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Energy transition: concept/project

A point of view from science studies and political theory

1. *Real philosophie* after Fukushima

When Professor Yamawaki Naoshi invited me to participate in this colloquium, he asked me to concentrate on the concept of "energy transition" and to focus on the case of France. I usually avoid studying the case of France because I am never sure of building the required *distanciation*. My answer to Professor Yamawaki was that I could only study the case of France from the perspective of my work on the Fukushima catastrophe (Rieu 2012, 2013). Today I thank him for his invitation because it forced me to concentrate on these issues. My goal is to build a symmetrical approach on the conditions of an energy transition in France and Japan. Finally I will draw some conclusions from this approach.

My approach has two sources. The first source is found in Science studies. In the present case, their perspective is best summarized by a simple formula: "Planes don't fly, airlines fly". Of course planes do fly but they would not fly without a complex infrastructure, which is all at once technological, economic, cultural (tourism for instance) and political. Beyond the question of energy, the concept/project of "energy transition" leads to the complex infrastructure, which is producing, transferring and consuming *energy* in all societies. The second source of my approach is derived from the work of Michel Foucault: his work transformed the conception and practice of philosophy by questioning the formation, presuppositions and role of human and social sciences in our societies. He also injected two

concepts and programs in human and social science: an analysis of power networks controlling a society underneath political institutions and the question of "govermentality" (Malette 2006). This awkward notion covers the disciplines, the political and social technologies and tacit practices having for goal to govern and manage a population, to shape and control the trajectory of a social system[1]. In my perspective, the concept of "energy transition" is a type of "governmentality". It does not concern energy *per se* but the energy infrastructure of societies as well as the power networks embedded in this infrastructure. My own research on the Fukushima catastrophe proves this point, at least in my view. It is best summarized by quoting the title of a paper published in 2013 (Rieu 2013a): "The Fukushima catastrophe: an epistemic shift in social sciences". My goal is therefore to explore some consequences for the concept/project of "energy/transition".

At first glance, the reasons for the present energy transition seem obvious and consensual. The goal on the long term is to save the planet and to preserve the biophysical conditions of the human species, on the short term to protect the living conditions of populations most affected by climate change and to prevent massive climate migrations. The core arguments behind these reasons and goals are our collective responsibility toward future generations in general (our children in particular) and to provide a fair or even equal access to energy for all people, notwithstanding their social status or wealth, their ethnic origin, their religion or, more cynically, their geopolitical interest. These are all moral and humanitarian, common sense and perfectly justified reasons[2].

But these explicit reasons, however generous and consensual, have little to do with the reasons and goals of present energy politics, with the search by advanced (mature) industrial nations for a long-term and thorough energy transition. According to my perspective, it would be more rational and wiser to go beyond these consensual reasons in order to reach the effective conflicts of interest and power, which are structuring, at all levels, the present world concerning energy and other related issues. In this perspective, an efficient ethical approach needs to be grounded on the real issues in a world woven by intricate competition and conflicting goals and interests[3]. This level of complexity calls for collecting and producing shared knowledge leading to effective debates on these real issues. This is a typical character

[1] The notion of "deep state" covers a similar range of problems.

[2] See for instance the *Africa millennium development goals*, which are going to be revised in 2015 http://www.undp.org/content/dam/rba/docs/Reports/MDG_Africa_Report_2014_ENG.pdf.

[3] Typically the *US-China climate change agreement* signed on 12 November 2014.

of the present world: an approach based on values tends to dissimulate the real issues: in the end it intensifies conflicts further. Knowledge has become the only basis for action, debate and negotiation. In our present epistemic condition, the joint production of validated knowledge plays a critical role.

