

Arguing the future. Debates on energy in Europe: programmes, scenarios and prophecies

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between forms of knowledge and public controversies: new tools and perspectives for
the analysis of key turning points**

Many commentators, within circles of experts and within the media, argue that the 21st century is undergoing a revolution in the production and consumption of energy. The past decade has seen the multiplication of diverse types of energy scenarios, based on different patterns, addressing topics such as the global demographic trends, the announced depletion of fossil fuels, the redistribution of economic power triggered by the rise of the emerging economies, climate change concerns, and expectations concerning “green growth” or “green economy”.

In its annual flagship publication, *World Energy Outlook 2012*, the International Energy Agency (IEA), assesses how new developments in oil and gas industry might affect global energy and climate trends over the coming decades. The IEA experts consider that “the world is still failing to put the global energy system onto a more sustainable path”. On the basis of global scenarios and multiple case studies, they contend that “the global energy map is changing, with potentially far-reaching consequences for energy markets and trade”, as a result of the new surge in US oil and gas production. The global energy system “could be further reshaped by a retreat from nuclear power in some countries, continued rapid growth in the use of wind and solar technologies and by the global spread of unconventional gas production”. They add: “If new policy initiatives are broadened and implemented in a concerted effort to improve global energy efficiency, this could likewise be a game-changer”. It is hence clear that two key issues – nuclear power and unconventional gas resources – are at the core of the new scenarios which, once assumed by an international agency, obviously have performative effects on many players, organisations and institutions worldwide.

Due to the high degree of economic interdependence, the producers of foresight and scenarios develop their reasoning at the global level, but different regional and national political spaces have generated a highly diverse range of public controversies. In Europe, the variability of objects and forms of debate is particularly striking with respect to four issues: the role of nuclear energy, subject to lively debate after Fukushima; the future exploitation of shale gas, or more generally unconventional gas; the role of renewable energies in the energy transition; and the various alternatives to the present model of economic growth, ranging from the defence of a “frugal economy” to more radical and increasingly popular claims in favour of “degrowth”.¹

¹ W.J Boonstra, & S. Joosse, “The social dynamics of degrowth”. *Environmental Values* 22 (2), 2013, p.171-189.

This paper presents a general analytical framework designed to help understand the constraints shaping the construction and use of the scenarios that actors use and produce to support their argumentation around energy issues. This framework will be illustrated through empirical examples on a series of corpuses consisting of texts relating to controversies over nuclear energy and shale gas extraction. Indeed, these two issues of energy policy are subject to a high level of controversy and social mobilisation, both nationally and globally, notably due to the turning points that both fields experienced in 2011: the Fukushima catastrophe called into question the “nuclear renaissance” announced by the nuclear industry, whereas the great promises placed on shale gas were accompanied by a surge of public concerns over the environmental impacts of shale gas exploitation in general and hydraulic fracturing portrayed by critics as an environmental “disaster” in particular. In some countries, citizen mobilisations, political debates, and controversies amongst experts have emerged, notably on the relationships between energy choices and their environmental consequences. These controversies are accompanied by, and partly overlap with, issues such as climate change, oil depletion, renewable energy sources, water resources, public health, waste management and biodiversity. A high degree of interdependence between all these topics appears through the various argumentative networks used by the actors. To quote the now famous United Nations watchword, the question of the “future we want” is clearly at stake in these issues, each scenario producing a bridge between epistemic options and normative preferences.

A plurality of temporal patterns in the face of the inertia of energy systems

The recent trajectories of energy issues illustrate both the strategies adopted by industries and governments, and the critical positions developed by opponents, concerning the technological, economic and policy challenges related to the so-called global risk society (Beck, 2009). Taking into account the different ways in which players bring together the energy and environmental issues in public debates allows us to propose a sociological modelling of the visions of the future grounded in a series of argumentative patterns, from anticipation, prediction or foresight to prophecy, and even to science-fiction narratives. At the core of most public controversies are conflicts around the modalities of predictions and foresight. How do actors defend or criticise different scenarios? What do they see or believe to see, or foresee, when they speak of different futures, conceived as possible or impossible, probable or improbable, certain or uncertain? By giving some examples of arguments and counter-arguments around the future of nuclear and shale gas, the paper seeks to clarify the different means whereby policy actors and stakeholders attempt to “grasp” the future.

Our first starting point consists of an old paradox: we know that nobody can predict the future with certainty, yet often we cannot help but predict its contours and imagine at least some aspects of it. Cognitive tension concerning the future permeates all causes that animate actors, from next month’s unemployment rate to the future of the humanity in the face of global challenges. Tensions are present in every type of scenario, whether they be based on an attitude of ‘wait-and-see’, prediction, promise, or prophecy – all crucial sources of action and judgment. In fact, taking seriously the processes by which scenarios and visions of the future develop in contemporary societies is an essential task for a sociology devoted to monitoring critical processes over the long term (Chateauraynaud, 2009, 2011).

