an important role in shaping the world’s energy system and environmental pathway. Seemingly, this scenario predicts a more top-down organization, a view from the top (there are always mountains in the background of the images, used as a potential analogy); basically the view of the wealthy. This is not overtly mentioned in the video except for the social mobility line which definitely can lead to such a conclusion (“by interfering with the free market, global social mobility is thwarted,” second snapshot).

The tension between social mobility and the free market is not explained in detail, opening room for different interpretations. One of those could be that this vision of the future world is largely pessimistic, with the rich becoming richer and the poor even poorer, touching on wealth disparities and possible furthering of inequalities. As explained in the brochure consulted, “influence remains concentrated in the hands of the currently powerful” (New Lens Scenarios 2013, p. 23). Also, the global policy support for the compact city (which looks modern and prosperous in the video) gives us a picture of actors holding the power and staying with it. However, what is not mentioned is what could be the consequences of such a political and economical lock-in and how the non-privileged sectors of society could react (Ibid.).

Meanwhile, this scenario seems to be environmentally sustainable. Firstly, it considers replacing oil and coal with natural gas. This scenario goes in accordance with some other predictions, namely with IEA‘s reports such as “Are We Entering a Golden Age of Gas?” and “Golden Rules for A Golden Age of Gas,” which are suggesting that gas use could grow by more than 50% by 2035 (IEA 2011; IEA 2012). Secondly, it pays great attention to carbon capture and storage technologies, which accordingly will prove very successful by 2030. Moreover, by 2060 CO2 emissions from the power sector will drop to zero. There is also a profound shift in the transportation sector envisioned here.

In the video, this is given with the example of Japan and the transportation based on electricity or fuel cells there. Whilst it is clear that oil and coal will have a much smaller importance than today, it is not explained whether they will be completely replaced and eliminated from the market.



Snapshot 5 (Source YouTube 2014)

Comparison between Oceans (blue) and Mountains (yellow) - all the details from the snapshot are not elaborated in the video.

As Shell sees it, one of the key terms of this work, transition, takes place when there are gaps between actual and desired conditions.[46] Anyway, the transition should analyze and include social processes, social changes and social outcomes (Miller et al. 2013) in both cases: whether it is solar power or a natural gas-based energy future, because of the magnitude and impact of potential changes. Science, technology and society scholars have demonstrated that the way in which infrastructure is built frames and reflects everything, having an impact in many diverse fields, such as political systems, environmental sustainability, working patterns, living arrangements and healthcare (Hughes 1983; Nye 1990; Winner 1980). In addition to that, many ethical issues and the governance of these future systems are not examined.

Making a comparison, the first scenario ("Oceans") gives us a much more bottom-up social organization, with more actors involved (more countries and energy sources), at the same time not mentioning the role of global policy. The second scenario ("Mountains") is more environmentally sustainable and concerned with CO2 emissions. While the first scenario is

[46] http://www.shell.com/global/future-energy/scenarios/new-lens-scenarios.html

more global and geographically varied (China, India, Africa), the second one includes only one country (Japan, given that it is highly industrialized and economically developed). Renewables play a very important role in the "Oceans" outlook, but they are neglected in the "Mountains" one. As seen from the snapshots, the "Oceans" scenario goes until 2070, while "Mountains" stretches to the year 2100. The main similarity is that both scenarios mention market and market forces as important factors, yet only the "Mountains" scenario considers the active role of government policies (regardless of the end of this role). Therefore, these two futures are not exclusively based on energy sources and technological developments but they are also political, social and economic at the same time. The way in which the video depicts and conveys these two scenarios makes us clearly see the contrast, which is evident and obvious.

7- BP

BP is one of the world's largest international oil and gas companies. Its headquarters are in London, England, and it was founded in 1908 as Anglo-Persian Oil Company. In 1954, the company became British Petroleum. It changed its name to the current BP p.l.c. in 2001.[47] The main products of this company are: petroleum, natural gas, motor fuels, aviation fuels and petrochemicals. BP is operating in around 80 countries, with 83,900 employees. It produces 3.2 million barrels of oil per day and wholly or partially owns 14 refineries. The company has approximately 17,800 service stations worldwide. The economic value generated by BP during 2013 was $403.3 billion.[48] In Russia, BP owns a 19.75% stake in Rosneft, the world's largest publicly traded oil and gas company by hydrocarbon reserves and production and Russia's largest oil company (BP Annual Report and Form 2013, p.5).

[47] http://www.bp.com/en/global/corporate/about-bp/bp-at-a-glance.html

48 Ibid

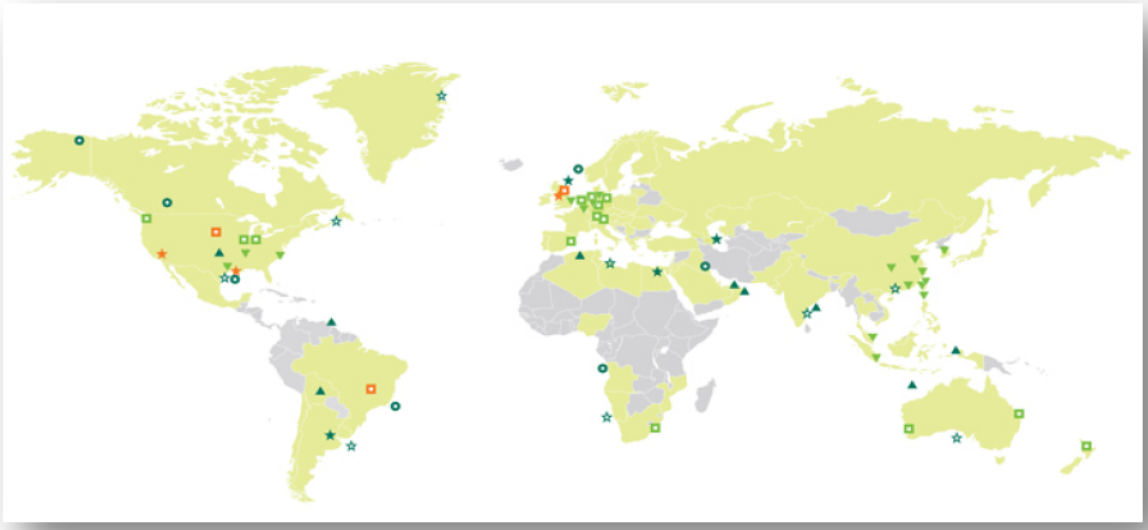


Figure 2: BP's global operations (Source BP 2014)

BP's strategy is made up of three distinctive parts: setting clear priorities, actively managing a quality portfolio and employing the firm's distinctive capabilities. The clear priorities are clustered into three segments: to run safe, reliable and compliant operations; to achieve competitive project execution and to make disciplined financial choices. The quality portfolio has been projected to concentrate on areas where BP can generate the most value.[49] This means growing of the exploration position by reloading upstream pipeline. Finally, by "distinctive capabilities," BP is referring to advanced technology, which is applied across the hydrocarbon value chain; to the proven expertise of employees coming to the fore in a wide range of disciplines, and to its strong relationships with governments, partners, civil society and others, enabling operations in around 80 countries across the world.[50]

As with Shell, there are two main operating segments, Upstream and Downstream. These segments develop and produce essential sources of energy, turning them into products. Renewable energy sources are not neglected; the focus is put on biofuels and wind. The Upstream segment focus is on activities in exploration of oil and natural gas, as well as production, transportation, storage and processing. It also markets and trades natural gas,

[49] http://www.bp.com/en/global/corporate/about-bp/our-strategy.html

[50] Ibid

including liquefied natural gas.[51] At the same time, the Downstream segment has significant operations in Europe, North America and Asia, comprising three businesses: fuels, lubricants and petrochemicals. Fuels include refineries, fuels marketing businesses and global oil supply and trade. Lubricants produces and markets lubricants and its services globally while petrochemicals manufactures products at different locations all over the world. [52] Therefore, BP's business model approach spans everything, from exploration and finding to marketing, as seen from the figure below.

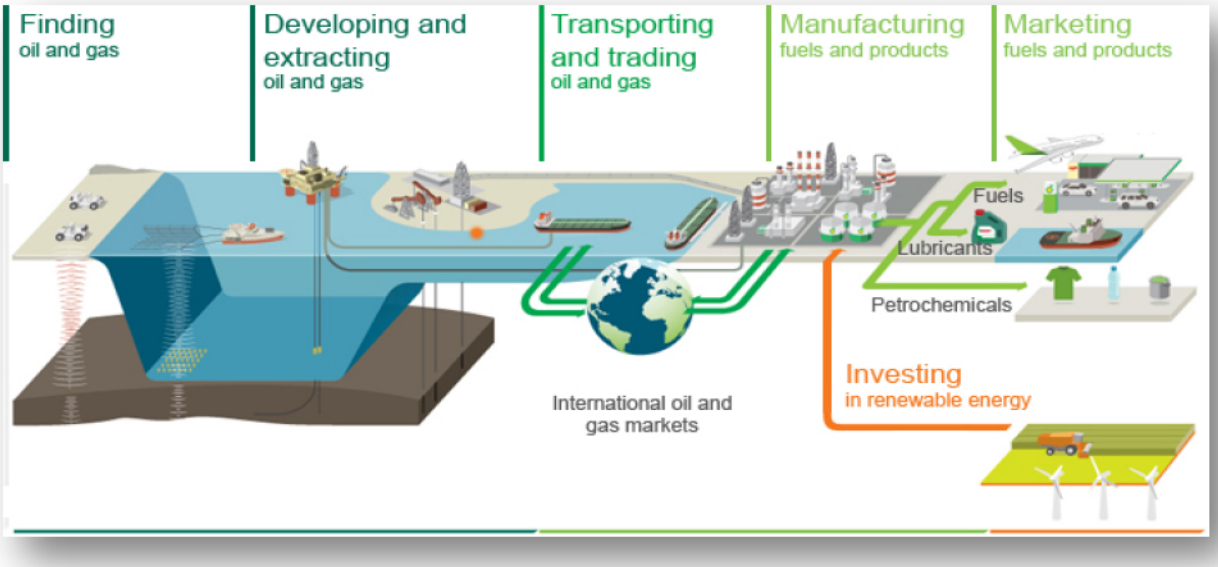


Figure 3: BP's business (Source BP 2014)

Additionally, BP launched its Alternative Energy Business in 2005, rooted in the belief that renewable and alternative energy will make up an increasing share of the energy mix. Alternative energy complements the core skills of this oil and gas company. The focus is on biofuels, produced in Brazil, the US and the UK and on wind energy, BP being the largest wind developer in the US, with 16 wind farms. The company intends to develop sustainable energy solutions, since lower-carbon resources are the fastest growing sector in the energy market.[53]

51http://www.bp.com/en/global/corporate/about-bp/company-information/grouporganization/upstream.html

[52] http://www.bp.com/en/global/corporate/about-bp/company-information/group organization/downstream.html

[53] http://www.bp.com/en/global/corporate/about-bp/company-information/group-organization/bp-alternative-energy.html

More generally, regarding wind energy production, in the US the focus was on large-scale wind turbines for use in centralized wind farms owned by electric utilities (Sovacool 2010). Although the US Department of Energy, US National Aeronautics and Space Administration and large aerospace companies spent approximately $1.1 billion to produce wind turbines, they failed in large numbers (Ibid). Interestingly, BP had a business with solar energy too, which was set up around 40 years ago. It was closed in December of 2011 because of the rampant competition from China, falling prices and lower government subsidies for the industry, on which it still depends.[54]

Biofuels are described by BP as a growing alternative, which is why the company had invested more than $2 billion in biofuels research, development and operations since 2006. (BP Biofuels fact sheet 2013). BP has invested in the production of ethanol from sugarcane in Brazil, the same as Shell did with the company Raizen, already covered in the previous chapter. Biofuels production has now expanded into more than 80 countries, and it is projected to double from today's levels by 2030. Ethanol offers up to a 90% reduction in emissions when compared to conventional fuels (Ibid.).