In my view, the Fukushima catastrophe is leading social sciences to accomplish this transition. I consider this catastrophe a *disruptive event* with the potential to change the trajectory of all advanced industrial societies. Three problems are closely related: the Fukushima disaster questions nuclear energy and energy policies in general. It is leading major industrial nations not to really renounce but to overcome this techno-industry in the next thirty to fifty years[4]. Germany and Switzerland are the most interesting examples. But another aspect of the Fukushima catastrophe focuses my interest. From the beginning, the catastrophe has generated a massive self-reflective process in Japan and outside Japan. It soon became clear that participating in this reflective process was and still is to participate in the construction of the historical meaning of this catastrophe. This collective construction is a major progress for human and social sciences. The object of this progress is "energy" *per se* but "energy and society", "energy policy". The third transformation injected by this catastrophe in the body of our societies is that this reflective process has included and associated a wide range of communities and people, from families directly concerned by the accident, to politicians, journalists, artists, writers, engineers, researchers, in Japan and outside Japan. Around Fukushima and its historical meaning, a new, both wider and deeper, concept of "civil society" has emerged. The adjective "civil" might even be superfluous: "society" is a better word. We, the people, including me at my minuscule and faraway place, learned one thing: the Fukushima catastrophe scanned Japan thoroughly. Japan's power structure was made visible, thrown in the open and known. The long term meaning and the political consequences of the Fukushima catastrophe are still to be explored.

In this context, my objective is to present and clarify some issues and debates related to the concept/project of "energy transition". In summary, the real issue is not to save the planet but paradoxically dealing with the real issues might be the best hope to reach this ideal.

2. Energy transition: a concept/project

[4] In French, concerning Germany, see the report "La transition énergétique allemande" (2014). Concerning France, see the Vigie Report (2014). Concerning Japan, see Hiranuma (2014). All these studies and reports are available on-line.

I do not pretend to bring anything new: my goal is just to elucidate what is really at stake within and behind this concept/project. First the idea of energy transition is a situated global policy. It is a slogan proper to advanced (mature) industrial nations, mainly nations with a strong "National innovation system" (OECD 1997). An energy transition is not really a priority for the BRICs and other New Industrial States (NIS) because their goal is to *catch up* by moving up the industrial ladder and to follow a model of development, which they did not chose but had to adopt and adapt in order to participate in the dynamics toward a global economy in order to share its expected benefits. The NIS are concerned by climate change and global warming. They take the energy transition for what it really is: the tentative overcoming by mature industrial nations of the type of modernization the New Industrial Nations have decided to follow at any ecological and social cost. After the collapse during the 1980s of alternative models of development[5], they had no choice. Advanced industrial nations have for goal to reduce dependency on imported energy, to recreate a gap with the NIS in order to maintain hegemony by defining what the "future" should be and showing the path to follow. In this perspective, the energy transition is a model of *governmentality*, an implicit strategy to design and lead the type of energy policy to be followed and adopted by all industrial nations. It is the "catalyst" of a new modernization process[6].

This tacit reasoning process of advanced/mature industrial nations can be broken down into the following arguments. For advanced industrial nations, to reduce energy dependency is to reduce their economic dependency on biophysical resources under the control of hostile nations or political leaders. This trend potentially reduces conflicts of sovereignty based on natural resources on one side and economic growth on the other. The goal is to emancipate advanced social and economic systems from increasing or potential scarcity of natural resources and also to control or reduce increased production costs induced by the scarcity of resources, whatever the real cause of this scarcity. The first energy crisis of 1973-75 was understood in the US as an aggression against the American economy and way of life. The response by successive US governments has been until today to control access to natural resources in the Middle-East and to diversify sources of energy, shale gas and oil today at any environmental cost in order to restart industrial growth.

[5] After the collapse of the Soviet Union and the turn of the Chinese communist party to a market economy.

[6] This is an interpretation of the GreenTech strategy of the German government (2014): "Green tech as a catalyst to modernization. Added value for providers and users, growth stimulus for the economy". A similar strategy is found in most mature industrial nations.