French pragmatic sociology became interested in the problem of temporalities of action and of judgement in the late 1990s with the observation of the increasingly frequent use of the

concept of “irreversibility”. Two among the expressions used by the actors quickly came to play the role of a prototype: “it’s already too late” and its counterpart, “before it’s too late”. Indicative of the expression of judgments on the evolution of a process, they serve to shape the relations between the past, present and future, and demonstrate that the concerned actors often carefully reflect upon their own capacities for action when faced with threats or opportunities. The use of these expressions in the vast collection of issues studied – from asbestos to GMOs, from nuclear power to climate change, electromagnetic radiation, nanotechnologies, flu pandemics and now shale gas fracking – demonstrate that these capacities are essential for dealing with dangers and risks, old and new. They render visible the process of thematisation of the relationships between perception, reasoning and action, a process that engages actors in a collective effort to deliberate and to weigh between multiple future scenarios – desirable or undesirable, open or closed, plausible, probable, possible or imaginary.

What does it mean to speak of “turning points” or “tipping points”?

In order to describe, compare and analyse social trajectories, Andrew Abbott (2001) has suggested a narrative approach of the concept of “turning point”:

“The concept of turning point is a ‘narrative concept’. That is, the concept refers to two points in time, not one. What makes a turning point a turning point rather than a minor ripple is the passage of sufficient time ‘on the new course’ such that it becomes clear that direction has indeed changed.” (Abbott 2001, 245)

Shifting from narratives to argumentation, this definition of a “turning point” can be used to address the question of change or rupture produced in the making of scenarios after a landmark event. How do actors discuss the reversibility or irreversibility of a turning point, try to avoid it in advance – as they do in risk assessment – or to interpret the causality and consequences afterwards, after a major event has occurred? Let us look at, for instance, a claim made by the geologist David Hughes, from the Post Carbon Institute:

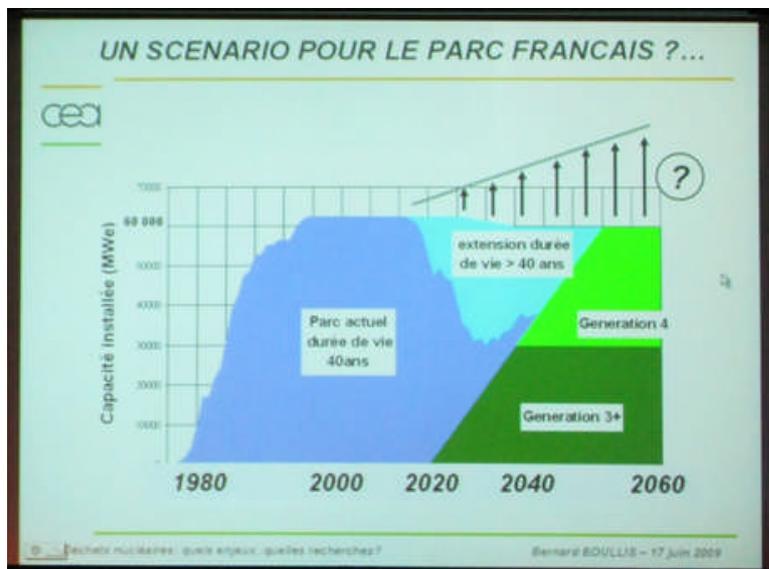
“[...] the exploitation of shale oil and gas and bitumen marks a dramatic turning point for both financial and energy markets and thereby challenge all economic growth projections².

The key idea is that a turning point forces the actors to develop an argumentation in order to maintain, reinforce, revise, criticise or reject the new vision caused by an event (a rupture such as an accident) or a series of events. Let us take the theory of argumentation commonly used in philosophical or sociological reasoning: according to this theory, two types of arguments refer to the means available for actors seeking to convince people of the advent of a situation or the plausibility of a given future: appeal to one or many *precedents*, and reasoning about *consequences* (Perelman, 1958; Walton et al. 2008; Chateauraynaud and Doury 2010). But we can also go further and seek to identify, at the heart of controversies, the different means by which actors seek to manage the tensions between different *temporal scales* that relate to the objects in question, *temporal modalities of action* (or of its public expression) and *regimes of discourse*, each in turn taking the form of a time of emergency or wait and see, anticipation, or prediction, promise or prophecy.

² “Fracking Bubble? Report Warns Shale Gas And Oil Won’t Solve Energy Crunch” By Climate Guest Blogger on Feb 25, 2013 at 2:39 pm

Temporal Scales and the Matrix of futures

No statement about the future – nor about the past or present, for that matter – can pass the first tests of credibility if it does not at least to some extent specify the temporal scale to which it refers. We also note variation in the relationship that actors have with time, depending on the time scales evoked. When an actor says that a phenomenon will gain momentum “in 10 to 15 years,” she does not have the same relationship with time as when he speaks of days or weeks, or, at the opposite end of the time spectrum, centuries or millions of years. There are many practical consequences of this constraint on scale. For instance, when a person, entering a subway station or tramway, looks at the display showing the waiting time until the next train, she expects a reasonable waiting time, at best, conforming to her expectations, and, at worst, corresponding with the worst possible delay. Imagine that instead of “5 minutes”, a duration which has very different meanings in practice that are entirely dependent upon the mode of transportation involved – for a subway, 5 minutes could be experienced as a long time, but for an airplane it is practically immediate – imagine that she reads “2 hours”, and the whole experience of the situation changes. The same phenomenon of temporal agreement pertains when applied to major issues of global importance: if the Intergovernmental Panel on Climate Change (IPCC) declares that warming of more than two degrees Celsius will occur in two or three centuries, the statement has a totally different meaning than if it predicted the same warming to happen by 2030 or 2050. Thus, a question arises immediately for addressing energy issues: how do actors ensure the coherence between temporal scales and the metrics they use for producing calculation or for reasoning? Do they all agree about the timing of the processes they seek to model?



