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Introduction: Energy in history, the history of energy

Abstract

Energy is a rich concept that can analyze much of the evolution of societies over time. Whether it be the means of production, forms of consumption, or periods of tension or scarcity, the quest for energy prompted humanity to go further in its search for new resources, to ceaselessly innovate, to share and conquer. While energy has been the basis of economic growth since the late 18th century, and even more so after 1945, its role cannot be reduced to the number of kilowatt-hours consumed. Energy-related issues actually affect major geopolitical, societal, political and environmental balances. Numerous new avenues connected to energy can be explored thanks to pioneering work surrounding questions of “gender,” transition, and network transformation, all of which are subjects of the past that remain topical today, and that must be confronted in the future. Sometimes in competition and sometimes complementary, different forms of energy form an indispensable framework for historical evolution. The great complexity involved in grasping the phenomenon calls for increasing historical viewpoints with help from all of the social sciences.

Plan of the article

- Energy, the matrix of civilisation
- Crises, deadlocks and renewal
- Transitions and breaks
- Energy, an instrument of power
- From the distribution network to the consumers
- Energy, companies and democracy
- Adapting contemporary notions to past problematics: on the topicality of history

1 The word “energy” is charged with hidden implications: it refers to a subtle something that has the ability to make nature do work. Energy now, as work formerly, has become something that individuals and societies need. It is a symbol that fits our age, the symbol of that which is both abundant and scarce” Ivan Illich declared in a 1983 lecture.¹ In his introduction the author systematically distinguished between the “E” of the physicist which is expressed in watts and joules, and a social construct, complex, historical and shifting, which is energy *in* society. It is true that the word “energy” has a history and only from the first half of the 19th century does it take on the meaning we know now. In Diderot and d’Alembert’s *Encyclopédie*, the only meaning of the word relates to discourse and is synonymous with fortitude. In the following century, in the Littré dictionary, one has to wait for the *Supplement* to find the following (quite complex) definition: “Energy, Add://4° Term relating to mathematical physics, indestructible element in its numerical value, but liable to transmutations which make it appear in its three forms: work, half-strength, and calorie (Mechanics course of the Ecole des Mines)”. Here it is truly humanity at work, humanity expanding or surviving, humanity in transition which is understood in its entirety through the rich word “energy”. Without our going into too much theory, but adopting an empirical approach familiar to historians, it is clear that contemporary societies have seen their destiny inscribed and limited by the energy needs, be it to produce, heat, illuminate, transform or answer new needs. Technical and societal changes are in fact often symbolized by a new means of production of energy: Watt’s machine, Tesla’s electric motor, Lenoir’s combustion engine or that of Diesel, the nuclear plant of Calder Hall, a wind field... Likewise, the new objects that transformed the world of work and the daily life of populations are nearly all objects requiring an energy supply, more or less large but always essential: the steam locomotive, the gasoline-powered car, the small electric engine,

artificial lighting and all the means of communication from the telegraph to the smartphone. Marx, who was born two centuries ago, closely linked—in a Hegelian vision—the major (great) phases of exploitation by man to a source of energy, from ancient slavery to the railway, passing by the mill. In fact he distinguished between driving machines (production of energy), machines which transmit energy, and those which do work.² Leslie White (1900–1975) is an American anthropologist. He is remembered for his “law” (1943) which stipulates that cultural evolution depends on the amount of energy available annually per capita or, in other terms, that increasing the efficiency of energy at work reinforces cultural means.³ For White, the history of humanity was divided into five stages according to the different sources of energy: muscular energy, animal energy, the agricultural revolution, fossil resources and lastly nuclear energy. The more contemporary periods, known as the first and second industrial revolutions, require extra energy to make boats and railways advance, and transform raw materials. The most recent acceleration, since 1945, is intimately linked to oil capacity. In short, one can debate the place of energy in social transformation but without this energy—too abundant or too scarce—societies would have had difficulty surviving and evolving.

2 And yet, is energy the forgotten item in the history of human society? The answer cannot be just yes or no. The history of energy is characterized on the one hand by a bibliography which is already large, sometimes scattered or ignored and on the other by a renewal of research on questions resonating with problems of today. The issue of energy is so broad, so complex that one can guess that throughout the world many researchers from all disciplines offer original approaches. For all

¹ Ivan Illich, “L’énergie, un objet social”, *Esprit*, n°8, 2010, 211 (translated from the English). Ivan Illich (1926–2002) has written in particular : *Énergie et équité* (Le Seuil, 1973 for the first edition). The author of the present article used the French translation.