Wind energy is the fastest-growing form of renewable energy in the USA (Wiser and Bolinger 2011). BP has also invested in wind energy across the US, and wind energy is depicted as safe, clean and increasingly affordable. However, government support is crucial in the expansion of wind power.[55] The possible social effects and impacts of this type of alternative energy are considered by BP during the planning stage for wind farms. Those concerns include: the impact on wildlife and habitat, the impact of wind farms on local residents, noise from wind turbines, shadow flicker and interference with communications signals. That is why wind farms are often in remote locations, well away from population centers.[56]

The main advantage is that compared to other renewables, wind is relatively inexpensive to install and operate. But there are drawbacks as well. One of the main critiques of wind energy systems is that, while concentrating the hazards, the benefits are usually distributed to far-off populations who do not experience many side effects, such as altered views, land-

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[54]http://www.reuters.com/article/2011/12/21/us-bp-solar-idUSTRE7BK1CC20111221

[55] http://www.bp.com/en/global/alternative-energy/our-businesses/wind-power.

[56] Ibid

use changes, ecosystem damage, noise, optical effects, and risk of accidents that come with the turbine structure (Ottinger 2013). Wind energy technologies maximize size in order to maximize the power, and the results are huge wind turbines, which have increased in size dramatically since the 1990s. The average wind turbine in 2010 measured almost 80m to the center of the rotor, had blades 42m long and had a capacity of 1.79MW (Wiser and Bolinger 2011). Technologies compatible with environmental justice are designed, among other things, to promote equitable distribution of hazards. In order to achieve procedural justice, it is essential to allow monitoring, decision-making and regulation by the people most affected by them, not only by designers and other experts (Ottinger 2011).

On the company's website, energy future forms part of the section Sustainability. The other sections are "About Us," "Products and Services," "Investors," "Press," "Careers" and "Gulf of Mexico Restoration." As the oil spill in the Gulf of Mexico is mentioned, it is necessary to underscore that unconventional oil production poses considerably higher environmental risk. This risk includes ecological damage from using complex technologies in difficult environments, technologies that are often poorly understood or ill-regulated, as shown in the case of the Deepwater Horizon oil spill (Miller et al, 2013). Further, drilling in deeper offshore waters in order to produce oil is significantly more expensive than in conventional oil fields (Ibid). The section on energy future is comprised of the following subsections: "Meeting the energy challenge," "Climate change," "Deepwater oil and gas," "Unconventional gas and hydraulic fracturing," "Oil sands," "The Arctic," "Alternative energy" and "Case studies." Coming back to the main topic of this work, energy future, BP sees the main energy challenge in managing and meeting demand affordably, sustainably and securely.[57]

The projected increased energy demand is based on population and economic growth. Among other things, fossil fuels will become less easily accessible than today. Many low carbon resources will remain costly to produce on a big scale.[58] The geographic distribution of resources is quite uneven, creating many challenges, such as energy security. The fact is that more than 60% of the world's known reserves of natural gas are in just five countries, and more than 80% of global oil reserves is located in nine countries. Most of these countries are far from the hubs of energy consumption.[59] If the energy demand in the world

[57] http://www.bp.com/en/global/corporate/sustainability/the-energy-future.html

[58] http://www.bp.com/en/global/corporate/sustainability/the-energy-future/meeting-the-energy-challenge.htm

[59] Ibid

increases drastically between 2012 and 2035, serious action will be needed to limit carbon dioxide (CO2) and other greenhouse gases emitted through fossil fuel use.

7.1- BP's VIDEO PRODUCTION

Since we are working mainly with promotional videos, it is necessary to have some definitions of what these videos are and what they do. A distinction between promotional and corporate videos should be made. A promotional or promo video is frequently used on a company website (but not exclusively there) to give the consumer or viewer some information about the company's products or services. Usually, they are short videos (four minutes or less), designed to promote or advertise a business, product, event, concept or organization. Promo videos are used as part of a social media campaign and as a publicity tool. [60]At the same time, corporate videos are different from promotional ones since they are not always intended for promotion. Conversely, they are often intended and designed for internal use only, within a company. The reasons may vary, such as training or simply to raise employee morale. The main similarity is that both promotional and corporate videos are often based on interviews with CEOs, executives, engineers, scientists, researchers and other key personnel. These videos can be similar in style to short documentaries. [61]

The reason for using these kinds of videos is that they are an incredibly powerful way of communicating information. In the modern world, the Internet is increasingly gaining importance as a technology spanning the world, with a huge influence on society and societal processes as a global information and communication network. Certainly, it is the case with the Internet that while "not everything or everyone is globalized, but the global networks that structure the planet affect everything and everyone" (Castells 2008, p. 81). Nowadays people have a preference for receiving content through a video, which is backed by the fact that YouTube is currently the second largest search engine, behind Google; it is the most popular video sharing service in the world and its videos are enjoyed by millions of viewers each day. Thus, a promotional video can be used very effectively within a video

[60] http://promovideo.hubpages.com/hub/How-to-commission-a-corporate-video-production

[61]Ibid

sharing platform such as YouTube to achieve a number of strategic business objectives as well. YouTube videos also rank very high within the universal search with Google.[62]

BP also has its official channel on You Tube. [63]It is comprised of different sections: "Supporting Glasgow 2014," "BP Statistical Review of World Energy," "BP and Technology," "The Energy Future," "BP People: Our stories," "Commitment to America," "BP Careers," "BP in the Community," "BP Careers for Students and Graduates" and "BP Careers in the US." There are 14,685 subscribers of the channel as of August 2014. The section of Energy Future comprises 29 videos, which last a total of one hour and 41 minutes and have had more than 31,000 views. Once again, the videos are diverse: firstly, there are interviews with CEO Bob Dudley, with Christof Rühl, Group Chief Economist and Vice President of BP plc, as well as with other executives and scientists. They talk about a wide range of topics and pressing issues: about climate change and how to face it, about the priorities for 2012 and beyond, about earning back trust and building a sustainable future, about the progress in Russia, BP land seismic imaging and so forth. Secondly, different outlooks are included: the ones to 2030 (considering the world's energy future and America's energy future), produced in 2013, and the ones to 2035 (again considering the world's and America's energy future) produced a year later, in 2014. There are reports on statistical reviews of world energy as well as the world's and America's energy trends. These future trends were produced in 2012. Hence, it is possible to observe that BP has been following and complementing energy future outlooks with videos since 2012.

The conclusion is that BP projects both different scenarios and outlooks (for the world and the US, making from the outset a recognizable geographical division) and interviews with the main executives on topics (most of them related to the energy future). The videos are mainly short in duration, around two or three minutes, although there are some longer ones, with the longest being the speech given by BP CEO Bob Dudley on the US, Russia and the World's Energy Journey at IHS CERAWeek in March of 2013. This video lasts for more than 20 minutes. As the topic of this thesis is energy future, two videos stretching to the year 2035 will be considered, both of them from this year (2014), because the point was to present and examine the latest trends and projections. They are based on the World's and America's

[62] Ibid

63 https://www.youtube.com/user/BPplc

energy future and on facts and trends exposed in the company's official Outlook, called "BP Energy Outlook 2035." Since this Outlook plays an important (if not crucial) role in presenting information and trends on which BP videos and scenarios are based, it needs to be considered more thoroughly and in detail.

7.2- BP ENERGY OUTLOOK 2035

The BP outlook is published for the fourth time, reflecting an effort to describe a "most likely trajectory of the global energy system" (BP Energy Outlook 2014, p. 4). The optimistic tone can be noted right from the beginning, when Bob Dudley, Group Chief Executive, answers with a clear "Yes" an inquiry as to whether the world will have sufficient energy to fuel economic growth. Conversely, there are authors (Tutton 2011, Leo Marx 1994) who give a contrasting picture of the future, based on other facts (e.g. environmental degradation or rising carbon emissions). BP's confidence is based on trends in global technology, investment and policy, which are seen as able to keep pace.

Furthermore, new energy forms such as shale gas, tight oil, and renewables are described as an important part of the future energy mix and as having a significant share of the growth in global supply (BP Energy Outlook 2014). The potential dangers of shale gas and the practice of hydraulic fracturing to obtain it (At the top of the list: the leaking of extraction chemicals and waste into water supplies and thus contaminating the water; the enormous quantity of water necessary to perform fracturing; the use of many chemicals in the process, some of them quite toxic, such as methanol and uranium; toxic fluid left in the ground) [64]are not examined. The fact that Africa is seen as an important future supplier is in accordance with some STS literature, describing plans to build solar and wind plants in North Africa in order to export energy to Europe. Despite the intentions, many events, including the "Arab Spring," have interrupted this project, whose future may be uncertain (Moore 2013).

Coming back to the outlook, the picture is similar to other documents consulted (e.g. Russian Lukoil's outlook): import dependence in Europe, China and India will increase, while Asia will become the dominant energy importing region. At the same time, Russia will remain

64http://www.globalresearch.ca/shale-gas-hydraulic-fracking-poisoned-water-inducing-earthquakes/30678

the leading energy exporter. Right from the beginning, BP is giving us a global picture, and the geopolitical division is based on energy exporters and importers (later this divisionary line will change). This anticipation does constitute economic and epistemic value by itself (Brown et al. 2000), since it relies on the premise of global advance for most of the account. At the same time, carbon dioxide emissions are expected to decline in Europe and the US.

Besides the introduction, these are the other chapters: Outlook 2035: Global energy trends; Liquid fuels; Natural gas; Coal and non-fossil fuels; Carbon emissions and the fuel mix. Therefore, this may be seen as a list of importance or the places BP envisions for diverse kinds of energy sources (curiously, renewables are not on the list, although BP is working with biofuels and wind energy, as explained above). The geopolitical division is made already in the first chapter, called Global energy trends. It includes OECD and non-OECD countries, adding China and India as separate entities. It is not clear why exactly this division, why not some other parameters (as for example geographical, by countries, regions and continents, or EU and non-EU in Europe) and why China and India are set apart, when they also belong to the so-called non-OECD economies. In the meantime, the troubling relation certainly may be the one between increasing energy demand (41% increase between 2012 and 2035) and slow growth, from approximately 2.2% now to just 1.1% predicted in 2035. Moreover, almost all of the projected energy growth will come from non-OECD countries (95%) (BP Energy Outlook 2014, p.9). India and China are seen as the key contributors to this growth.

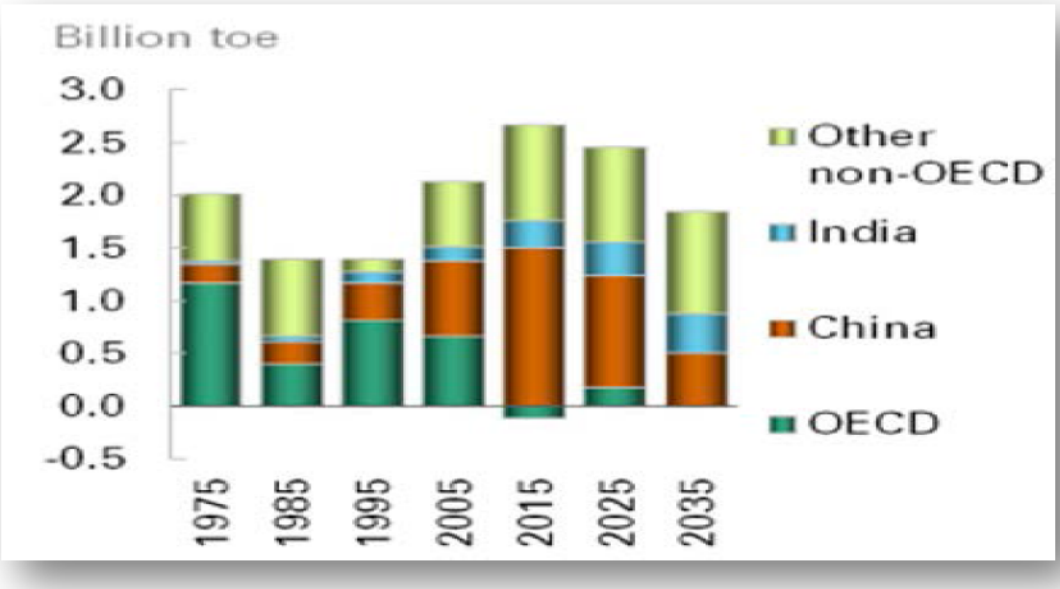


Figure 4. Regional increments of energy consumption growth over the decades to 2035. (Source: BP 2014)

Once assessed by countries (or regions), the distinction is further made based on sectors: industry as the first consumer, accounting for more than half of the growth of energy consumption 2012-35, followed by "other" sectors (residential, services and agriculture), with transportation being the last one. Renewables are predicted to have the fastest growth over the forecasted period, with 6.4% per year. There is not a division or mention of which renewable specifically, but they stand together and as a general statement. Gas will be the largest single contributor to growth in the decade from 2025 to 2035. Although there are many changes forecast in the energy mix and growth in energy demand in general (Europe being the only exception), the assumption that BP Outlook makes is that "the right competitive and policy conditions are in place to support that investment and technical progress" (Ibid. p. 15). BP assumes that the right policies and conditions will be there.