A model of nuclear energy future presented by experts of French CEA (Commissariat à l'énergie Atomique in 2009). The time scale is related to the transition between two forms of reactors (3rd generation to 4th generation based on fast-neutron reactor)

Temporal scales vary greatly from one process to another, depending on the objects in question. Consider nuclear waste, and the half-lives of radioactive isotopes: 300 years could be considered (by engineers) as a short span of time for certain types of radionuclides (hence the notion of waste with a short half-life), but a very long time from the perspective of the

political history of human societies. We also see tensions and conflicts between temporal scales, because of the radical differences between, for instance, the time needed to arrive at political decisions and the time required for the maturation of technological projects – as we have seen for different renewable energy projects over time. When the question of temporal scale intersects with regimes of argumentation, it simultaneously defines the short term and the long term for the actors, which in turn involves a confrontation between three logics of action: the degree of *certainty*, the “*possibilisation*”, and the continued *indeterminacy* of the future.

Table 1: Matrix of futures

Temporal scale	System of understanding	Mode of existence of futures	Logic of action
Short term	Scope within the course of action	Future already here	Certainty
Medium term	Programming	Not yet here but in preparation	Various degrees of certainty
Long term	Devising scenarios	Beyond the horizon of action	Imagining/exploring possibilities
Very long term	Unprovable conjecture	Beyond humanity	Indeterminacy
Eternity	Metaphysics	End of time	Indeterminacy

The nature of understanding of the future changes drastically depending on the time scales and modes of constructing futures that the actors apply in their reasoning. Indeed, the time frame in question and the degree of determinacy about what could happen are often at the heart of controversies. From this point of view, examining how scenarios are elaborated and how the limits and conditions for their influence are constructed occupies a middle position between the production of certainty and the reference to indeterminacy. In the matrix of the futures presented in table 1, scenarios have little relevance for the short term: the broad, structural determinants of the course of events are known with a reasonably high degree of certainty. At the other end of the spectrum, with extremely long time scales, scenarios are equally of little use, because the nature and degree of uncertainties escape the efforts of scenario-building. Therefore, in the rest of this paper, we shall focus on the management of the medium and long-term processes, in which scenarios have become increasingly important.

Already and not yet

In their argumentation concerning the future, actors shift between short and long term, between what is already there and what has not happened yet. Looking at the ways in which visions of the future are developed in narrative or argumentative sequences, we see a recurring tension between these two movements. The first attempts to introduce time markers into *both the distant and the recent past*, a past that extends into the present and will continue on its course towards the future. This reference to the past operates according to three different modalities: *anteriority* (“it was already the case in the past...”), the *precedent*, which initiates a series according to a comparative operation (“for the first time, X”), and the present course of events, the *tendencies already at work* (“we are already there”). The second movement is oriented either towards the *immediate future* (“we will soon move on”), or an impending deadline (“we will soon review the energy scenarios”, “soon, humans will no longer be able to live on this planet”), or to a plausible or probable, desired or unwanted, *future beyond (in the next generation, we will see...)*.

Examples that demonstrate the importance of timescales abound. In a document devoted to France’s nuclear future, or, rather, to announcing its decline³ (with an introduction written just after Fukushima), Benjamin Dessus and his colleagues suggest that their earlier diagnosis concerning the future French nuclear sector in the next few decades was being further confirmed by the Japanese catastrophe. Only three years earlier, they write, the nuclear industry seemed optimistic and was considering an extensive relaunching of nuclear programmes, anticipated by positive economic forecasts, but after March 2011, the uncertainties overwhelmed the decision-making frameworks based on “official projections”. Examining the key issues in the sector, from the supply of uranium through to the management of nuclear waste to the scenarios of energy production, the authors of *Global Chance* deploy the full range of argumentative strategies typically undertaken in critical evaluation of models of the future. The critical arguments refer to the crux of the production of visions of the future: not only do the models and scenarios indicate, in keeping with their goals, variable degrees of likelihood that events capable of instantly reconfiguring the visions of the future could happen, but the logic of inquiry into the consequences of events is written into the timeframe. In other words, a long time could be needed before one could clearly identify and assess all the consequences of a process. In practice, the strength of a scenario in public arenas and decision-making depends on the ways in which actors bring together past sequences, present constraints and openings to the future. Yet disagreements among many regimes of discourse about the future, and more specifically the different interpretations of any given scenario, stem precisely from this combination of temporal dimensions.