Secondly, the goal of advanced industrial societies is to control and sustain their long-term economic competitiveness by balancing production costs depending on energy resources with the increased added value of their products and services. This strategy was successfully adopted by Japan at the end of the 1970s's and early 1980s. It was explained in 1985 by Sakaiya Taichi in an influential book, *The knowledge-value revolution* (1985), published before European economists and sociologists designed at the end of the 1980s the powerful concept of National Innovation System[7]. What is at stake for advanced industrial nations is the global innovative potential of their respective social and economic systems. This is expressed today in the ever increasing scale and inclusiveness of research and innovation policies, in Japan, Germany, the US, France, etc., including the EU. There is therefore a major difference between these research & innovation strategies and the catch up strategies by NIS. To catch up is to follow a path designed by others. These are two different epistemologies, different conception, organization and role of research and innovation processes. These two strategies are dangerously asymmetrical.

This leads to the third point: such diverging strategies generate a growing tension between the innovative value of a given social-economic system and the value of natural resources in a very different type of type of economy and society. This difference is not the result of chance or choice due to climate, geography and geology. It is an historical construction and the result of long-term power relations. The "curse of oil" and, by extension, the "curse of natural resources" are creating an increasingly dangerous situation in many different parts of the world[8], within nations[9] but also, for instance in Eurasia, between Russia and European nations, potentially also between different regions of Eurasia and even within Ukraine. The more a natural resource of a given nation is required for the growth of the value-added economy of another nation, the higher becomes the discrepancy between nations grounding their economic growth and political influence on the exploitation of their natural resources and economies grounding their growth on their innovative potentials. The resulting gap is widening to the point of becoming dangerous.

The exploitation and also the consumption of natural resources by NIS generate a high level of pollution. The costs and damages of this pollution need to be deducted from the expected social and economic benefits of this exploitation or consumption. It is estimated that

[7] See Freeman (1987), Lundvall (1992), Nelson (1993).
[8] For instance China and fertile lands or rare earth in Africa, oil in the Brazil's or Ivory Coast in its sea waters.
[9] For instance in the American West, from North to South, concerning water resources, in the Democratic Republic of Congo (RDC) concerning rare earth, etc.

pollution, induced heath problems and land erosion, reduces China GDP by 3% annually. This situation creates an imbalance and feeling of injustice, which reinforce the trend toward conflicts and violence. This is what happened already in 1972-73 with the price of oil. The revolt of oil producers, the rising costs of oil, gas and all natural resources during the 1970s transformed in depth the growth, productivity and competitiveness of all industrial nations, starting what is understood today as an irreversible evolution (Rieu 2012a). The concept/project of energy transition is the present phase of this evolution. The growth and the overall productive value of this second type of economy will remain on the mid and long-term higher than the growth of any economy based on natural resources. Investment for value growth will attract more capital: in fact this capital measures what the level of investment needed for a resource-based economy to escape from the "curse of natural resources" and to the social and political system associated to such an economy. This confiscation or monopolization of added value by advanced nations has become dangerous. It is probably not worth the incommensurable cost of an open and violent conflict.

This discrepancy and related tensions are intensifying around the world, especially since 2010 with the crisis of emergent economies and again in 2014 with the drop of oil prices. Before reaching the brink of multiple conflicts and local wars (like in Ukraine or Congo), one can only expect or hope that at a certain point, this asymmetric situation leads to a negotiation. This is the first reason why real issues and strategies behind the concept of *energy transition* need to be made explicit and be openly negotiated. The second reason is that the divide between these two types of economic and political system remains a stronger priority than all warnings about climate change and its consequences. Climate change is the effect of multiple causes and processes. Advanced nations tend to consider climate change as a cause of multiple disruptions, which can be effectively answered by an energy transition based on research and innovation. The asymmetry between these different visions and asymmetries cannot be overcome without joint research on the various issues at stake in the project of an energy transition. This knowledge is the only answer against growing instability and violence. What is at stake is peace or at least appeasement.

3. What "energy" stands for?

The first part proposed an interpretation of the project of energy transition not only as a required response to climate change and global warming but as a strategy by industrial

nations to shape and control responses to climate change. These solutions are expected to be found in their innovation potentials and in the capacity of their democratic, social and economic institutions to reform and adapt to changing biophysical constraints. The perspective of the second part is derived from science studies and their counter-intuitive motto quoted in introduction.