In STS, Brown and Michael (2003) have analyzed the dynamics of expectation and its development considering different actors, such as scientists, regulators, and the public. It is necessary to recognize the central role of expectations in science and technology" (Borup et al. 2006), but here it is policy makers who are expected to create optimal conditions for technological growth. Going more in depth, it is unclear what those conditions could be. What about some undesired events and interruptions in the cycle of development? Is this view somehow neglecting and excluding recent events, such as the world financial crisis from 2008, given that the recovery across the globe has been slow and is still in progress?

The following information is about the world's GDP, which is projected to grow by 3.5% per year from 2012 to 2035. However, already in 2012, the global growth was not as predicted by BP, but only 3.1%. Similarly, in 2013 it was 3%, which is less than the forecasted growth of 3.5%. Most of the growth is forecasted to come from emerging markets and developing economies. [65] Gas gains its place steadily, and that is also projected by some other reports, like the ones from the International Energy Agency (IEA, 2011; IEA, 2012). The interesting fact forecasted is that for the first time since the Industrial Revolution there will not be a dominant fuel by 2035, although fossil fuels taken together still will have the main role. Renewables are seen gaining share rapidly, growing from around 2% today to 7% in 2035 (BP Energy Outlook 2014).

[65] http://www.imf.org/external/pubs/ft/weo/2014/update/01/

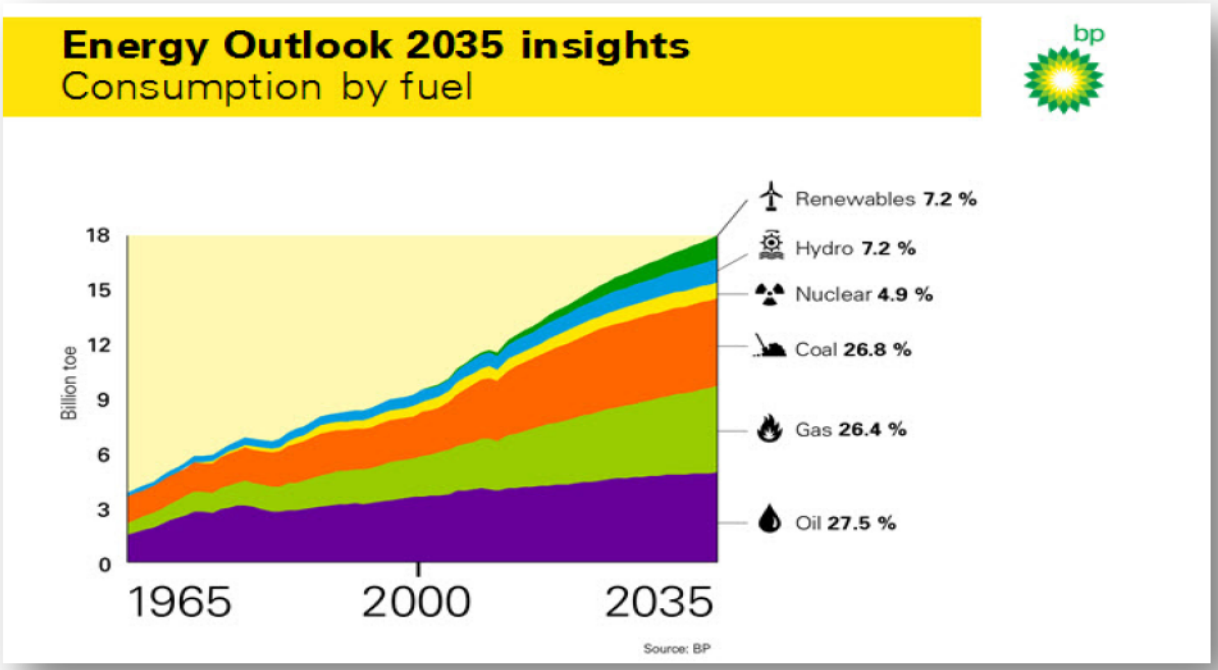


Figure 5. Consumption by fuel from 1965 to 2035 (Source: BP 2014)

It is interesting to see the position of biofuels and electricity, which could be an alternative to oil for the transport sector. BP Outlook does not foresee any bigger growth in terms of consumption of these sources, thus they will remain with minor roles (4% of the share for biofuels in 2035 and just 1.5% for electricity). The global vehicle fleets will more than double from today until 2035, when there will be 2.3 billion vehicles (both commercial vehicles and passenger cars). This information can be compared to Shell's video "Earth 2050," which forecasts two billion vehicles in 2050, therefore these projections are diverging.

Alternative fuels are envisioned playing a greater role in the post-2030 era. This is in agreement with the reviewed literature, where an increasing number of policymakers, researchers, and NGOs view electric vehicles and biofuels as more sustainable than oil-fueled cars. Still, the closing down of opportunities for diversity in the fueling of the transportation sector took place a century ago. Back then, the transportation system was more open than it appears to us nowadays. Steam, oil, electricity, and ethanol were all potentially viable sources of energy (Mom 2004; Carolan 2009). The benefits of electric cars, as well as the shortcomings, are more deeply examined by Alastair Illes (2013) from the Department of Environmental Science, Policy and Management, University of California at Berkeley. Because of the relevance to the topic for this thesis, it will be briefly mentioned here. Electric cars may have lower carbon and air emission, and the running costs might be small. At the same time, they can use materials in batteries that are toxic for assembly

workers and cause serious social and environmental impacts from mining (Illes 2013). An efficient battery recycling system does not exist yet. As a partial solution, car manufacturers would mingle a conservative design that combines plug-in batteries with conventional fossil fuel engines. Obviously, this means that oil will still have a big role to play, with all the side effects that come with it.

One of the potential solutions has already been put into practice: Chevrolet's cars can already change between ethanol and oil according to the driver's choice. Besides the standard and current biofuel producers, new cellulosic feedstocks are beginning to enter the scene: crop wastes, grasses, and trees. This input could significantly change our relation to fuels; nonetheless, there is something more crucial that demands strategic change (Ibid.). The debate about our transportation future needs to be open to consumers and the general public, because industry and government actors may shape our vision of future cars. "In other words, a strong technocratic stance colors the re-emergence of electric vehicles and biofuels, because it is primarily technical experts who are involved in deliberations" (Mees 2000 echoed by Illes 2013, p. 169). Industry interests in particular are framing the broader technological picture in the USA, with intertwining and merging between oil and biofuel companies (Illes 2013).

Therefore, "knowledgeable publics" (Jasanoff 2003) should be brought into the debate directly, without relying on intermediaries. Another point to conclude, which is seen as crucial, is the change in thought of NGO's and universities from "we need more electric cars" to a more proactive stance, such as "we choose this battery design over that model because it does not use rare earths" (Iles 2013, p. 170). Not denying the big role of lobbying, industry interests and multinational corporations in framing and decision-making concerning transportation future, a more distributive system is urgently needed, one that can address things not seen by large and wealthy actors. Moreover, the idea that the energy source system was much more open before seriously challenges the idea of eternal and unavoidable progress so common in the modern depiction of reality.

Going back to BP Outlook, natural gas is the next to be considered, and the demand growth is forecasted as well, mostly coming from non-OECD countries. Once again, this division seems fundamental for BP analysis because gas will overtake oil and will be the dominant fuel by 2035 in the OECD "zone," something very different from the trend coming from non-OECD countries, where gas will remain third, behind coal and oil. A profound and thorough analysis and space is given to shale gas. Shale gas is examined in a variety of aspects: growth (it will have the fastest production growth) and regional distribution: North America,

which will account for 70% of the growth by 2035 and China, described as “the most promising country for shale growth outside North America” (BP Energy Outlook 2014, p. 55). Asia will overtake Europe as the largest importing region. In this part of the document, the division is geographical and not based on the OECD versus non-OECD parameter. The so-called “US shale revolution,” as framed by BP, is considered in terms of adjustments. However, these adjustments are only in terms of market ones, the supply-demand relations, not considering transitions in energy systems (Hess 2013), environmental justice in energy transitions (Ottinger 2013) or the social dimensions of energy transitions (Miller et al. 2013).

Concerning this matter, other sources had to be analyzed to establish that BP relies on the US Department of Energy Ninety Day report from August 2011, which claims that “risk of fracturing fluid leakage into drinking water sources through fractures made in deep shale reservoirs is remote.” In addition to that, the fracking issue is examined in additional information, like in “Unconventional gas and hydraulic fracturing Issue briefing,” where it is stated that “BP is advocating for regulations based on the best-available science and sound technical practices. We believe hydraulic fracturing can be done safely and responsibly and that these techniques are important for the development of secure energy sources” (Ibid. p.3). BP is very much present in North American gas production. A major move into shale gas has been made by BP already in 2008, when Woodford Shale in the Arkoma Basin and a joint venture in the Fayetteville Shale in Arkansas were acquired. . Moreover, recently, in 2012, BP acquired about 100,000 acres in leasehold agreements in the Utica/Point Pleasant area of northeastern Ohio. [66]

Yet, there is a lack of information on the issue in the Outlook, especially if it was produced for external and public consumption, as many documents are (Atkinson and Coffey in Silverman 2004). The shale gas future is only seen in terms of quantitative data and statistics, without considering many hazards already mentioned before. Basically, it looks like BP relies on shale gas and the hydraulic fracturing practice as one of the factors to meet the growing need and demand for gas supply. This is one of the future scenarios envisioned by the company. Geographically, the trend is mainly set up in the US. According to the stats, the US will shift from an ongoing importer to a gas exporter in 2018. The question that should be asked is if this is forecasted to bring any benefits in the energy source mix more generally. The answer can hardly be yes if, for example, one considers the power sector alone. There, gas is likely to continue to grow at the expense of coal, despite the rapid

[66] bp.com/en/global/corporate/about-bp/bp-worldwide/bp-in-america/our-us-operations/exploration-and-production/north-america-gas/operating-areas.html

expansion of renewables; but if it is shale gas, at what social and environmental cost would it come?

The growing importance of renewables for power generation in Europe is essentially attributed to the "strong policy push in Europe" (BP Energy Outlook 2014, p. 75). It is not examined whether there are some broader values or meanings behind this endeavour, as seen from co-production in the Theories chapter. In particular, it will be interesting to consider a European imaginary in the field of renewables and the sociotechnical imaginary (Jasanoff, Kim 2009) standing behind it. As it stands in the BP Outlook, renewables in Europe are mainly a political decision. When compared to other regions, in terms of renewables volume growth, the EU is surpassed by China, and almost matched by the US. Nuclear power is essentially seen as something from the past and obsolete: nuclear generation is expected to decline in the OECD (-0.2% per year), some plants will be decommissioned, while very few new plants are expected to be built. A peak in nuclear energy is forecasted soon, among other things because of the technical retirement of many reactors, especially in the US and Europe (BP Energy Outlook 2014).

The last chapter is devoted to Carbon emission and the fuel mix. This picture is worrying, as, for example, global emissions in 2035 are forecasted to nearly double the 1990 level! Most of the emissions growth will come from non-OECD countries. Yet, even taking into account the emerging economies and their growth, the US will be the country with the most CO2 emissions by 2035 by far, well above China, the EU, the world average and India. The basic factor that determines the so- called fuel mix is the availability and the local costs of fuel. The global competition is forecasted to be between natural gas and coal. However, a global change in fuel mix remains a missed opportunity (BP Energy Outlook 2014). The very last part is devoted to the Conclusion (one page), where trends are summarized and qualified and they go as follows:

"Sufficient and available? − Yes – new energy sources and efficiency improvements; *Secure and reliable*? − Mixed – improving for some, a concern for others, *Sustainable?* − Room for improvement" (Ibid. p.90).

Essentially, this conclusion is answering the key questions from the introductory part. It comes accompanied with a picture of our planet, taken from space. It is the first picture of that kind that appears in the Outlook, the rest being tables with stats and charts regarding quantitative indicators and parameters. All of the facts were not mentioned here deliberately because otherwise they would take too much space for the purpose of this thesis. Staying

with the conclusion, it mentions three different parts: sufficiency and availability, security and reliability and sustainability. The order in which they were given is a proper one, since it is following the structure of the document.