Regimes of discourse and visions of the future

A pragmatic sociology of futures distinguishes different regimes through which the protagonists try to overcome uncertainties and the indeterminacy of the future. What the seven regimes discussed here have in common is their ambition of linking major argumentative figures and ordinary experiences. They are also marked by a tension between scepticism about the possibility of predicting the future on the basis of what we know about the past and what is going on in the present, and the need to develop a minimal understanding of the immediate yet uncertain future. And yet, the extent of action may depend on more long-

³ Nucléaire: le déclin de l’empire français, *Les cahiers de Global Chance*, 29, April 2011.

term visions of the future – and of course, the long-term future is also shaped by present action.

In the public discourse around energy issues, we can distinguish continuous shifts between the following regimes: *emergency*, *wait-and-see*, *anticipation*, *prediction*, *foresight*, *promise* and *prophecy*. These regimes are not mutually incompatible and actors may employ simultaneously several regimes in the same discourse. However, depending on the cognitive and political configuration in which the actors act and think, certain regimes tend to take precedence over others.

Acting under emergency

In the *emergency regime*, visions of the future are produced under severe pressure, because everything plays out over a very short period of time, too short for the actors to evaluate, through deliberation, the different openings to the future. To act in an emergency or to declare a state of emergency is to act in a kind of close combat with a process that has either partly or completely gotten out of hand. It is the immediate future that matters, and the challenge for action is to either open up or close down the perspectives concerning that future. Action must be taken as soon as possible – which is not necessarily synonymous with acceleration as understood by Rosa (2013). One can imagine a world in which everything is done in a state of emergency, when the visions of the future would be folded into a type of “presentism”. The ordinary phenomenology of global networks lends credence to the idea that the multiplication of connections “in real time” (Castells, 2000), creates a permanent state of emergency, tending to foster the development of tunnel visions about the future. For instance, in the following statement, the transition to shale gas production is explicitly presented as an urgent need to save the UK energy system:

“If properly developed, shale gas could contribute significantly to UK energy security by reducing our reliance on imported gas, and provide a valuable, low-cost source of feedstock for UK-based chemicals manufacturers. More significantly, the acceptance of the case for shale, **signals an awareness** across the Coalition of the **urgent need for new measures** to ‘keep the lights on’ in the UK. Market watchers report that gas supplies have been stretched almost to the limit during the continuing cold weather, and point to a **mounting list of danger signs concerning UK energy security**. This list includes the **imminent loss of coal power**, which is currently providing 45% of our electricity, dwindling North Sea supplies, uncertainty over the cost of new nuclear and the fact that the Government’s commitment to unreliable wind power is discouraging investment in gas power plants. While shale could go some way to plugging the gaps, the best-case estimates indicate that the benefits would not kick in before 2020 at the earliest. The Budget measures, so, might just be a starting point for a major shift in the Government’s energy strategy.” (“Shale gas a turning point?”, *Process Engineering*, 22 March 2013)

Wait-and-see...

Wait-and-see is almost the exact opposite of an emergency situation. It is moreover linked to an important theme developed in the social sciences, through the concept of *expectation* (Brown N. and Michael M, 2003). Waiting time is time suspended, during which the actors experience time that does not pass, even as it goes by, yielding the bulk of the experience of the length of time (Duval 1990). Just as the possibility of waiting forever cannot be excluded, consideration of the future, or at least its organisation under the form of a clear and determined vision, can be postponed indefinitely. Indeed, in the wait-and-see regime, the production of the future can be determined or undetermined depending on whether we know what we are waiting for or whether we are waiting for something to happen to inspire us to

take action. “The thing that could happen” is the focal point of the horizon of expectations, while annoyance, impatience, loss of desire and weariness haunt those who wait. For example, we know how sentries quickly lose their watchfulness when they are constantly waiting for something to happen – hence the importance of staffing watchtowers with a group of watchmen who can take turns.

A critical example: The Japan Times / date: 23/09/2011

"Since the quake, however, a growing number of private businesses and local governments aren't waiting on politicians and bureaucrats but forging ahead with plans to create a post-nuclear power nation."

Anticipation

Today, the two preceding regimes are subject to intense criticism. Emergency action is reputed to cause unintended, usually negative consequences, while preventing distancing and a reasoned evaluation of the dynamics at work. Waiting is associated with a form of institutional dormancy or “waiting and seeing” among actors, a type of lethargy and monotony considered fatal or, at least, unsustainable. Action and communication about action are preferred. In fact, *anticipation* is a regime that goes beyond the other two, ensuring advance preparation, being ready, organising the benchmarks and tools for coping and, in doing so, further promoting the desired future while warding off the worst-case scenario. In most controversies and crises over the last 20 years, however, acting too late has been treated as serious misconduct, so it is always in the name of managing expectations that the principle of precaution is wielded by the actors: “We must act now instead of waiting for more knowledge,” or “We should take measures before it’s too late...” Of course, the role of major precedents is central in the activation of this regime (Chateauraynaud and Doury 2010; EEA, 2013). Anticipation is also the name given to a literary genre in which the narrative changes a series of parameters while keeping the essential parts of the actual configuration unchanged – in contrast with anticipation as a kind of futurism on one hand and of science fiction on the other. Incidentally, the wellspring of visionary activity allows us to revisit whole sections of culture, the ingredients of which were laid down over successive periods of modernity (Giddens 1991). The rise of a logic of preparation, another way to designate anticipation – that is, facing the impending crisis of risk calculation models in the face of growing uncertainty – characterises an epoch marked by a continuing escalation of vigilance and precautionary measures. The dominant temporal modality of anticipation is acceleration, since it is necessary to speed up the process and always act further upstream; this reinforces social acceleration, which in turn creates a chorus of complaints marked by the inability to reconnect with the experience of time passing (Rosa 2013). In this process of acceleration, energy questions appear to present duration and a high degree of inertia, allowing time for organising the relationships between visions, deliberations and decisions. Hence, a question arises : do all the actors agree on the speed of the so-called transitions through another energy system or do they take into account political opportunity windows marked by a potential emergency or acceleration?