If "planes don't fly, airlines fly", the notion of energy becomes ambiguous and conveys different meanings. Energy cannot be reduced to a natural resource: it is extracted from natural resources. Energy is not oil, gas, coal, water, sun, wind, hydrogen or nuclear fission. It is a *flux* extracted, produced, refined, stored, transported, distributed, sold and consumed. It has different sources, requires different technologies and industries for different purposes and uses. Energy is always a *mix* of different sources and industries. Gas, oil, coal and nuclear are the main sources of energy, but electricity has become the generic energy of all advanced industrial societies. For Sakaiya Taichi (1985, p 146), where electricity comes from does not matter. The natural source and the geographical origin do not count anymore. Energy is what counts: it supposes and requires a complex process to be produced, distributed and consumed, including to save and store. The function of energy is simply to activate an engine or machine of any kind, which converts energy into another energy or into an action, any type of movement. Energy is a process within a system, be it a living organism or a society. Therefore energy requires a complex technical infrastructure within a social and economic system. This technological infrastructure is embedded into the biophysical environment to extract and produce the energy, which circulates in social systems[10].

This infrastructure is the backbone of any society. It is composed of technical networks spread around the world beyond national borders but reticulated in the social and economic systems, which require for growing and functioning the energy these networks produce, concentrate and distribute. What counts is not energy but the technical infrastructure, which produces energy within a social and economic system. Energy only names the flux, which is produced and circulates in this system, which *fuels* and activates this system. Therefore the energy transition is a transition of the technical infrastructure of advanced industrial societies: it implies a transformation of these social and economic systems. It implies also a transformation of the technical networks around the world, which exploit the biophysical environment of nations living from this extraction of their natural resources by foreign

[10] This view is derived from an epistemology of technology developed by Bertrand Gille and Gilbert Simondon. I am aware of crossing the work of Nicholas Georgescu-Roegen (1979).

nations. This is obvious but it proves that the energy transition is necessarily a long and complex process extending beyond climate change.

But the distinctive property of energy is that it is extracted, processed and transmitted but it is also consumed. Energy is not information: it responds to the laws of thermodynamics and it needs to be indefinitely renewed. Energy depends on sources. However the social imaginary, even phantasm, of energy is to become independent from its source. It is the search for the endless or endlessly renewable resource, like water and air in the past, like atom, hydrogen, wind, sun, light today. The energy phantasm of advanced industrial nations is the production of energy by the means of energy[11], to dispense with the rest of the world, with those nations who control the resource and from scarcity. The phantasm is to produce one's own energy, at any cost and whatever the consequences, in order to negate objective dependencies in the name of political and economic autonomy and sovereignty. This phantasm has own its metaphysics: to escape not only from scarcity, but from the Law of diminishing returns. A recurrent example of this law refers to oil: "each additional barrel of oil is on the long-term scarcer and more expensive to extract from earth"[12]. This metaphysics has a formula: "endogenous growth" [13].

In summary, energy, technical infrastructures and social systems do not exist separately from each other. As multiple intertwined processes, the problem of energy reproduces and expresses all aspects of a social system, its historical progress, its economic organization, its class structure and political institutions. It also expresses the power structure controlling and managing the social system. The Fukushima catastrophe has revealed that this power structure is embedded in utilities companies and energy industries. These industries required and still require massive investment. This is true of Japan, the USA or France, Russia and China or Canada, of all nations. Furthermore, the energy production and consumption, its transfer and storage, do not only characterize a social system: they also condense the diversity and complexity of the knowledge capital of a given nation and type of society. Writing these pages, I realize that these problems seem to defy existing human and social sciences: they call for new knowledge.

[11] Similar to financial speculation, i.e. the production of money by the means of money.
[12] It is necessary true on the long-term but until this term, empirical facts prove that politics, military actions, economic policies and financial speculations can postpone the immediate or near effects of this law of diminishing returns. Between 1982-3 and 2006, the relative price of oil has been under control.
[13] For instance the work and ideology developed by Paul Romer in the 1980s and 90s.