The question is why enough space was not given to sustainable development. It is certainly not clear exactly what "room for improvement" means in terms of sustainability. Moreover, as an extension of current trends, increasing the rate of carbon dioxide emissions to almost 45 billion tonnes can hardly leave "room for improvement." According to the IEA's "World Energy Outlook," this means that the rise of average global temperature is projected to be at least 6°C in the long term. Unless there is some action taken to tackle these events, like a successful intergovernmental agreement to restrict carbon dioxide emissions, this could represent a global catastrophe.[67][68]

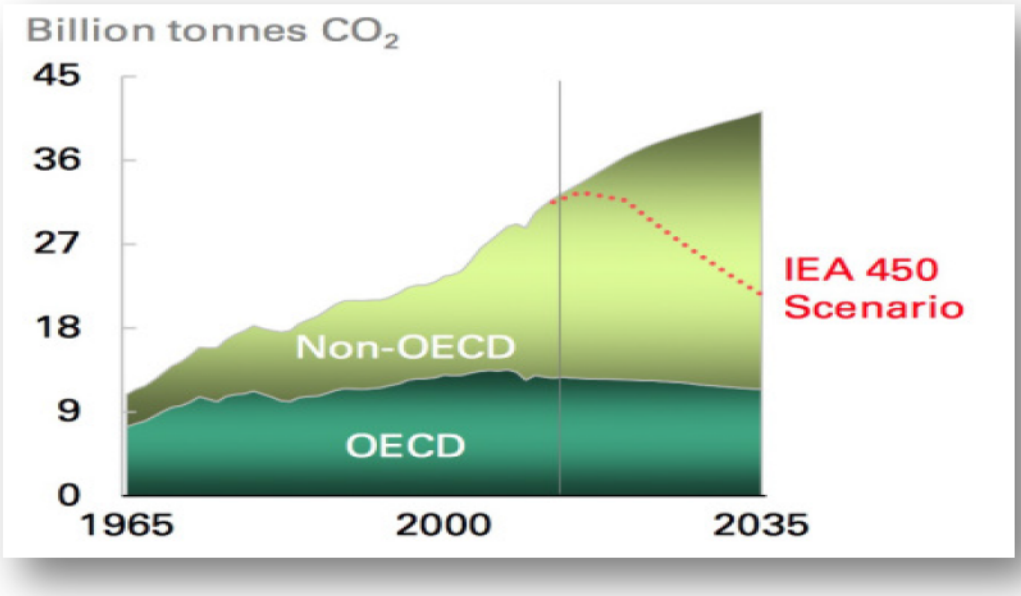


Figure 6. CO2 emissions from energy use continue to rise (Source: BP Energy Outlook 2014)

Arguably, the main intention of the planners in BP was to provide an extensive overview covering the diversity of energy sources but with the focus on the currently dominant ones, such as natural gas and oil. Thus, it can be seen as a planning tool for different audiences: companies, governments, international organizations, policymakers, engineers, students. It focuses on final objectives, including intermediate and long-term milestones. It is

[67] http://www.iea.org/publications/scenariosandprojections/

[58] http://protonsforbreakfast.wordpress.com/2014/01/22/bp-energy-outlook-2035-room-for-improvement/

encouraging forward thinking and early research for solutions to problems that are likely to emerge on the road of the energy future. Therefore, it can be a useful guide and a tool to assess the future possibilities and probabilities in the energy field.

While recognizing some shortcomings of the current way of production and consumption, it is not enough if it is not introducing the search for the solution at the same time (Adam 1998). Given CO2 emissions as a fact to take into consideration in the future, BP Outlook falls short of giving some kind of anticipatory solution to the issue. Although the relation between economy and ecology has been one of sheer interdependence for at least the last 25 years, it does make a difference how this interdependence is going to be conceived and consumed (Ibid. page 62). The report is looking from the perspective of the *present future*, which is to be distinguished from *future present.* The present future speaks from the standpoint of the present, while future present assesses the potential impact that present actions might have on future generations (Adam and Groves 2007). How to cope with the foreseen developments and innovation and what will be their potential societal impact is not clarified within the report.

Another point this Outlook wants to highlight is the power of competition and market forces. They are depicted as very important in unlocking technology and innovation to meet the world's energy needs. This approach needs a further and closer examination and deliberation, because serious negative consequences of market forces are not addressed; one of the crucial ones is the merging of companies and monopolization of the market, as described historically with the case of oilmen tycoons and Standard Oil (Jones 2013). However, this does not mean that the society is helpless, lacking tools to exert influence on policymakers and private corporations, even in the modern, neoliberal age (Ibid.).

7.3- VIDEO 1: "BP ENERGY OUTLOOK 2035: A VIEW FROM 2014"

The starting point of this video is the year 2014. It was published on January 15, 2014, by BP, and it is available on You Tube.[69] The video forms part of the BP section on "The Energy

[69] http://www.youtube.com/watch?v=bzkHlRsUspk

Future," which states that "Today's challenge is to manage and meet growing demand affordably, sustainably and securely."[70] Compared to previous Shell videos and others coming from energy futures, the peculiarity immediately noticeable from this one is that it does not have a narrator or voice over, but rather facts go on the screen throughout the whole video, accompanied by digitalized music. It lasts 2 minutes and 37 seconds and looks as far ahead as the year 2035, asking some fundamental questions regarding energy futures: how much energy will we need, who will use the most and where will it come from.

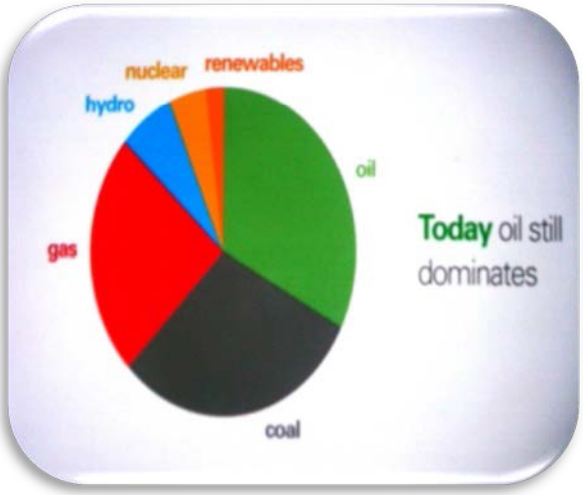
What can be concluded right from the beginning of this BP look ahead to 2035 is that it is strongly based on the BP Energy Outlook 2035, which was also published in January of 2014. The video is synthesizing major trends like a motion picture does. The picture is global from the outset and shows the world as one, where the energy demand will mostly come from emerging economies, as mentioned in the document. The geographical implications are assessed as well, with China as the biggest importer and consumer of energy compared to the EU and India. This video goes along perfectly with the aforementioned Outlook, giving the same stats and data, although much more compressed and summarized, allowing for a video of short duration. Nevertheless, there is a change of priorities, which are structured differently than in the document, being that this change is very important (e.g. the role of renewables playing an important role in the video and a much less important one in the Outlook). Is BP somehow shifting priorities and changing main focuses in the video as compared to the Outlook?

The reality is based mainly on production and consumption, examining some of the principal trends. Societal aspects are not considered exhaustively in the video (e.g. political and cultural processes and changes, growth of population, fears and expectations). At the same time, different energy sources (oil, coal, gas, nuclear, renewables) are deeply assessed. This is a promotional video from a multinational corporation and has to be analyzed as such. "Corporate Video is an all-encompassing description of video programs made for business and/or information purposes." [71] In this case, it has an informational purpose, based on the future energy scenario, which is mainly grounded on facts and data available from the BP Outlook, rather than focusing on imaginary of different kinds and possibilities. The video is based on variety, which encompasses both the actors involved in terms of countries and regions as well as the big variety of energy sources considered.

[70] http://www.youtube.com/channel/UC9m-Yl4kfv8nIriI7Ry8CxA

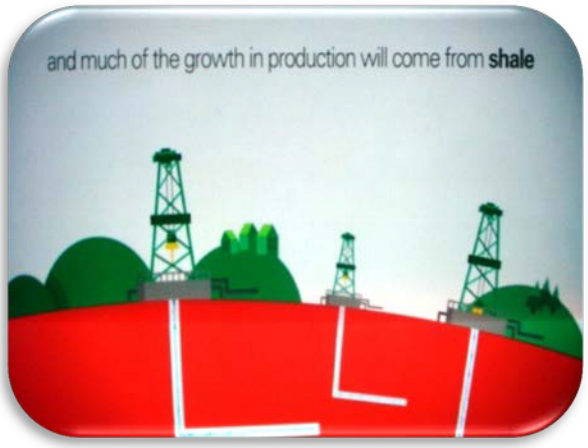
[71] ww.artagecom.com/corporate.php

TRANSCRIPTS AND ANALYSIS



Snapshot 1 (Source: YouTube 2014)

Snapshot 2 (Source: YouTube 2014)



Snapshot 3 (Source: YouTube 2014)

00:30- 01:05 "What is the outlook for individual fuels? (Oil, coal, gas, hydro, nuclear, renewables) Today oil still dominates but it will grow the slowest. Until 2020 most growth in demand will be met by western hemisphere production led by tight oil in US. Growth in consumption of coal is also slowing. Natural gas will be the fastest-growing fossil fuel…and much of the growth in production will come from shale."

The video gives an introductory "hook" by asking questions that are considered fundamental nowadays regarding energy production and consumption. Our globe is presented right from

the beginning, with the surface being entirely green and the oceans blue. The symbolism of the colours could be understood differently, if taken into account that the BP logo is predominantly green, therefore it could be seen as the company's stance, which this video certainly is. The video ends with an invitation to join the conversation on BP's social media, which can be interpreted as broadening social interaction and public participation, especially if it entails the bottom-up meaning of public participation in science and technology (Felt and Fochler 2008).

While the genre is a promotional video from a corporation, there is nobody talking nor any voice-over; the music played is constantly in the same rhythm. The video does not contain spoken words, therefore there is no need to transcribe it except for the written trends; it does not have subtitles either. Different energy sources are portrayed with distinctive colours (oil - green, coal - black, gas - red, hydro - blue, nuclear - orange), although, altogether, the prevailing one is the green followed by yellow, often taking the shape of the official BP logo.

The oil (dominant energy source today), coal, gas, hydro, nuclear and renewables are all included in the chart, as seen from the first snapshot (snapshot 1). Yet, it is not clear why renewable and hydro are separated, since many authors count hydropower as a renewable energy source, along with biomass, geothermal, solar and wind energies (Demirbas 2008). While the snapshot is based on present facts and data, oil is forecasted to have the slowest growth in the future. Tight oil in the USA will presumably lead in meeting the growth in global energy demand, while natural gas will be the fastest-growing fossil fuel (snapshot 2), which goes hand in hand with the Shell Mountains scenario described before. Natural gas is the fastest growing alternative also for transport demand (6.8% per year) and it is expected to reach almost 7% of transport by 2035 (BP Energy Outlook 2014, p. 43).

The images in the video entail the full cycle of oil production and transportation (oil wells, refineries, transportation trucks, barrels going to the warehouse), followed by the picture of the Western hemisphere (interestingly, only North, Central and South America) when it comes to meeting energy demand. Once again, the picture is largely green, probably making allusion to the name "Green Continent" given to South America because of the Amazon and other forests. Tight oil extraction and consumption are presented in the following sequence (snapshot 3), where it is observable that refineries have their tubes deep in the ground, although the depth differs. There are three refineries of different sizes, with green background, green mountains, and forests, giving a more environmentally concerned picture mingling with the highly controversial practice of hydraulic fracturing, as it is the way of obtaining this kind of oil. Coal production is presented as expected traditionally, with mining,

colliery and wagons loaded with coal. Eventually, all of the mentioned sources merge into a pie chart, still giving the major role to fossil fuels.

Most likely, images can clarify the complex aspects of the scenarios. In the last two snapshots (2 and 3), the red is prevailing beneath the surface, as it is the colour of gas in the video. There are natural gas processing plants in both snapshots. We can observe nature in the background, with trees, hills and mountains. Sometimes the impressions of scenarios can be confusing, especially if there are more than two scenarios. The use of colour and icons can help to distinguish scenarios from each other and graphic elements can highlight essential features of each story (Shell Scenarios: An Explorer's Guide 2008).