Prediction

Without a doubt, *prediction* is the regime that has left the biggest mark on modernity. Apart from the famous “to govern is to foresee,” the metrologies and spaces of calculation shared by the actors give modelling a central place in the construction of understandings of the future (Dahan 2007). The advocates of the regime of *prediction* generally justify their claims by a “sound use” of mathematics. Prediction requires a relatively stable computational space with commensurable and computable parameters. However, at present, actors frequently face

difficulties in their attempts to give their predictions a stabilised computational form; they are unable to make calculable the processes in which they operate. Indeed, the frequent oscillation between emergency and “wait-and-see” leads visionaries to produce shorter and shorter cycles of revisions, creating a sort of planned obsolescence of their own predictions. Most predictions employ tools and models, with trend being the most common form used to describe futures while respecting the constraints of the timescale in question (Bostrom 2009). Futuristic images, by contrast, are not usually bound by such constraints.

In the following fragment, extracted from a recent report published by the US Energy Information Administration, the process of building a relevant space of calculation, oriented towards prediction, is made manifest and explicit:

“The history of shale gas and shale oil exploration has shown that with time the success /risk factors improve, particularly the prospective area success factor. As exploration wells are drilled and the favorable shale oil reservoir settings and prospective areas are more fully established, it is likely that the assessments of the size of the shale gas and shale oil in-place will change. [...] The technically recoverable resource is established by multiplying the risked OIP and GIP by a shale oil and gas recovery efficiency factor, which incorporates a number of geological inputs and analogs appropriate to each shale gas and shale oil basin and formation. The recovery efficiency factor uses information on the mineralogy of the shale to determine its favorability for applying hydraulic fracturing to “shatter” the shale matrix and also considers other information that would impact shale well productivity, such as: presence of favourable micro -scale natural fractures; the absence of unfavorable deep cutting faults; the state of stress (compressibility) for the shale formations in the prospective area; and the extent of reservoir overpressure as well as the pressure differential between the reservoir original rock pressure and the reservoir bubble point pressure”

(US EIA, *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*, June 2013.)

Foresight and planning

Early on, prediction became subject to frontal attacks. As Jean-Pierre Dupuy (2010) recalls, Jouvenel’s “*prospectivism*” of the 1960s sought to replace the logic of prediction with the production of different scenarios, allowing for the opening and exploring the space of the possible. *Foresight* could be considered as an open space of variations between plausible and unimaginable scenarios, possibly involving actors in a process of deliberation concerning different possible futures.⁴ The regimes of *foresight* and *anticipation* share a mistrust towards predictive models, but differ with regard to temporal modalities of action (Godet, 1991). *Foresight* does not act in advance or change the order in which phenomena occur, but rather, operating at a distance, it visualises a plurality of futures to constrain reasoning and deliberation, and to make visible the expected cognitive and normative frames that make some future directions more plausible and more desirable than others. The concept of “scenarisation of the future” used in argumentative sociology (Chateauraynaud and Doury 2011) falls within this foresight regime, which is perhaps the closest to the deliberative activity expected from participatory democracy and public debates. To enter into a debate is often to question the models of the future elaborated by experts, which explains why counter-expertise has such a strong appeal in the production of future scenarios.

Technological Promise

⁴ See F. Chateauraynaud & M. Doury, “The collective making of temporal aspects in public debates”, ISSA, 2010 <http://gspr.ehess.free.fr/documents/papiers/FC-MD-2010-ISSA-Amsterdam.pdf>)

The last two regimes of discourse are *promise* and *prophecy*. Science and technology studies have examined the construction and the role of “technological promises”, particularly in innovation processes in which actors announce ruptures, displacements, or achievements that can change the course of the relevant science and technologies (van Lente 1993; Brown and Michael 2002). While from this point of view nanotechnology or synthetic biology constitute true laboratories of technological promises (Bainbridge and Rocco 2006), the regime of *promise* is present in numerous public issues and, in the field of energy, each stakeholder supports her own line of promises – renewable energy for some, nuclear for others, and Eldorado of shale gas for yet others. In this regime of discourse, speakers are expected to be heavily engaged in their statements about future because they subject their reputation to scrutiny. Timescales are here crucial, notably since *promise* defers to the future the advent of success or a brighter state of things. Always portrayed positively by its advocates, promise is easily vulnerable to criticism, being frequently denounced as unrealistic, false or untruthful.