This might seem very abstract but it clarifies what is at stake in the "energy transition".

- First the energy transition is energy substitution, the substitution of natural resources with knowledge. In this broad sense, knowledge includes research and innovation processes but also human and social sciences on all issues concerned with the energy transition. It also includes technologies and among them nuclear technology.
- Secondly the energy transition is or, if happening, it would be a mutation of the whole social system, including the power structure within this social system. An energy transition is made possible not by the discovery of a new source of energy (cheaper, easy available, endless or immensely abundant) but by a reform or mutation of the power structure within a social system. This mutation might not so much exclude *a priori* nuclear energy than transform in depth its present technology, its inscription in given power structures, for instance in France or Japan. If nuclear technology is proved incompatible with such reforms, it might play a role in the transition but would also be progressively excluded. This seems to be the case, at least for the moment.
- Finally, the substitution of natural resources with knowledge is a conceptual challenge because knowledge has properties rather similar to energy. Knowledge is not information: it is the use of information within a social system. At the age of digital technology, information can be reproduced and transferred at no cost and without being consumed. But knowledge falls also under the law of diminishing returns. Knowledge needs to be constantly activated and renewed: it requires a constant flow of discoveries and innovations, which requires capital, competence as well as an adaptive and evolving social and economic system. Knowledge is what generates added value, what needs to be endlessly substituted for natural resources. It brings freedom, but no escape from the law of diminishing returns. To be sustained and become sustainable, knowledge does not need only to grow but also to mutate. It needs discoveries. "Innovation" is the name given today in advanced industrial nations to this process, which defies manageable and predictable complexity.
- The concept/project of "energy transition" goes beyond the question of energy, the energy *mix*, the various or new sources of energy. It questions the configuration of social systems and within the social system the power structure controlling and managing the evolution of each social system. This is the reason why case studies are necessary.

The Fukushima catastrophe has revealed what was already known but was not exhibited in the open: controlling energy supply and distribution is to control the social system. But this

catastrophe has also shown that such a power structure is always in the end counter-productive, economically, socially and *environmentally*. Fukushima also taught that political institutions are unable to transform a power structure because political institutions develop and exist within a power structure. I certainly do not mean that a catastrophe is necessary to transform a social system by deconstructing its power infrastructure. What Fukushima brought to Japanese society is a knowledge and experience of the existing power structure, of incalculable level of risk a power structure generates in a social system. This knowledge makes the difference. Fukushima is a lesson for all industrial nations. What seems to me important in this lesson is the self-reflective process and knowledge a society is able to generate on the power structure, which dominates and manages this society with the goal to reproduce itself. After Fukushima, Japan's future seems to hold in the capacity of its *society* to reform the power structure, which made the Fukushima catastrophe possible. If the Japanese succeed, there would be far in advance in comparison with all other industrial nations.

4. Thinking after Fukushima: the case of France

These two perspectives constitute a referential to study the case of France. The present and future of energy policy in France are better understood if compared with Japan's pre and post-Fukushima context. The objective is to analyze according to this referential the situation of France in order to examine the conditions in France of an energy transition[14]. The starting point is the idea that an "energy transition" involves the whole social and economic system, from its energy infrastructure to the power networks embedded in this infrastructure.