The third snapshot is showing more in detail the process of hydraulic fracturing (it is noticeable that liquid is being injected into the well), which is essential in the modern shale gas production. However, the wider health and environmental implications of using hydraulic fracturing in shale gas and tight oil production are not mentioned or examined. Namely, there are concerns about health hazards of chemicals used in the fracking process as well as about the large carbon emissions associated with the growth in gas-fired electricity production (Miller et al. 2013). The fact that much of the growth in natural gas will come from shale is based on the BP Outlook projection, which states that shale gas will be the fastest-growing source of supply (6.5% per year). It will provide nearly half of the growth in global gas (BP Energy Outlook 2014). However, there is a big difference with the official Outlook, which gives a lot of space and consideration to shale gas alone (even labelled “US shale revolution”), while in the video it is just a small segment of an overall presentation.

Snapshot 4 (Source: YouTube 2014)

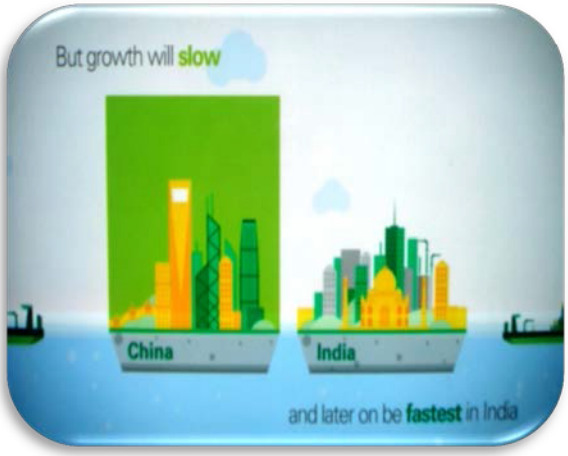
Snapshot 5 (Source: YouTube 2014)

01:07 - 01:28 “Renewables will continue to grow rapidly, overtaking nuclear for the first time

and becoming increasingly competitive. Global market shares for fossil fuels will converge and fossil fuels will remain dominant".

Renewables present an interesting picture, with wind turbines, solar panels and crops (which could be sugar cane used for ethanol production, for example: snapshots 4 and 5). The main colours are blue and green, with sky and forest - all these elements lead to a conclusion of a more ecologically thought-out balance. The renewables are next to nuclear in the fourth snapshot because the comparison is made between the two of them, and on the screen it is written that renewables will overtake nuclear for the first time. The nuclear energy share is presented with characteristic nuclear power plants, while the small portion of blue comes from hydro. We can see that by the order and way of mentioning them, renewables have a much more prominent role in the video (they are mentioned right after natural gas, which is projected to be the fastest growing fossil fuel by 2035). Furthermore, renewables are described as "becoming increasingly competitive." It is not clear in which sectors (industry, transportation, power) this is projected to happen. However, in the same vein as the BP Outlook, fossil fuels will remain largely dominant (with 81% of share by 2035) (Information transcribed from the snapshots). Therefore, according to this projection, the consumption of fossil fuels will decrease only by 5% in more than 20 years' time (starting from 2012).

Snapshot 6 (Source: YouTube 2014)



Snapshot 7 (Source: YouTube 2014)

01:50- 02:07 "Overall China will still import and consume the most energy using more per head than the EU. But growth will slow and later on be fastest in India. The US will achieve energy self-sufficiency".

The first two sentences (coming from snapshots 6 and 7) are in complete compliance with the BP Outlook, on which this video is based. The projected growth of energy consumption will mainly come from non-OECD countries (95%). “China has emerged as the key growth contributor, but by the end of the forecast China’s contribution is starting to fade. India’s contribution grows, almost matching that of China in the final decade of the forecast” (Ibid. p.9).

Moving to a geographical distribution, different countries and regions are presented. In science and technology studies, geography retains an important role (Wagner 2008). China is represented with modern city architecture and skyscrapers, at the same time with the Great Wall of China, while the EU has the distinctive features of some of its biggest capitals (Paris, Arc de Triomphe and London, Big Ben) and modern urban portraits. China is compared both to the EU and India (which is represented with the famous Taj Mahal temple standing in front of the city’s modern architecture). The geopolitical division differs from the official Outlook, in that the main division framed in the document was between OECD and non-OECD countries, and this is not mentioned here.

The video is apparently seeking global trends, emphasized by showing the image of the planet several times. The image of planet Earth has achieved almost an iconic status in our visual culture, since it appears everywhere (Jasanoff 2004). However, it is noticeable that some important regions and countries from the point of view of energy sources production and consumption, such as the Middle East or Russia, are apparently neglected. The power of images is not only to represent the Earth, but also to construct it (Sachs 1999). Furthermore, the kind of reality video produces has to do a lot with geographical distribution; many parts of the world, like Africa or Australia, are out of the picture and consideration. The USA is portrayed with a map of the country in green colours (light green-dark green contrast) within a circle..

Unlike the Shell “Oceans and Mountains” video, which has years included for the key turning points, BP does not consider time in such a way. Except for the fossil fuels time consideration and comparison (in 2012 and 2035) and the year 2020, when presumably most growth in demand will be met by production of tight oil in the USA, it does not consider other time spans or deadlines in numbers, referring to the future more generally and abstractly, by using “will” phrases. Still, according to Bob Dudley, BP Group Chief Executive, “the numbers that make up this Outlook are less important than the long-term trends” (BP Energy Outlook 2014, p.4). This may be the explanation for why the video was made in such a way, regarding years and time span consideration.

The circle is the main geometric symbol; the one used the most in the video. The meaning can be interpreted twofold, as it takes different shapes: one is the representation of the Earth and the other of the BP logo. Most of the time, the background of the video is white. Although there is a variety of colours, the main one used is green, with different shades, from a very light green to a dark one. Green is the main colour of the BP logo, followed by yellow, but sometimes it is used as an environmental symbol, for instance when used on the image of Earth. Yet, the picture of Earth is not interpreted straightforward or in one way. For instance, the image of our planet may start a controversy between those who wish to approach environmental problems on a global scale and those who have more down-to-earth considerations, focusing on the kinds of lives people want for themselves, for their communities and their descendants (Jasanoff 2004).

Ultimately, the video asks about the environmental implications of the rise of global CO2 emissions. These emissions will grow, but the growth is expected to be slower due to the increasing role of gas and renewables as well as energy efficiency improving worldwide. However, in the USA and Europe these emissions will actually fall, as rising economic growth now goes along with the flattening of energy demand.

7.4- VIDEO 2: "BP US ENERGY OUTLOOK 2035: AMERICA'S ENERGY FUTURE- 2014"

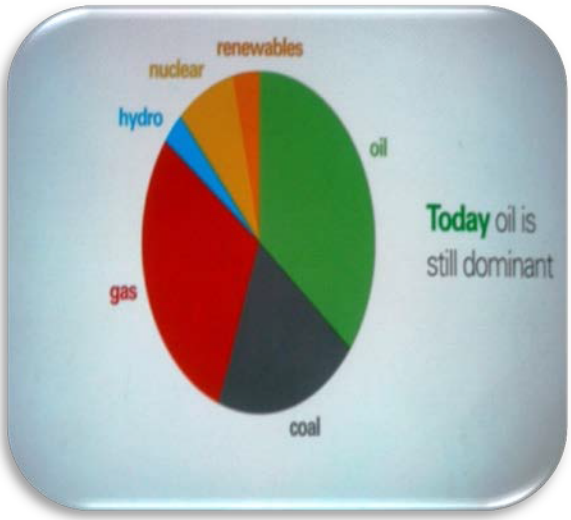
This is the second video analysed from BP, and it lasts almost the same amount of time as the first one (2 minutes 36 seconds), which can be seen as a duration pattern for making these kinds of videos by the corporation. The video also forms part of BP's "Energy Future" section on the company's official YouTube channel.[72] It was published on February 5, 2014, and so far (as of August 2014) it has attracted more than 11,000 views. Interestingly, America's energy future (i.e. the US, which should have been specified) is the only one considered by BP in the videos. Therefore, the techno-political imaginary of this company is particularly concerned with US energy trends, not explaining explicitly why this country has

[72]http://www.youtube.com/watch?v=i8B1MJNSFIs

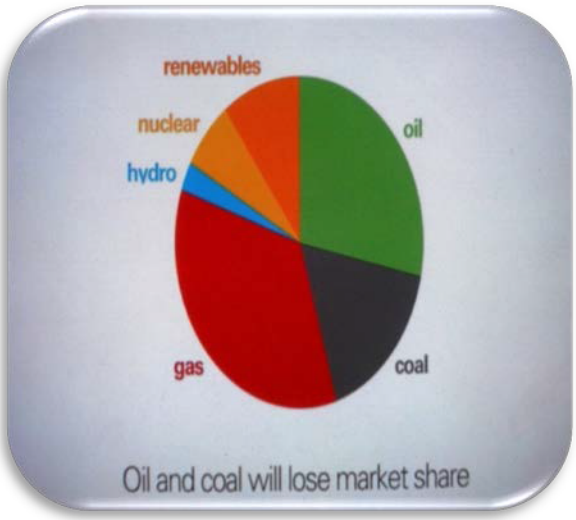
been chosen. At the same time, there are videos examining other national realities, such as "BP in UK" but they do not deal with energy future scenarios.

Snapshot 1 (Source: YouTube 2014)

While on the green surface the year 2035 appears, different questions are added: In 2035, how much energy will the US need? In 2035, what will it be used for? In 2035, where will it come from? In 2035, what role will the US play in global energy? One of the interesting questions right from the beginning and which largely differs from the last video (otherwise, the questions are very similar, if not the same) is the role of the US in global energy distribution. Again, the images and the music are very similar, and the script is basically the same as in the previous video, "BP Energy Outlook 2035: A View from 2014." The sequences are accompanied by soft background digital music--once again, there is not a narrator or voice-over. This is contrasting with Shell, where the narrative is seen as important and complementary to the picture. There, institutional talk is one of the key components of making energy futures. In the BP videos, it is not possible to compare text and images, to see whether they are complementary or how they frame a story when combined. Besides digital music (always playing the same rhythm), the video does not contain any other sound effects.

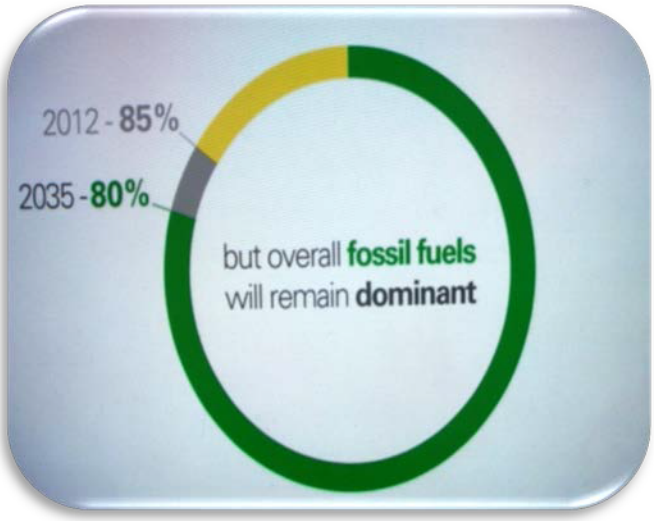


Snapshot 2 (Source: YouTube 2014)



Snapshot 3 (Source: YouTube 2014)

Comparison between current energy sources (left) and the trends in 2035 (right)



Snapshot 4 (Source: YouTube 2014)

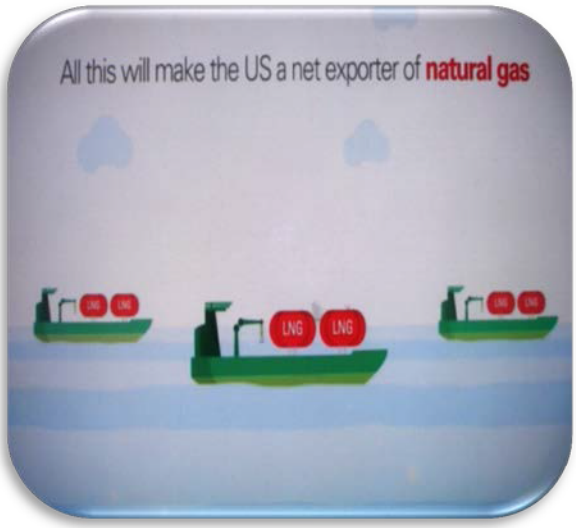
0:35- 1:11 "Today oil is still dominant but its use will decline the most. Consumption of natural gas will grow in all sectors and overtake oil. Renewables will become increasingly competitive. Oil and coal will lose market share, but overall, fossil fuels will remain dominant."