² Arnold Heertje, *Économie et progrès technique* (Paris: Aubier, 1979), 82.

³ Leslie A. White, *The Evolution of Culture. The development of Civilization to the Fall of Rome* (MacGraw Hill Books, New York, 1959, republished in 2007, Left Coast Press, California). Culture is to be understood as the sum of human cultural activities on Earth. White distinguishes technological, sociological and ideological culture, the first being to his mind the most important.

human societies have seen their development made possible, or limited by questions to do with energy resources, whether they are available on a given territory, to be exchanged or to be conquered. Of course, reducing the history of humanity to the sole question of energy would be absurd. Our intention therefore is to underline the role of energy in history as collective constraint, as a source of sustainability and complexity and as a factor of evolution.

3 In the lines below there is no discussion about drawing up a laborious catalogue of all the possible subjects and sub-subjects for approaching the history of energy. The task would be huge and worthy of the Danaides' cistern. There is no question either of drawing up a "state of the art" with bibliographies both bulky and necessarily incomplete. We would prefer to emphasize themes which open up new horizons, studies often little known by the general public, sometimes for reasons of language, sometimes for reasons of distribution. We will certainly try to underline the contributions of French-language authors but this is not our main aim. We wish to go beyond the subject of history. For the history of energy cannot only be defined by historians: the journals of economy, sociology, geography, the exact sciences... also have energy as a research topic, and more and more often, a multidisciplinary approach and a long-term perspective. In short, economy, sociology, politics, geopolitics... all rely on the history of energy to draw up a strong, informed analysis. A cross fertilization is all the more necessary as questionings are broader and broader: even if history is a global discipline, it requires fresh views and other contributions to understand a phenomenon as polymorphous as energy. Lastly, this history is constructed along the way: new perspectives appear, others are temporarily left aside. The history of energy is a pioneering front.

ENERGY, THE MATRIX OF CIVILISATION

4 If one were to add up research on wood, coal, city gas, hydrocarbons, hydroelectricity, nuclear energy, renewable energies...one would certainly be seized with giddiness and consider that this

mass of research is sufficient. In reality, it is worth raising the requirement level and passing from *one* energy to energy in order to build new syntheses.⁴ For, all the same, energy supposes *energies*, and consequently a choice *a priori*. But since antiquity have men really had the choice between several energies? For Aristotle, the question does not arise: "when shuttles fly on their own and plectrums play by themselves, there will no longer be any need for slaves" he wrote.⁵ As for Marx he linked closely the source of energy to the social organization (in fact, for him, a type of exploitation): "By acquiring new productive forces, men change their mode of production, and by changing their mode of production, the way they earn their living, they change all their social relationships. The quern produces a society with a suzerain: the steam mill, a society with industrial capitalism."⁶ We will not fall into too strict a determinism and seek in societies their capacity for adaptation, their energy choices, even if they are limited. Since the most distant times, men have dealt with a more or less wide range of sources of energy going from human or animal strength, the biomass, to fossil fuels, not to mention energy saving which is a preoccupation not only for our time. The more one advances in time, the more the issue

⁴ Energy, the matrix of civilisation: one can sum up in this way the vast work of Vaclav Smil and in particular his last great synthesis: Vaclav Smil, *Energy and Civilization. A History* (Cambridge : MIT Press, 2017). But also: Nina Möllers, Karin Zachmann (eds), *Past and Present Energy Societies. How Energy Connects Politics, Technologies, and Cultures* (Bielefeld: Transcript Verlag Science Studies, 2012). George Basalla, "Energy and Civilization", in Chauncey Starr and Philip C. Ritterbush (eds), *Science, Technology and the Human Prospect: Proceedings of the Edison Centennial Symposium* (New York: Pergamon Press, 1980), 39-52. Carlo M. Cipolla, "Sources d'énergie et histoire de l'humanité", *Annales Economies, Sociétés, Civilisations*, n°3, 1961, 521-534. Gildo Magalhaes (dir.), *História e Energia, Memória, Informação e Sociedade* (Sao Paulo: Alameda, 2012) José M. Martínez-Val, *La Energía en sus Claves* (Madrid : Fundación Iberdrola, 2004).