“It is our belief that we can reach these targets faster and more cost-effectively if natural gas plays a significant part in the energy mix not only **in the short to medium term** (from now until 2030), but also over the longer term (towards 2050) when deployed in tandem with CCS. Given its advantages in terms of both cost and carbon, an energy pathway emphasising natural gas could support European competitiveness while increasing chances of meeting climate targets. However, in some of the emission mitigation pathways currently being promoted, natural gas is being phased out of the energy mix and overtaken by coal combined with CCS and nuclear and renewable energy. Renewable energy will undoubtedly play a pivotal role in the future energy mix; its share is bound to grow in any lower-carbon scenario. Using more natural gas instead of coal would enable renewable energy to be developed more efficiently. This is mainly because natural gas plants can provide the operational flexibility needed to balance intermittent renewable energy in an economical way. As we evaluate emissions reduction pathways it is vital that natural gas's potential contribution is fully recognised: a greater role for natural gas in the European energy supply of tomorrow has the potential to deliver the same level of sustainability more economically.”

European Gas Advocacy Forum, *The Future Role of Natural Gas*, June 2011, Phrases 38-44

Prophecy

Based on the efforts of an enunciator to convince other people that an event will certainly occur, prophecy has early on been at the heart of sociology in the form of the celebrated *self-fulfilling prophecy* (Merton). By definition, a prophecy announces an inescapable future, attributing determination to what seems to be fundamentally indeterminate. At its extreme end, the regime of prophecy meets eschatology. It is therefore by no means surprising in to find announcements of the end of the humanity, or at least the end of modern civilisation, as part of this regime. In analyses conducted to date, doomsday prophecies have been the dominant figure, which may announce a collapse, a crisis, depletion or the end of something well established in the past. Jean-Pierre Dupuy’s (2002) “enlightened catastrophism” consists of using the prophetic form as something between the ambiguity of the pure thought experiment (like a “what-if” game in which the impossible becomes real) and a quest to determine the future, in which the future, conceived of in terms of “what concerns us,” is the only true interpretive framework for the present.

“On Feb. 23, 2005, Kobe University professor Katsuhiko Ishibashin, an expert on Earth and planetary sciences, appeared before the Lower House Budget Committee and pointed out the

risks of operating nuclear power plants in earthquake-prone Japan. "An earthquake and its seismic thrust can hit multiple parts (of a nuclear plant)" and induce not one but a variety of breakdowns. Such a scenario could knock out even the backup safety system and possibly result in a "severe accident," such as overheating of the reactor core or even a runaway nuclear reaction, he warned. Warnings like this from Ishibashi and other experts went largely unheeded. Two weeks after the tragedy struck the Tohoku region, the situation at the Fukushima No. 1 nuclear facility has shown at best only incremental improvements. **Ishibashi's prediction of a chain of catastrophes proved all too prophetic."**

"Signs of disaster were there to see", The Japan Times, 27/03/2011

Writing the future of nuclear energy after Fukushima

The Fukushima disaster seemed to bring an abrupt end to what some had called "nuclear renaissance", frequently suggested as a response to the challenges of climate change and energy security⁵. To the extent that it stopped the renaissance, Fukushima would constitute a key turning point in the rivalry between visions of "sustainable energy transitions". However, the repercussions of the Fukushima accident to nuclear policy, industry and public debate vary greatly across the European countries, even between those that were at the forefront of the "nuclear renaissance" prior to Fukushima. We have studied in detail three configurations: Finland, as the first Western country since Chernobyl to decide on the construction of a new nuclear reactor (2002), France as a nuclear 'superpower', and the UK with one of the most ambitious nuclear new-build programmes in the Western world.

By comparing the post-Fukushima public debates and their interaction with nuclear policies – through the two key dichotomies of the state vs. the market, and the expert vs. the citizen – we observe that the extent to which Fukushima is considered as a rupture or a pathway to a new wave of nuclear energy is a feature distinguishing between the debates in these countries. Building on earlier research (Teräväinen et al. 2010) on the role of the country-specific "policy orientations", in pre-Fukushima nuclear policy, and on Hecht's (1998; 2012) concept of "techno-political regimes", the different trajectories of the debates can be examined against the broader context of the historically developed institutions and cultural and political orientations in the three countries. The fluidity and dynamism of the country-specificities is evident especially in the trend towards greater market-orientation and transparency in the French debate and policy practice in years preceding Fukushima, as opposed to the gradual decline of the "market fundamentalism" and a partial return to authoritarian energy policy in the UK. Likewise, despite the exceptionally high trust among Finns in experts, authorities, technology and the nuclear industry, signs of a gradual erosion of trust may be emerging even in Finland.

The empirical analysis of the framings and perceptions concentrates on the argumentation and reporting on post-Fukushima nuclear debates in the main national daily newspapers. Distinct phases are identified in the debates, from the early days of confusion, doubt and focus on risks, towards an increasing emphasis on national and international nuclear policies. Factors explaining the partly contrasting policy and media reactions to Fukushima in the three countries – the "business-as-usual" approach in Finland and the UK, as opposed to the very

⁵ William J Nuttall, *Nuclear Renaissance: Technologies and Policies for the Future of Nuclear Power*, Taylor & Francis, 2004.

lively political debate on the future of the nuclear industry in France – include the weight of nuclear industry in the economy and politics, public trust in state institutions and experts, perceived transparency of decision-making, and the historically shaped "state orientations" and techno-political regimes.