Some of the projected energy trends are described in the video. By 2035, US energy consumption will grow by just 3% (which is a huge difference compared to the previous outlook, where global growth will reach 41%)! Oil is still dominant (the same as in the global outlook- snapshot 2), but its use will decline the most. Consumption of natural gas will grow, and it will overtake oil (snapshot 3).The years are not mentioned, except that fossil fuels will remain dominant by 2035 (snapshot 4). Similarly, renewables will become increasingly competitive. Thus, when compared to the previous video, the trends are literally the same as

for the global outlook. This includes individual fuels such as oil (dominant, but declining), natural gas (growing), coal (slowing) and renewables (growing, becoming increasingly competitive), as well as more broadly fossil fuels which will remain dominant by 2035. Visually, the colours portraying different energy sources are the same as in the previous snapshots, namely oil - green, coal - black, gas - red, hydro - blue, nuclear - yellow, renewable - orange, and once again hydropower is considered apart from the renewables. The comparison between current trends and the ones in 2035 is given in the form of pie charts (snapshots 2 and 3), while in between, different facts regarding individual fuels are shown. The conclusion is that although the consumption of fossil fuels will decline slightly, they will be dominant by 2035, with an 80% share (snapshot 4).

What differs is that, being a US energy outlook, there are images pointing to a particular national scenario. This national particularity is underlined by portraying a US flag in some of the sequences; further, there are also tall skyscrapers and three famous buildings and structures in the US: the Chrysler building in New York City; the Sears Tower in Chicago, the tallest building in the United States; and the Seattle Space Needle, an observation tower built in 1962 for the Seattle World's Fair. As can be seen from the snapshots, the circle is by far the most frequently used geometric symbol in the video, taking different shapes.

Certainly, signs, symbols and images work in a certain way in order to create a particular way of meaning making (Becker 1982), as can be observed from this video. The constant use of green as the primary colour for the images points to the company logo, but also sometimes to the bigger picture, to the environment, as there are small sequences with forests and hills. Therefore, the choice of colours and images is very similar to the previous video, denoting that the same company is standing behind its production. The same is not the case with Shell, with its diversity in video production, as seen from the previously chosen examples.



Snapshot 5 (Source: YouTube 2014)

Snapshot 6 (Source: YouTube 2014)

2:13-2:30 "...US remains the global leader in natural gas production. All this will make the US a net exporter of natural gas while importing less and less oil and eventually becoming energy self-sufficient."

US energy self-sufficiency is a hotly debated topic lately, and BP states that it will happen by the year 2035. On the other hand, some other sources, like Rex Tillerson, CEO of the world's largest publicly traded oil company, Exxon Mobil, consider that it will become a reality already by 2020.[73] Basically, energy self-sufficiency in the US has increased in importance, making the continuation of the so-called "shale gas revolution" more likely (Stevens 2012). In the past few years, public protests against the use of fracking technologies in the natural gas industry on a global scale have accelerated (Ferguson and Smith 2012), and this controversial technology is opening up a new potential line of social conflicts regarding energy production. It is already creating tensions between the profit-led economy (since the price of gas in the US went down considerably) and public opinion (Miller et al. 2013).

Coming back to the images, the reality they produce is a national one, positioning the US now as an energy exporter, while the structure of the video is essentially the same as the "BP Energy Outlook 2035: A view from 2014. "The colours, images and music basically look alike, and so is the way in which energy sources are presented and described, except that some trends (for coal or power distribution) are given in small circles, and not as full images. The maps of the country and US flags are repetitive and recurring features. Those are the images that often come back, emphasizing a particular national scenario. The colour most used by far is green (even the map of the country is painted in a dark green-light green

[73] http://www.cnbc.com/id/101321945

combination) and much less yellow, making an allusion and hinting at the company's logo, shaped like a circle. The forecast for the USA does not differ much from the global one; the trends are quite similar, such as the one projecting that nuclear power will be overtaken by renewables. The circle as a symbol is much more present in this video than in the previous one, as seen from the image below.

Snapshot 7 (Source: YouTube 2014)

For a person not very familiar with the topic, some terms may not be easy to comprehend immediately. This might be the case with abbreviations or new technologies, for instance, with terms such as shale gas or the term LNG (liquefied natural gas), which appears as an acronym in the video. Furthermore, considering the language, the trends and forecasts are given as facts, something that is supported by the recurrent use of the word "will," performing a forward-looking statement on the one hand, but also stating high confidence and certainty about future events, on the other (e.g. "oil use will decline the most" or "fossil fuels will remain dominant," to name just a couple). It is the most repetitive rhetoric in the video, as it can be observed from the snapshots as well; basically, the word "will" is present in each sentence. Given a larger context, it implies construction of a particular scenario. However, this may be problematic if considering a number of different possible and probable influences on energy future scenarios (natural, social, political, economical and environmental) or the so-called sideswipes, already mentioned in the State of the Art section, like surprises or disasters, breakthrough technologies, wars, extreme natural disasters, pandemics or the breakdown of the climate systems (IEA 2003). It looks like this future in the US is imminent and unavoidable, as something that will happen regardless of anything. Nevertheless, many social and socio-environmental issues are frequently producing unpredictable, long-term outcomes (Adam 1998, Adam et al. 2000, Beck 1992).

The wider implications of a changing energy mix are also examined at the end of the video. Declining use of coal and oil will bring some benefits, such as falling CO2 emissions in the USA. Finally, shale gas and tight oil growth are assessed, and this growth will have big implications, bringing transformation in oil and gas production and consumption. Namely, the US will become the main producer of liquid fuels, and will remain the leader in natural gas production. There is a big difference with the official BP Outlook, which gives a lot of space and consideration to shale gas alone (even labelled the "US shale revolution"), while in the video it is just part of an overall presentation. In conclusion, there is a notable difference between the priorities stated in the Outlook and in the video (not only considering shale gas and tight oil, but also renewables in the US, which are not considered that much by the official publication).

Looking for an answer to the question of why the US has been specially selected, other sources had to be consulted, leading to a more accurate answer. Namely, BP's presence in the US is greater than in any other country where this company operates. Almost 40 percent of BP shares are held in the USA, and they employ more people and invest more dollars there than anywhere else. There is a clear commitment with the USA stated by the company.[74] Politically, this might be seen as a continuation of the "special relationship" between the UK and the USA, especially since the end of the Second World War, with an unparalleled level of cooperation in the military field, but also in economics (Wither 2006). Obviously, these special Anglo- American relations translate into the field of trade and commerce. However, it is interesting to see that BP was a part of one of the biggest scandals recently. The corporation became the target of strong criticism and comments in the US media and by public figures after the Deepwater Horizon oil spill, which led to diplomatic friction between the two countries. The blast aboard the Deepwater Horizon rig killed 11 people in April of 2010, causing one of the worst oil spills in history.[75]

The particularities of US sociotechnical imaginaries, governance and national energy policies were particularly compared to other countries and described by Sheila Jasanoff and Sang Hyun Kim (2013), who assessed the distribution of costs and benefits of innovation and the influence of US policymaking in the process. One of the main features of American sociotechnical imagination is that "technology's benefits are seen as unbounded while risks

[74] http://www.bp.com/en/global/corporate/about-bp/bp-worldwide/bp-in-america/committed-to-the-US.html

[75]http://www.bbc.co.uk/news/world-us-canada-12124830

are framed as limited and manageable" (Ibid. p.190). In addition to that, there is a recurrent pattern where private developers reap technology's benefits while risks and costs are transferred, although without explicit accounting, to the public. This pattern is also applied in other fields. The financial crisis of 2008 caused a much more visible assumption of risks by the public, while at the same time poorly regulated private financial markets gained huge profits (Jasanoff and Kim 2009).

A more just energy infrastructure in the US was examined closely by Christopher Jones (2013). While cities, such as New York and Philadelphia, enjoyed enormous benefits from injections of cheap energy, such as creating jobs, goods and wealth (benefits not evenly distributed among the urban population), the energy-producing sites, like the anthracite coalfields of northeast Pennsylvania or the oil regions of western Pennsylvania, experienced far fewer benefits. The ones who profited the most from the production of energy were not local landowners and miners, but rather the capitalists in seaboard cities who controlled the transport and marketing of coal, oil, and electricity (Dublin and Licht 2005). Further, the quality of the environment was diminished: the most affected were typically the sites of extraction, not the sites of consumption (Jones 2013). One of the dire consequences of the mining of coal was the damaging of the landscapes in the anthracite regions. Similarly, frequent spills, deforestation and tainted water supplies often accompany oil drilling (Ibid.).

The reality constructed by BP in the future is based on the present energy sources and their distribution, with trends forecasted as exposed above. An open question is the assumption that the economy will become more energy efficient, which is also stated in the Outlook: here, there are not facts to support this claim, probably because of the length of the video. The video envisions energy changes in a relatively short time frame, of 20 years; at the same time, it does not consider what will happen to the society and the social dimensions of energy transition envisioned, considered in the State of the Art chapter (e.g. Miller et al. 2013; Hess 2013), except for briefly mentioning some optimistic trends concerning environment, such as falling CO2 emissions.

Summing it up, the main message from the second video is clear and understandable: the trends may vary, but US will remain an important global producer and eventually will achieve energy self sufficiency. At which cost will this happen, remains to be seen.

8- DISCUSSION AND CONCLUSION

“Imagination is more important than knowledge, for knowledge is limited, whereas imagination embraces the entire world – stimulating progress, giving birth to evolution.”

Albert Einstein

This thesis examined different energy future scenarios described by two of the world's largest multinational corporations. Due to the work exposed here, it is possible to observe which scenarios these companies are forecasting and how they will play out in the future. Betting on a certain future with complete accuracy is impossible, and so is choosing one particular energy source or a winning technology which can take us to a prosperous, affordable and sustainable energy future. These scenarios have explored possible paths towards an energy system(s) which will find solutions to chief social and environmental concerns.

Brief summary- Presenting the solutions and conclusions from the material, the first clear thing is the variety. It is expressed both in terms of energy sources as well as geographic locations. Starting with the “Earth 2050” video, the imaginary goes from biofuels through driving efficiency to get to the building of future cities. The first part of the video, considering Brazil’s biofuel production, has a conclusion most effectively expressed by Isaias Macedo, researcher at the State University of Campinas, Brazil. The fact is that there are not very large quantities of oil anymore, while coal is not transforming in a clean way. In his opinion, the best we can do are biofuels. This statement is backed by concrete actions by Shell, such as the company's move into business and production, Shell being a large biofuel producer itself.

In the second part of the video, the focus is on driving efficiency, i.e. by radically changing the way in which people drive, there is a possibility to save more energy. It is also based on the use of intelligent vehicles, redesigning the existing ones, which as a result leads to a drastic reduction in fuel consumption. The emphasis is put on energy efficiency and conservation, thus protecting our environment from dramatic changes and saving the depleting resources for future generations. As a specific locus, Scandinavia and Australia have been selected.

Lastly, there is a thorough consideration of how to build new cities, since, according to the architects, the way cities were built previously, during the last century, is unsustainable and inefficient. The comparison is made between Abu Dhabi and the new project city Masdar, favouring the latter in terms of sustainability and energy consumption, which is mainly based on solar energy. Again, maximizing energy efficiency is the main goal and the city's construction is entirely based on human beings rather than on motor cars.

Yet, the three scenarios have some potential drawbacks as well. Biofuel production can be developed only under auspicious conditions for growing sugarcane (meaning not everywhere in the world). At the same time, it can take land necessary for food growth and production, which can be a huge issue, especially for poorer countries. Driving efficiency, as foreseen by Shell, with the development of intelligent vehicles and a system of city map monitoring, looks quite promising, but the question is how feasible and affordable those projects are, especially in emerging economies which are projected to have the biggest increase in car and vehicle fleets.