The first step is to understand the social conditions and geopolitical context of France's choice of developing a large-scale civil nuclear energy program. Around 73% of France's electricity is nuclear, versus 23% in Japan. This policy was decided and voted during the 1970s in response to the first energy crisis. This energy crisis was understood as an implicit aggression against French economic sovereignty. Japan made a similar diagnosis. But Japan was constitutionally forbidden to develop nuclear weapons. Still, supported by the Liberal Democratic Party (LDP), a civil nuclear industry had been in the making since the late 1950s,

[14] For a detailed analysis, see Lepage (2014). Corinne Lepage is a remarkable lawyer and former politician specialized in environmental issues. Her book describes the French nuclear industrial-military complex, its configuration, its members, their training and career, their relations with the government and the State bureaucracy.

in close collaboration with American firms (Nishioka Nobuyuki, 2011). The energy crisis gave this nascent industry the opportunity to grow and to build one after the other the existing nuclear plants. In France, since in power in 1958, the General de Gaulle considered that French sovereignty, defense and security, its economic and political autonomy, had to rely on nuclear deterrence, i.e. on nuclear weapons. The goal was to prove to the world and to the French themselves that the reconstruction period was over and France was again a world power. The scientific, technological and industrial capacity to build nuclear weapons had been since 1945 and is still until today for certain nations a proof of power, competence and sovereignty. But during the 1970s the world was rapidly changing: in a context of growing *détente* with the Soviet Union, nuclear technology was not an obvious and rational response to the energy crisis. Energy saving was the advertised priority. But, on the contrary, in this new context, developing a nuclear civil industry was bringing legitimacy to a costly nuclear military program becoming useless. The enemy was vanishing. Nuclear civil energy had for goal to share the cost and legitimacy of the military nuclear program of the 1960s. It was also reinforcing the traditional French sovereignty imperative, source until today of political legitimacy. In summary, the civil nuclear program was a sort of multi-billion miscalculated national reflex.

The real problem is the institutional context of this decision. Science studies, not political science, have formulated the right problems and the adequate concepts for describing the choice of such a policy. First of all, this policy was not "France's choice" as mentioned above but the choice of the people who were in charge at that time of governing and managing the evolution of the French economy, security and society. Those individuals and groups are certainly part of the French population but the French people never participated in the decision. These groups understood themselves as a substitute for the French people, expressing their collective will, interests and values. They constituted the power structure around the presidency, in the high administration and ministries, playing the effective role of governing the nation, the territory and its policies. They did not usurp this role: it was delegated to them through the political process. Political institutions and the elected government itself are part and players of this power structure[15]. Furthermore the president expresses the sovereign and long-term interests of the nation: the nuclear defense and the energy policy are ultimately his responsibility. He selects the presidents of EDF and Areva.

[15] "Government" in France is considered part or a function of the State. By comparison, in Great Brittan or the USA, the state is part of government, the administrative extension of government. Since the early 1990s, Japan's political evolution seems to experiment how to shift from a type of French model to a type of British model.

The problem lies in the configuration of this power structure. In France, at that time, it associated the high military officials, the heads of national industries in charge of energy and nuclear industries (nearly all of them from the Ecole polytechnique and the Ecole des mines), the heads of research institutions in these fields (CEA, CNRS) and finally top administrators and advisors (former students at the ENA) in related ministries. This power network includes also the CEO and directors of national banks and insurances. In the case of France, these interest groups are easy to identify because they are trained in the same national schools (*grandes écoles*) and they move during their carrier from one administration to another, including national private or semi-private companies. These individuals are certainly amongst the best trained in France, with a strong scientific and/or administrative background. They consider themselves an "enlightened elite". The president elected at that time, Valéry Giscard-d'Estaing belonged to this group: he shared with them the same education and carrier.

This information makes sense when comparing the collective decision of this power structure and the epistemic conjuncture in 1970s. It was the moment when the "new technologies" emerged in all industrial nations and were recognized as the seeds of a "second industrial revolution", potentially transforming and driving the long-term economic development of those nations in which this revolution would take place. In a period of energy crisis, "new technologies" were also considered in Japan, the US and Western Europe as a decisive technological and industrial response to these constraints. Like today, these "new technologies" were Information technologies, biotechnologies as well as energy saving technologies and new energy technologies, including solar, wind, ocean tide and of course nuclear. Many reports were published at the time. Some of them, by authors with similar background, became even best sellers[16], in the mist of many special issues in magazines and debates in the media. In the second half of the 1970s, the *high tech* sector was flourishing in France, with new companies, a real spirit of entrepreneurship and progress in all domains.