⁵ An interesting reflection on slavery and industrial society: Jean-Claude Mouhot, *Des esclaves énergétiques. Réflexions sur le changement climatique* (Seysssel : Champ Vallon, 2011).

⁶ Karl Marx, *Misère de la philosophie. Réponse à la "Philosophie de la misère" de M. Proudhon* (Paris : A. Franck, 1847). chapter XV of *Capital*, "Machinery and Heavy Industry" Karl Marx develops these ideas relying essentially on British examples.

of energy balance seems obvious, even if the emergencies were not all as urgent. A balance is to be found between the availability of resources and the changes brought about by technological evolution. The 18th century raised the question of the means in wood, for instance.⁷ For in the last resort, energy choices are choices made by society. To consume much, to just consume, to consume meanly: these are modes of existence which differ radically. And when one has to move from one system to another, work methods, consumer habits, ways of residing and moving change. Energy is a trait of civilisation not so much because of the nature of the energies used but rather because of the way we produce and consume. The steam society was different from that of electricity, which itself will be different from the society of energy efficiency we have entered into. The same is true for location: the industrial zones were close to the sources of energy during the first industrial revolution⁸ (and even later if one thinks of the Soviet combines), electrometallurgy was organized according to hydropower resources and today the big computer servers migrate towards cold climates.

- 5 So the energy system evolves, internally through its technical progress, externally because of social expectation. It is not only the sources of energy which change, but also the structures of transportation and distribution, the returns, the speeches, the reputations, etc. In short, if energy more or less shapes society, it is itself in tune with contemporary expectations. We must therefore go beyond technicalities to envisage a source of energy or a use of energy in its socio-economic context.⁹ Between Edison's light bulb and today's led, there is not only technological progress, there is a discourse on energy

efficiency in the context of a world anxious about its future. These global evolutions are not easy to understand. We certainly need archives, statistical data,¹⁰ preferably long-term. A certain number of researchers have dared to adopt this quantitative approach which makes it possible to envisage in the long-term the quantities of energy absorbed and the distribution of sources of energy.¹¹ However the quest for figures prior to the 19th century is difficult, even in countries which have preserved old archives. And in the regions where the sources are still less reliable and rarely followed up, collecting figures can be a real challenge. Prices of energy are fundamental data not only for the consumer but also to explain the competition and the preferences between energies. Price must however be moderated according to budgets, the wish to distinguish oneself or local characteristics. Thus a new type of energy on the market is in general expensive and suffers awhile from its luxury image. The quantitative approach (concerning consumption, prices, exchanges...) will be balanced according to historical contexts, the wishes of customers, public policies and many other socio-economic factors. For energy is the daughter of its time.

CRISES, DEADLOCKS AND RENEWAL

Energy is thus a living, evolving and reactive system. And it is probably less linear than one might think. With hindsight, some uninformed minds might imagine the history of energy as an unstoppable machinery, a logical sequence of technical solutions adopted unanimously. In

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⁷ Reynald Abad, "L'Ancien Régime à la recherche d'une transition énergétique ? La France du 18^e s. face au bois", in Yves Bouvier et Léonard Laborie, *L'Europe en transitions. Énergie, mobilité, communication 18-21^e s.* (Paris: Nouveau Monde éditions, 2016), 23-84.

⁸ Edward Anthony Wrigley, *Energy and the English Industrial Revolution* (Cambridge: Cambridge University Press, 2010).

⁹ David Edgerton, *The Shock of the Old. Technology and Global History since 1900* (New York: Oxford University Press, 2007).

¹⁰ Many quality resources are becoming available: retrospective statistical yearbooks (France 1966), global data (OECD, BP), works of historians: Angus Maddison, *L'économie mondiale 1820-1992, Analyse et statistiques* (Paris: OCDE, 1995) ; Dominique Barjot, *L'énergie aux 20 et 21^e s.* (Paris: Presses de l'École Normale Supérieure, 1991) ; Bouda Etemad et Jean Luciani, *Production mondiale d'énergie 1800-1995* (Genève: Droz, 1991).