The second Shell video analyzed is based on a future much more distant than most of the other videos or outlooks consulted, even further than the previous "Earth 2050" video. The two scenarios envisioned ("Oceans" and "Mountains") go as far as the years 2070 and 2100. The first scenario, "Oceans," is based on the growth of renewables, with solar power becoming the world's largest energy source by 2070. It also considers political and social tensions, influenced by market forces. Conversely, the "Mountains" scenario is based on natural gas as an alternative to oil and coal because natural gas is the cleanest- burning fossil fuel. Electricity will become carbon neutral by 2060, but at the same time there are no changes in social mobility around the world.

Moving to the scenarios offered by BP, only the conclusions from the videos will be given, since the conclusion from the Outlook has already been described and videos are the primary source of information and analysis for this thesis. Again, in the video "BP Energy Outlook 2035: A view from 2014," there is a variety of energy sources considered as well as geographical places. Natural gas will be the fastest-growing fossil fuel, and although the role of coal and oil will diminish, fossil fuels will still be dominant by 2035. Regarding the environment, CO_2 emissions will rise, but more slowly due to growing shares of renewables and natural gas. This fact contributes to the overall optimistic conclusion from the video, as there is also a rising economic growth projected.

The second video analyzed from BP, called "BP US Energy Outlook 2035: America's Energy Future - 2014 Report," has a very similar structure as the previous one, and the main trends

assessed are basically the same. The only change is that, while the last video was global, this one depicts the US energy future. Having a boom in gas production, the US will transform itself into an exporter of natural gas and will import considerably less oil. As the consumption of coal and oil will decline, there will be less CO2 emissions. However, as pointed out several times in the "Analysis" and "State of the Art" chapters, the environmental price to pay for using hydraulic fracturing technology, which makes possible the exploitation of shale gas and tight oil, is not considered.

Coming back to the main research question, ***how are energy futures made by these companies***, there are few points that must be highlighted. Firstly, we can see narrative as an important part of Shell videos and energy future making. It is crucial in the movie "Earth 2050", with many engineers, scientists, architects, professors, and executives consulted and interviewed. Images and sound play an important role as well, underlining the particularities and distinctiveness of the places selected (e.g. Brazilian landscape or music when talking about ethanol production there). The shots from the streets of Masdar, showing partly an Arabic medieval architecture incorporated into modern buildings with solar roof pannels, are complemented with an interview to Mr. Relton, an architect himself. The same is the case with Brazil, where people talk about problems and solutions while their environment is being filmed and presented (e.g. when researcher Macedo or CEO Dinucci speak, snapshots 1 and 5). Thus, Shell uses the technique of being much more present at the spot, where the events are actually taking place and then translating that reality directly to the viewer. All of the examples narrator and interviewees are talking about are covered with images and shots from the places they are speaking from. As can be seen from the empirical part and the videos, Shell energy scenarios are characterized by considering undesirable events as well.

Next, all the processes described (i.e. ethanol production in Brazil and solar power in UAE) are covered in great detail, meaning that the viewer can observe the process of obtaining ethanol from sugar cane or how the prototype called solar beam down is expected to supply Masdar with energy. The planted fields, harvesters, trucks, factories, solar panels, architectural designs to avoid heating make part of the video and contribute to the intended credibility, since all the processes and developments are shown publicly and thoroughly. The narrator and interviewees explain the scientific and technological background of the solutions presented by Shell, answering some questions as well.

Similarly, the second video from Shell ("Mountains and Oceans") uses narrative to describe and point out the main trends, complemented with the facts that go on the screen throughout the video. However, in this case, the person speaking (the narrator) is not visible. Already at

the beginning, Shell is stating its more than 40 years experience in the field of energy scenarios, affirming the potential credibility; this credibility is being coupled with the experts who have been producing the scenarios in the past, a fact also mentioned at the beginning of the video. While the music is the same, the images are in stark contrast for both scenarios: Oceans is mainly blue, Mountains mainly yellow. The shots are selected in a way to make us clearly see the difference between the two alternative scenarios, as it can be deduced from the snapshots in the empirical part. The timeline is seen as essential in constructing energy future: namely, most of projected trends are accompanied by the year of the expected fulfillment.

At the same time, narrative or talk is not part of videos analyzed from BP. The focus there is on the facts that go throughout the screen in the videos, accompanied by sequences portraying distinctive energy sources and futures. While the time span is present in some cases, the energy sources and their mix are the ones having the fundamental role. Most of the trends are not accompanied by the year expected to realize the forecast. Both BP videos analyze the economic (supply-demand) and environmental impact of future trends, assessing the level of CO2 emissions. They portray distinctive national realities by using some recognizable architectural features, such as the Great Wall in China or Arc de Triomphe in Paris. The colors are seen as very important, since they tend to describe certain energy sources which later merge into a pie charts, keeping the distinctive colors. There is also a repetitive use of green, depicting the environment but also making part of an official BP logo.

***Similarities and differences*- -** As identified above and in the chapter of Empirical analysis, these scenarios have some common features regarding the findings. Firstly, the important role of natural gas as a fuel over at least the next two decades. Secondly, there will be pressure on oil markets as new vehicle technologies spread (biofuels, natural gas and electricity). Thirdly, environmental concerns are becoming a major driver for energy policy in many countries. The difficulties in identifying a single winning technology or energy source stem from the fact that, as seen from the literature consulted from the field of STS, energy choices are ultimately social choices. These scenarios remind us that today primary sources of energy are mainly non-renewable: natural gas, oil and coal. The renewable sources (biomass, geothermal, solar, wind and hydro energies) are becoming increasingly important in the energy mix and probably will continue to do so (Shell and BP agree on that point).

Furthermore, it is imperative to consider the role of governments and public attitudes in framing and choosing a particular energy system in the future. Governments could have a

key role in establishing the framework within which energy transition can take place, a position assured by the two corporations (Shell “Mountains” scenario and the official BP Outlook). Furthermore, both companies agree on the importance of sustainability and energy efficiency as the key factors for better quality of life.

At the same time, is it important to notice an apparent contradiction between projected economic growth, successfully improving living standards (assured by both companies), and events that could potentially lead to an escalating and increasing geopolitical chaos in many parts of the world. This is the picture mainly described by Shell in “Oceans and Mountains” but also by BP in its Outlook. The processes of political instability and unrest are seriously threatening even the most optimistic forecasts. While a more environmentally sound and economically achievable energy pathway into the distant future may be possible and remains an open opportunity, it is evident that it requires new dimensions of political will and international cooperation to achieve it.

Besides the similarities, there are big differences as well. The main differences between the scenarios and their dominant energy sources and technologies reflect different imaginary behind the construction of energy futures, energy resource potentials and time frame span (Shell considering scenarios until 2050, 2070 and even 2100, while BP is focusing on scenarios up to 2035). The length of the videos also varies: Shell’s “Earth 2050” lasts more than 43 minutes, while the videos from BP, describing energy future, last around 2 minutes and 30 seconds; however, Shell “Mountains and Oceans” scenario lasts 2 minutes and 12 seconds. More generally, Shell has longer videos, while BP has shorter ones.

One of the main differences between the selected videos regarding the strategies or tactics is that Shell’s are more based on innovation and anticipation of future trends, while BP relies on sound data, facts and projected trajectories of energy sources and economic growth. Basically, Shell is offering different possibilities to tackle fossil fuel dependency and curb climate change; even in the case of the second video, there are two alternative scenarios offered by the company, two directions in which the world can move.

Thus, Shell is giving a possibility of choosing our energy future, based on company’s imagery, trends and projections. Furthermore, new and innovative solutions, such as autonomously driven vehicles or building of new cities in a more sustainable way, form an important part in the making of energy future scenarios by this company. The same is not the case with BP, where apparently stats and data from the Outlook shape the making of energy future (although BP also states its intention to add to the global energy discussion and debate). Also, while Shell includes experts from different fields in its scenarios they are not visible in the future scenarios offered by BP in the videos. All of the scientists, researchers,

engineers and architects from the Shell's video "Earth 2050" consider current trends as they try to give different solutions within their fields and investigative processes. The other three videos analyzed (one from Shell and two from BP) are impersonal, which is also one of the main differences.

Geography and places- The variety of geographical locations is evident from the Empirical part. As these companies are multinational, the reality they assess is also global. The scenarios cover entire continents and countries. To start with Shell, the movie "Earth 2050" includes Brazil, the US, Scandinavia, Australia and Masdar city in United Arab Emirates. All of these places certainly matter: Brazil, with arable land and auspicious conditions for growing sugar cane; the US, with traffic and congestion issues which need to be solved; Scandinavia, with the truck test polygons where they have been able to drastically reduce fuel consumption; Melbourne, in Australia, where the driving educators from the Taylor family live but they also travel around the world educating people about how to improve their fuel efficiency and finally Masdar, a laboratory city in the desert. Its importance lies in the fact that it is possible to build a whole new city, architectonically different from the other ones built previously and which is entirely based on sustainability (e.g. with solar power energy supply or car-free streets). All these places certainly matter (Livingstone 2003) as they present unique conditions and innovative solutions for a betterment of human life conditions, especially regarding the energy efficiency and environmental sustainability.

The second Shell video, "Oceans and Mountains", mentions different parts of the world, but only in the first scenario, in the Oceans one. There are China, Africa and India mentioned, while the second scenario, "Mountains" is more global and considers only one country (Japan). While some facts at first glance are not connected to the making of energy futures or to natural resources, like the one considering Chinese GDP in the year 2025, it is evident that all these trends are related to the energy future, in one way or another (boost in production or consumption or both). There is not any particular depiction of these places outside of the mentioned forecasts in the second video analyzed from Shell, such as maps or characteristic features of the countries.

In the videos from BP, the first one, "BP Energy Outlook 2035: A view from 2014" starts with the more global picture and trends in energy sources, turning later to some countries and regions (the US, China, EU and India). Yet, the video finishes with the more global trends regarding environmental concerns and energy efficiency worldwide. The second video, "BP US Energy Outlook 2035: America's Energy Future - 2014 Report" obviously covers the

forecasts within the US, portraying a particular reality by presenting recurrently the maps of the country or US flags.

It is possible to conclude that the importance of geography and place in the videos analyzed is twofold: firstly, they are important as countries or regions having specific and distinctive conditions allowing certain type of energy production (e.g. sugarcane in Brazil) and secondly, they are important as a potential bigger markets for production and consumption of energy (e.g. China and India). Subsequently, different countries are considered as potential bigger exporters and importers of energy; this is underlined both by Shell and BP.

Politics- Which is the role of politics and political processes in the videos from the companies? How are the political and technological presented by the companies? Power and authority do play a role in the shaping and framing of technological futures, even if sometimes it is not visible at first glance. Technology can be seen as a form of extended politics and political processes, through policy documents and international organizations such as the UN. The role of government and political processes is most overtly examined in Shell's "Oceans and Mountains" scenario, where both market forces (Oceans) and government and free market influences (Mountains) are assessed.

Langdon Winner (1980) wrote about two ways in which technologies can contain political properties. Firstly, he mentions technologies and inventions which in some instances can settle an issue in a community and secondly, there are the so called "inherently political technologies", requiring particular kind of political relationship (Ibid. p. 123). From the outset, it was clear that Brazilian move to ethanol production was strongly supported by the government, with incentives and subsidise. However, it was done regardless of the form of political order. The main proof is that the investment in ethanol production started in the 1970s, with the military dictatorship on the power. When the military dictatorship governing Brazil came to an end in 1985, the new democratic government has not stopped the programme. Rather, the programme managers focused on ethanol blending and vehicles which can operate on both ethanol and gasoline (Sovacool 2010).

The inherently political technologies which require highly centralized and hierarchical chain of command, being the nuclear power the most prominent example, are given very little space by the companies in the videos, and hardly mentioned at all. It is not only the question of safety that is associated with the nuclear power, but there are also concerns about the possible authoritative limitation of civil liberties (Winner 1980). In the Shell "Mountains"

scenario, the global policy support is given to the modern cities, a change in transport network and to technologies such as carbon capture and storage. Yet, there is a friction between the free market and social mobility, going even into the distant future. Similarly, in the “Oceans” scenario, a free market is not only seen as beneficial but also as bringing strong social and political tensions.