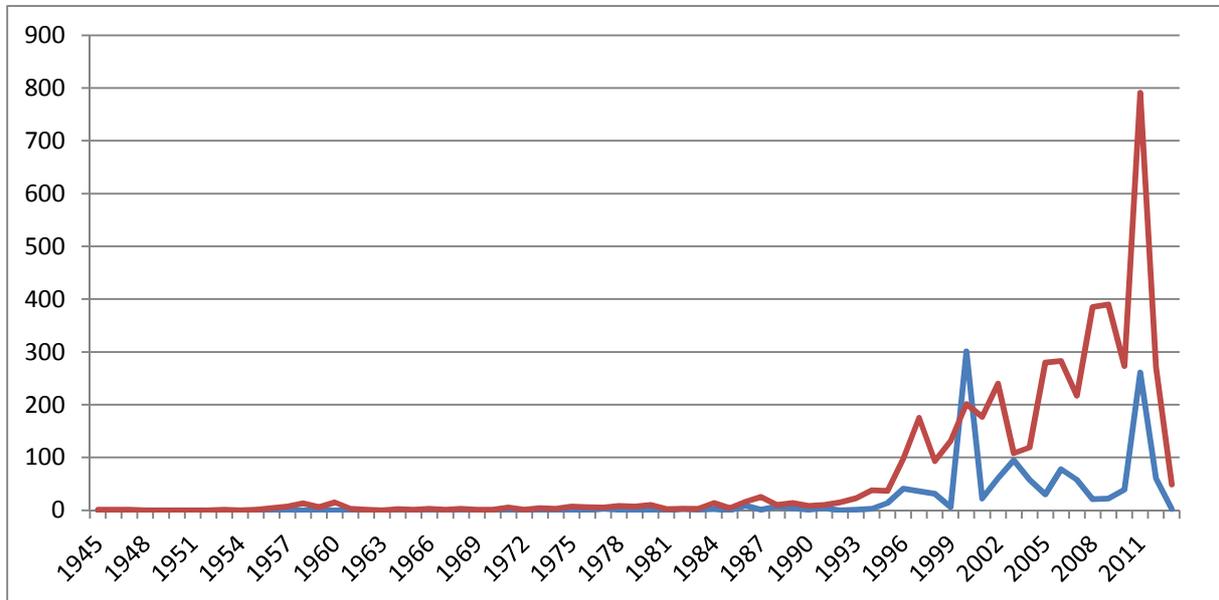


Figure 1. The red line indicates the number of texts per year, while the blue line shows the annual score of the term “scenario” in the French text corpus on nuclear issues. Two peaks are evident: in 2000 and in 2011. In 2000, a major economic prognosis of the future of the nuclear industry, ordered by French government, was published (Charpin, Dessus et Pellat, *Étude économique prospective de la filière électrique nucléaire*, Rapport au Premier ministre), whereas in 2011, Fukushima led actors to reconsider their scenarios. Two minor peaks can also be observed: in 2003, a national debate on energy was held in France, with nuclear as a key topic, while in 2005-2006, the two public debates on the EPR reactor planned for Flamanville and on nuclear waste management led different stakeholders to develop scenarios.

Producing new scenarios on the future of energy after the rise of shale gas

In France, the scale and the speed of mobilisation against the exploitation of shale gas – and specifically against the use of hydraulic fracturing (“fracking”) – seemed to take all commentators by surprise. Until November 2010, few were concerned by shale gas as a major issue of energy and environmental policy or knew anything about fracking, even though the technique had been used in the industry since the 1980s in the US, with the first horizontal drilling by the firm Halliburton. The intensity of the mobilisation was due both to previous controversies (GMOs and nanotechnologies) and to a variety of case-specific issues: the risk of water pollution, damage to protected landscapes (sometimes related to the historical struggles for defending local cultures and ways of life, in particular in the South of France), confrontation of anachronistic legal systems (the recent environmental law vs. the old mining law), citizen concerns over environmental problems, amplified by the “Grenelle of the environment” – participatory and deliberative process concerning the future of the country’s environmental policy – but also by the prior existence of debates and disputes in North America (Chateauraynaud and Debaz, 2011)

“The catastrophic events in Japan – the earthquake followed by tsunamis, which lead to the nuclear disaster at the Fukushima Daiichi nuclear power plant – as well as the political turmoil in North Africa and the Middle East forced politicians to rethink how they are achieving their national energy mix. These events remind us, yet again, of the need for economically viable, ecologically friendly, secure, and publicly acceptable forms of energy. It will shift the discussion, once again, to the focal issues of domestic supply policies and international initiatives to ensure stable and reasonable priced energy supplies. Natural gas - as the low-carbon fuel of choice for the consumers - is critical in bridging the long-term fuel gap between the present and towards a renewable and sustainable energy future. Coinciding critical economic, political, and technological factors - the drop of demand linked to the global recession, an increase in incremental U.S. non-conventional shale gas production, and the arrival of new LNG delivery capacity - together created a sudden global " gas glut " and, therefore, laid the groundwork for an expanded role of natural gas in the world economy. On the other hand, various obstacles for European unconventional and shale gas development in particular are in place, preventing the seizure of the full potential of this commodity. Important questions about the future market structure, the regulatory environment, political risk, investor confidence, public acceptance and competition with other fuels - especially renewables -, need to be answered in the months and years ahead.