The late 1970s were also the coming age of neo-liberalism as proven by the famous course by Michel Foucault (2004) at the Collège de France, *Naissance de la biopolitique* in 1978-79. In this course, Foucault was explaining the revolution, which was taking place. Neo-liberalism was not yet (not only) considered a destructive ideology. It was also considered as a liberal wind, an opening for society and for the economy, including in France. Nonetheless, the existing power structure made the choice to launch a massive program in nuclear civil industry, building in each region nuclear plants with the goal to secure France "energetic

[16] See the *Nora-Minc Report* (1978), commissioned by President Giscard d'Estaing (1974-1981).

independence" and economic sovereignty[17]. This power structure did not see in these new technologies the potential of substituting high tech and higher added value for oil and other natural resources. It was not a business or management mistake. It was worse: an epistemic mistake, not ignorance but the institutional blindness of a power structure.

In the last ten years, the French economy and industry started to crumble, to lose markets, jobs and industries. The French people slowly realized that the billions of Francs poured into this nuclear policy had been removed from investment in promising high tech research and industrial development. The "new technology" sector in France never recovered from this change in investment policy. It was a type of *substitution* policy, substituting a national nuclear civil industry to a full high tech industry. The sectors saved from this investment transfer were sovereign national programs in communication infrastructure (from high ways to high speed trains), avionics and hardware electronics (now defunct). The French industrial debacle has its source in this industrial substitution: France is absent or late in each high tech industry, in innovative small and medium size firms, plagued by inadequate training and massive unemployment. On top of it, French nuclear industry is rampant with hidden costs: electricity prices do not include the costs of dismantling now aging nuclear facilities and long-term storage of nuclear waste. Certainly, this situation cannot be compared with Japan's situation after Fukushima. But it is also an institutional catastrophe with long-term consequences. Today this situation seems irreversible: the cost of closing the plants and/or of developing alternative energy industries is too costly. Public deficits are too high and the private sector too weak. The French people understand they are in a trap.

In a democracy, however imperfect, people search for an explanation. The French society needs to know how in a period of international *détente*, the choice of the wrong policy was made and implemented by people who had supposedly the best available education in France, who were considered competent and well informed and were even individually promoting high tech industries in the 1970s. These people are not individually the cause of this wrong choice. The power structure they constituted was the cause of this policy. But these people are individually responsible for being collectively the cause of a negative choice of this scale. The power structure was so compact that individuals just followed and reproduced its configuration. They reinforced their collective interest, their control on positions and fields of activity and, through these positions, on policies, society, the economy and territory. Elite

[17] Hecht (2004), Sezin (2013), Delfour (2014).

individuals in a blind power structure lose all legitimacy. This has become today a serious political and institutional problem.

Knowledge is a requisite for critical debates leading eventually to political reform. Knowledge needs to be comparative as suggested by the following example. France, Japan and the USA were probably the only industrial nations to be obsessed with energy sovereignty. Many other industrial nations, for instance Germany and Switzerland, built nuclear plants since the 1970s for reducing dependency but never with the goal of reaching energy sovereign. The case of the US is revealing: an American company, Westinghouse (now sold to Toshiba), developed civil nuclear technology in the 1960s. This led to a massive program by private companies with the ambition to build seventy nuclear plants in the USA. This program was stopped in 1979 after the Three Miles Island accident. Why did it stop? The Federal government and local governments required that private companies ready to invest in nuclear energy would themselves insure their plants in the private insurance sector. After extensive studies, insurance companies declared that they could not afford insuring such high-risk projects[18]. The custom in France is that the State is its own insurer in the last resort: French tax payers carry in the end all costs. In such an institutional arrangement, the State has no real limit: it can decide in the name of the public and national interest. This power is blind, counter productive and a denial of democracy. The situation is still the same today.