Geopolitically, it would be interesting to see what are the projections coming from the companies regarding the emerging economies (China and India) and their future status in the global political events with the major growth of supply and demand envisioned to happen in the energy sector. The same holds for the US, with the transition from importers of energy to exporters, as forecasted by BP. Also, the energy self sufficiency, if and when achieved by the US, will clearly reshape some political priorities and processes in that country. What will be the consequences on international politics of such a change? Some technologies could also be assessed, such as carbon capture and storage or hydraulic fracturing. Will these technologies have essentially authoritarian or democratic features in the future? As Winner puts it, “what matters is not technology itself, but the social or economic system in which it is embedded” (Winner 1980, p.122).

By not stating overtly the role of politics or government in the videos, the BP is not neglecting this aspect. There is a mention of rising economic growth at the end of the video “BP Energy Outlook 2035: A view from 2014”. This will bring political consequences, depending of the redistribution of economic growth and wealth. This trend is mainly set up in the US and the EU. However, some events, such as the financial crisis from 2008 and the sluggish recovery of the global economy (excluding the so-called emerging economies), seriously challenge this assessment.

At the same time, as can be concluded from the videos and documents consulted, the politics remain largely local and national, offering solutions and pathways that go along with a particular nation and its established technopolitical culture. Therefore, there are clear differences in constructing technological and energy futures among countries. The importance of politics in defining energy future is clear. To name just one example, the development of relatively new sources of energy will face a number of barriers which can delay its being put into practice, since some of them will be more expensive than current sources are. This is the case for example with the growth of renewable energy production (Shell and BP make the claim that this will happen in all the videos analyzed). These obstacles can be overcome by policy actions and regulations, with government strategies and plans to tackle future issues.

The future of energy systems is vital for all of us. Energy is fundamental for economic development and rising living standards. The world needs more energy and less carbon dioxide emissions at the same time. It is evidently deducible from the materials seen that there are no ideal answers or fast solutions. Neither of the scenarios is comfortable or completely accurate, since the future is very difficult to predict. It is up to governments and societies to make tough choices, as they are required to address many challenging questions, without delay. Both the public and private sectors should carry out extensive research, development and investment in many technologies within the next decades, as mentioned and recommended in the videos.

Moreover, a serious planning process should include trends such as demographics, urbanization, and energy demand, which are becoming important factors in the shaping of any given energy system. The companies are aware of those facts, and they underlie the importance of the mentioned trends in the videos and outlooks. Nevertheless, the key question already is the availability of energy resources and especially potential oil scarcity in the second half of the century. Furthermore, there are serious concerns about the greenhouse effect and global warming, air pollution and energy security. The current processes of globalization have resulted in a global risk society, where national boundaries cannot offer protection from environmental risks (Beck 1999).

However, choices must be made in order to meet the growing demand for energy. Finally, those choices are the main message from the companies, but, as discussed previously, they should be seen through a more STS perspective. This perspective means that by choosing an energy strategy or system, the decision makers, governments and societies inevitably choose a particular social, economic, political and environmental strategy and order. Regarding the design of energy systems, “an STS perspective on design suggests that one can examine design from both technical criteria such as cost effectiveness and energy efficiency, but one can also include broader social goals such as resilience and social inequality” (Hess 2013, p. 202). Resilience is one of the key terms, because that is what planning and scenarios are meant to build when considering different, possible and probable future events.

Regarding social inequalities, it is an imperative to establish whether the implementation of new technologies and energy systems will even further deepen the differences or, to the contrary, will they serve to bridge and reduce the already huge gap between the rich and the poor. Shell addresses social issues, both in the first video (e.g. the costs and consequences of driving inefficiency on average US family, spending $400 a month on gas) and in the

second one at larger scale (Oceans and Mountains scenario, where the second one apparently denies social mobility). By pointing at economic and more efficient driving techniques, the intention is to reduce the money spent on gasoline around the world. Thus, the technology is seen as useful in making life easier and things more affordable to many people. While Masdar might be a specific case, hardly affordable to most people in the world, Brazil's ethanol production has been successfully implemented in the country, with the half of the transportation already based on it.

The BP states that oil will lose share to renewable and natural gas, but the economic processes and implications behind this fact are not clear, since that means a good progress for countries exporting natural gas and a bad one for the others exporting oil. The question of access to natural resources remains open as well, both in the case of fossil fuels and renewables. The access to renewable sources is highly uneven as well and it might trigger new round of wealth (re)distribution between the countries that can afford to build these large systems and the ones having auspicious conditions. However, this will exclude many parts of the world from participating in those negotiations and marginalize entire sectors of population, as seen from the example with the ambitious Desertec solar plan (Moore 2013).

All the various energy sources can contribute to energy future. Nonetheless, it is important to realize that each energy source and choice has its own health, economic and environmental cost, even in the case of the renewables, as it was demonstrated by STS scholars. It has distributed benefits and risks. Although there are no ideal answers to the coming challenges, certain choices must be made. The overall energy systems will change slowly and gradually, because of the complexity and intertwinement of scientific, technical, economic, social, and political elements. This long time span and the urgent need to address climate change and energy security make it essential to set the foundations for energy future right now.

Even though the future is hard to foresee, this thesis has tried to point out foreseeable trends and uncertainties related to the future of energy systems. Hopefully, it will make a small contribution to the field of energy futures by portraying main scenarios depicted by two of the world's largest multinational energy companies and their imaginaries and projections. The aim was to open the debate, to foster the process of (re)thinking about some pressing matters that concern all of us. By focusing on STS theory of coproduction, combining technological and social elements, the goal was to analyze the actors and elements included in making energy futures and their distribution, impact and influence..

Nevertheless, there are some open questions and aspects on which the future research on this topic could focus. Those are the challenges and hazards of implementing new technologies and relying on some energy sources unquestioningly. How will these

technologies and energy sources affect people? Further, it is necessary to examine how shifting social, political and economic priorities will shape the energy system. Will the consumer demand for a clean and affordable energy system and services have a final say or will the governments decide on behalf of the citizens? The biggest technological concern is when will the growth in demand for oil and gas exceed production's capacities, this date being fundamental to many forecasts. That opens a new line of inquiry and the necessity to assess how the companies will deal with a more pessimistic forecast, facts and scenarios in the future. What will be the role of climate issues in energy policies? What will be the impact of technological changes on commercially-oriented energy markets? All these questions remain open and need further deliberation.

As a conclusion, we can see that science and technology have and will have an undeniable impact on society and societal processes, and the place of coproduction is important, even if sometimes neglected in parts of energy future making. As open and inclusive as STS is, it also poses a lot of essential questions about technological processes and scientific knowledge often taken for granted. In order to have more affordable, secure, and environmentally sustainable energy system, things need to change. What is clear from the analysis of the long-term energy scenarios is that radical social and technical changes are necessary if we want to reduce our reliance on fossil fuels. The continuous human tendency to have the future tamed makes it strongly necessary to interconnect the three elements of action, knowledge and ethics (Adam and Groves 2007), which now stand adrift. Once it is understood that human beings can be active protagonists instead of mere recipients, "the locus of responsibility changes too" (Ibid. p. 18). That is one of the possibilities a more proactive and constructive vision of the future opens to society.

What is clear from a number of recent and not so recent developments (Deepwater Horizon oil spill in the Gulf of Mexico, Texas City Refinery explosion, Exxon Valdez oil spill, Piper Alpha disaster, Fukushima, Chernobyl and Bhopal) is that the general relation towards the future cannot continue. As some authors have demonstrated (e.g. Jacobs 1991), environmental damage and numerous threats and hazards are not "an incidental consequence of economic activity," but, rather, they are "a central feature of the ways in which production and consumption are currently organised" (Ibid. p. 13). This is probably the biggest challenge modern technologies and ways of production face. The same claim is valid for big oil and gas companies.

At the same time, there are ways in which issues concerning energy and energy transitions can be dealt with in an entirely different way than now. This entails a combination of ethics

and knowledge and shedding light on unknown potentials and possibilities human action may have, by becoming aware of both positive and negative impacts and outcomes of these actions (Adam and Groves 2007). It makes us both morally and economically responsible to the next generations and our planet. “Finding ways to reconnect action, knowledge and ethics is a pre-condition to being able to accompany our actions to their time-space distantiated effects and to take responsibility in ways that are appropriate to our socio-environmental time print” (Ibid. p. 167). And the sooner this happens, the better.

9- ABSTRACT

In modern times, the importance of energy for our civilization does not have to be explained deeply. Energy keeps industries running, lights our cities and fuels our transportation. It is hard to imagine any human endeavour that will function without energy. The fossil fuels (oil, gas, coal) are the main energy sources and the ones without which we cannot imagine the contemporary world. However, the side effects such as climate change and depletion of resources are becoming more and more evident and worrying as global trends. The question is what to do next after we run out of some sources such as oil, whenever that might happen.

This thesis tries to give an answer as to how energy futures are made, based on the scenarios offered by two large multinational corporations, Shell and BP. They have a particular way of expressing expectations and anticipating future events which is analyzed in depth throughout the thesis. By shedding light on different estimations and events these corporations foresee, it will be possible to have a picture of what is awaiting us in the future, the challenges and hopes, the hazards and the solutions. While time span and the particularities of space are very important in the making of the future scenario, it is even more important to consider the energy transitions envisioned, their scope and kind. Videos projecting energy scenarios into midterm and long-term future and published officially by the companies will be the main source of information, and the idiom of coproduction will be a useful theoretical guide to see the influence science and technology exerts on society and vice versa.

The thesis findings point out particular ways of making the energy future by two large multinational companies, as well as the similarities and differences they present. They touch on diverse fields and their complex relations, such as the importance of natural sources, technological artefacts, environmental concerns, geography and societal and political processes in the framing of energy future scenarios.

ZUSAMMENFASSUNG

In der modernen Zeit ist es nicht erforderlich die Bedeutung der Energie für unsere Zivilisation eingehender zu erklären. Die Energie ermöglicht die Tätigkeit der Industrie, beleuchtet unsere Städte und ist der Treibstoff für den Transport. Es ist schwer sich irgendein menschliches Unterfangen vorzustellen, dass ohne Energie funktionieren soll. Die Fossilbrennstoffe (Erdöl, Gas, Kohle) sind Hauptenergiequellen, ohne die die moderne Welt unvorstellbar ist. Die unerwünschten Nebenwirkungen jedoch, wie Klimaänderungen und Vorratserschöpfungen, werden als globale Trends immer offensichtlicher und besorgniserregender. Es stellt sich die Frage, was tun nachdem manche Brennstoffe wie Erdöl erschöpft sind, egal wann das geschehen mag.

Diese Magisterarbeit versucht die Frage zu beantworten, wie die Energiezukunft der Welt aussehen wird und zwar aufgrund von Drehbüchern zweier großer multinationaler Gesellschaften: Schell und BP. Diese Gesellschaften äußern die Erwartungen und Prognosen künftiger Ereignisse, die in dieser Arbeit eingehend analysiert werden. Durch das Vorstellen unterschiedlicher Einschätzungen und Ereignisse, die diese Gesellschaften vorsehen, wird es möglich sein, sich ein Bild davon zu machen, was uns in Zukunft erwartet, welche Herausforderungen und Hoffnungen, Gefahren und Lösungen. Während die Zeitspanne und die Besonderheit des Raums bei der Erstellung künftiger Drehbücher sehr wichtig sind, ist es noch wichtiger sich mit der vorgesehenen Energiewende, ihrem Umfang und Arten auseinanderzusetzen. Die Videos, die die Energiedrehbücher der Zukunft in einer mittelfristigen und langfristigen Zeitspanne projektieren und die von den Gesellschaften veröffentlicht wurden, werden die Hauptinformationsquelle sein und die Theorie der Koproduktion wird einen nützlichen theoretischen Führer bei der Wahrnehmung der Einflüsse darstellen, die die Wissenschaft und Technologie auf die Gesellschaft ausüben und umgekehrt.

In den Schlussfolgerungen dieser Magisterarbeit wurden die spezifischen Arten zur Herstellung eines Drehbuchs der energetischen Zukunft aus der Sicht zweier multinationaler Gesellschaften hervorgehoben, wie auch die Ähnlichkeiten und die Unterschiede, welche diese präsentieren. Diese Gesellschaften erforschen verschiedene Bereiche und ihre komplexen Beziehungen, wie: Wichtigkeit der Naturressourcen, der technologischen Mittel, Fragen des Umweltschutzes, Bedeutung von Geographie und der gesellschaftlichen und politischen Prozesse bei der Gestaltung eines Drehbuchs der energetischen Zukunft.

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