Maximilian Kuhn et Frank Umbach, *Strategic Perspectives of Unconventional Gas: A Game Changer with Implication for the EU's Energy Security*, Report, May 2011, Phrases 8 – 14 (corpus Fracking and Unconventional Gas)

In the UK, the extraction of shale gas has been debated, with many actors expressing concern over the potential risks associated with hydraulic fracturing. The Royal Society carried out a review jointly with the Royal Academy of Engineering of the relevant geological risks, such as seismicity, and environmental risks, such as groundwater contamination. By reviewing the “scientific and engineering evidence”, in order to provide “a clear indication of where any potential risks are well understood”, where there is general agreement but continuing debate and where more significant uncertainties remain, the report suggested ways of managing such risks.

“The review is not an exhaustive analysis of all the issues associated with shale gas, nor does it promise to make any judgements on the appropriateness or otherwise of shale gas extraction being undertaken. The hope is that this review will be a valuable contribution from the scientific and engineering community to **a wider debate on the future of shale gas extraction in the UK that should also encompass societal and economic issues**. The following argumentation appears as an attempt to **guarantee the future of shale gas exploitation** by **promising to conduct a serious risk assessment** to ensure that environmentally friendly industry. The health, safety and environmental risks can be managed effectively in the UK. Operational best practices must be implemented and enforced through strong regulation. Fracture propagation is an unlikely cause of contamination. The risk of fractures propagating to reach overlying aquifers is very low provided that shale gas extraction takes place at depths of many hundreds of metres or several kilometres. Even if fractures reached overlying aquifers, the necessary pressure conditions for contaminants to flow are very unlikely to be met given the UK's shale gas hydrogeological environments. Well integrity is the highest priority. More likely causes of possible contamination include faulty wells. The UK's unique well examination scheme was set up so that independent, specialist experts could review the design of every offshore well. This scheme must be made fit for purpose for onshore activities. Robust monitoring is vital. Monitoring should be carried out

before, during and after shale gas operations to detect methane and other contaminants in groundwater and potential leakages of methane and other gases into the atmosphere. [...]Regulation must be fit for purpose. Attention must be paid to the way in which risks scale up should a future shale gas industry develop nationwide. Regulatory co-ordination and capacity must be maintained. Policymaking would benefit from further research. The carbon footprint of shale gas extraction needs further research. Further benefit would also be derived from research into the public acceptability of shale gas extraction and use in the context of the UK's energy, climate and economic policies.”

(Royal Society, *Shale Gas Extraction in the UK. A review of hydraulic fracturing*, June 2012)

Conclusion

According to Vaclav Smil, fundamental change occurs in one of two ways: as a sudden discontinuity, often a catastrophic event, or as a persistent and gradual trend (Smil, 2012). If the most part of scenarios and visions of the future are designed to withstand unexpected events, they are continuously revisited at the crossing roads of future: if trends are made by demographic data, environmental (especially climatic) processes, economic patterns and policies that unfold over time, some events can produce shifts, acting as real “reconfigurators” (Chateauraynaud, 2010). Thus, a key dimension of a pragmatics of transformation – or a sociology of processes – is the attention paid to the manner in which the actors gradually elaborate the array of consequences relevant to events and actions. This implies two things: on one hand, we must focus on concepts oriented towards open processes, without fixing a set list of consequences *a priori*, to see how things play out over time; the list of consequences being often impossible to express and, at the very least, to prioritise in the short term. The comprehension of processes understood over the long term, on the other hand, involves consideration of perspectives that actors may have in the future, actors whose points of view open or close according to events, surprises and conflicts. The impact of scenarios depends on the balance of power between different epistemic authorities. Official agencies are not the only ones to define the possible futures: researchers, NGOs and emerging players earn their place in the space of scenario-building through public controversies – in France, for instance, a group of counter-experts called NegaWatt defends an energy scenario for 2050 based on sobriety, energy efficiency and renewable energy.

If we accept that the concept of risk makes sense only with reference to a space of calculation, to the establishment of probabilities about a state of the world fixed in advance, then the theory of risk implies *bounded consequentialism*, or better, *primary consequentialism*. The idea that we can make the consequences of an event or a series of events calculable is in opposition with a form of *overt consequentialism* or *secondary consequentialism*, for which the list of consequences is not fixed from the beginning, but constructed over time, through the series of interactions between tests of reality and visions of the future. This secondary consequentialism is based on *abductive logic*, which introduces argumentative chains of questions and hypotheses, and even new rules of inference or heuristics not yet fixed in a formal system. This avoids the closing argument of a classic syllogism, one of the major concerns of the founding fathers of pragmatism. In the canonical form expressed by a clause such as “if X, then Y,” a variety of more complex clauses can be substituted, the expression of which can be derived from the form of “if X, then M [temporal modalisation] Y,” such as “if X, then maybe there will soon be Y.”

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