The crisis of France is the crisis of the French power structure. Even if Japan's power structure tries to survive, it was virtually deconstructed by the Fukushima catastrophe. It has been exposed naked into the open. By comparison, the systemic crisis, which is deconstructing France since 2008, does not deconstruct (at least not yet) France's power structure. It is still in place and manages the crisis it made possible: it just continuously extends its circles to new officials and partners, who are expecting to share the benefits. In the French popular imagination, this power structure is virtually opened to all French people.

Because it extends from Left to Right (including now the extreme right), this power structure feels immune: it organizes and manages the French financial crisis. The budget deficit keeps growing: it measures and reproduces the role and extent of the power structure in place. France's partners in the European Union and the EU institutions themselves, neither the Commission nor the Parliament, have the right and power to question the institutions and historical configurations of a Union member. They can require "adjustments" and "reforms" but these requirements do not touch power networks, which are below political institutions.

[18] This comment was suggested to me by Michel Villette.

Still the increasing budget deficits, the worsening state of the French economy, massive unemployment, prove that recent policies are counter-productive whatever the government. What is at stake is not only the French institutional and economic system: it is the power networks managing France's economy, society and politics. These power networks revolve around a sovereign technology and industry: nuclear technology.

In summary, an effective energy transition in France would require a thorough institutional reform, which is not on any party's agenda. On the contrary, each successive government in France since the 1980s, Right or Left, surrendered not to nuclear energy but to the power networks organized around nuclear energy. I mentioned at the beginning that an energy policy is always an energy *mix*. The proportion of nuclear energy in France can only be reduced if private and public investments could support the creation and development of strong medium size firms specialized in non-nuclear and non-carbon industries. For the moment, EDF impedes the creation and growth of such companies in order to manage the energy transition at its own rhythm and according to its own interests. The rest is political wind. Of course a type of energy transition is and will take place in France. But it will tend to reproduce the present networks of interest controlling France. The energy transition will not be a collective opportunity to reorient and reconstruct the economy and society but an endeavor to sustain and even "save" the existing trajectory. Therefore the gap between those societies, which have understood what the energy transition really means and France will continue to grow.

5. Conclusion

Some elements need to be recapitulated for further debate and research. First comparing the cases of Japan and France proves that the energy transition is less a question of energy than the question of a given institutional system, the aggregated interests of existing power networks, their capacity to control government and the evolution of the economy and society. To operate any energy transition requires not only reforming the institutional system but transforming the power networks embedded in this system. However strong the pressure on a society and economy, the power structure will respond with the goal to protect its control, interest and legitimacy. But it also means that criticizing and resisting the power structure by exhibiting its structure and behavior is an efficient way to engage an energy transition. Collective knowledge is the requisite but the decisive transition is political.

Secondly the concept/project of energy transition requires a specific study for each nation, region and even locality. The energy transition for the Region Rhône-Alpes, its economy, ecology and history cannot be the same than for Alsace, Bretagne or Bayern. This confirms that the possibility of such transition depends on establishing strong and vivid local democratic arrangements. France's future is local, not national. This progress requires joint and shared knowledge production. A rather embarrassing consequence is that the energy transition will probably never be global but will be local. The national and regional levels are probably not the pertinent scale for an effective energy transition. This conjecture might have consequences regarding a global phenomenon like climate change. Global warming might not be controlled and curbed by global policies, but only by a great diversity of local initiatives and policies. This probably means that global warming and climate change in general will have to become much worse, admittedly irreversible, before efficient local responses aggregate and start making a difference.

The only solution to prevent waiting until it is too late might be to explain this situation, without hiding the reasons and consequences. Another solution could be to start analyzing the role of national, regional and local power networks, of political and economic interests, how they shape energy policies, not only to profit from these policies but to control through these policies societies, economies, territories, international relations and trade. This approach might seem desperate and utopian. But the risks generated by climate change are so high that it is not an improbable solution but a rational one. Finally what is missing in this paper is a problem raised by Kamisato Tatsuhiro (2012), the next step to explore: what is an energy policy? How to democratically construct an energy transition policy? It has become a key component of a democratic society.

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