¹¹ The work of Roger FOUQUET provides excellent historical landmarks on the question of transitions: for example, Roger Fouquet "The Slow Search for Solutions: Lessons from Historical Energy Transitions by Sector and Service", *Energy Policy*, vol. 38, n°11, 2010. From the same author : *Heat, Power and Light : Revolution in Energy Services* (London: Edward Elgar, 2008).

reality, this evolution was marked by hesitation, crises and impasses. Wrong tracks, speeches with no follow-up and aborted alternative solutions must also be part of our research because they reveal the expectations of society. And if we think of failures, it is with the easy hindsight of those who can prophesy the past. Let us take an example: in the 19th century there was a strong belief in pressurized air which seemed simple to use, effective and universal; be it for the railway, electricity, industrial machines, the cold production or communications, a whole industry supported by a positive discourse developed (in some cases up until today). And yet, pressurized air is only granted a few lines in our textbooks, condemned because of its insufficient posterity. Likewise, there were gas refrigerators, competing against electricity, in the Salon des Arts Ménagers. Charcoal was long deemed to make better steel than fossil coal. The electric aircraft had its heyday at the end of the 19th century... We must include these missed opportunities so as not to transform a complex history into a clear path marked by determinism and simplification. Let us go further. Since the time-dimension is our horizon as historians, is the very concept of impasse relevant? The electric tram disappeared from many cities because it obstructed the traffic and was quite dangerous. Half a century later, it is experiencing a revival, if only to get rid of cars and develop public transport. Another example: it is a fact that air conditioning, which is very energy-consuming, will be one of the essential needs of the future due to global warming and increasing urbanization. Yet this usage is still widely perceived in certain countries as a luxury, and not yet as a comfort. We will have to change this view. In short, let us not present too soon a formatted history but rather move towards a certain proliferation linked to the needs and potentialities of a given time

- 7 As for crises, they can reveal characteristic traits of a society. Economic tensions have generally been accompanied by a lowering of energy-consumption (for example during the Great Depression). But there again we must broaden the perspective: it is not impossible

that innovation in the field of energy should have played a counter-cyclical role. Industrial electricity and oil developed at the end of the 19th century at a time of economic contraction and this undoubtedly played a part in boosting the economy at the beginning of the following century. Another type of crisis: the fear of being in need. The lack of wood at the end of the Ancien Régime has already been mentioned. In the 19th century in 1865, W.S. Jevons wrote a book entitled *The Coal Question: an Inquiry Concerning the Progress of the Nation and the Probable Exhaustion of our Coal-Mines*. Not so long ago the peak-oil was forecast and dated, and with it came the threat of a shortage of oil. A history of energy forecasts, with or without figures, would be useful: pessimistic or Malthusian estimates have, in a number of cases, proved wrong. A detour through history enables us to confirm that the worst is not always certain. But energy crises can also take much more acute forms. Conflicts have provoked blockades, directly affecting the sources of energy: world wars, the Suez crisis, the Yom Kippur war, etc. Consumers kept the memory for a long time, their reflex being to quickly “fill up“. Finally, electrical systems, although more and more interconnected, experience supply disruptions which are often spectacular. The electrical blackouts hit New York, Western Europe and more recently India.¹² The fear of total electricity failure has produced a few terrifying novels like *Ravage* by René Barjavel¹³ (1943): it shows how the brutal and unexpected disappearance of electricity provokes the collapse of society and its values in a very short time.

TRANSITIONS AND BREAKS

Traditionally, history constructed by historians unfolds according to distinct and individualized stages, punctuated by breaks or transitions. In this unfolding, where the evolution of energy is concerned, it appears that the most distant periods (the discovery of fire, the development of

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¹² David E. Nye, *When the Lights went out. A History of Blackouts in America* (Cambridge: The MIT Press, 2010).

¹³ Published for the first time by Editions Denoël.

crops and sedentarization) pose specific problems (dating, means used, the place of fire in the organisation of society)... and require much more research. For the most contemporary phase, this evolution is described as a succession of periods dominated by three industrial revolutions.¹⁴ The 19th century is presented as the century of coal and rail, then the most advanced societies added innovations leading to breakthroughs, such as the internal combustion engine and the electric engine. The most contemporary stage can rely on nuclear energy and the recognition of the finiteness of the resources of the earth.¹⁵ The contemporary period is thus marked by a double acceleration from the point of view of energy consumption: that linked to coal and steam in the middle of the 19th century, that, closer to us, with the take-off of oil-consumption. The 20th century is undoubtedly a break, above all after the Second World War and the acceleration of needs in energy due to greater mobility and rather energy-consuming ways of life. Vaclav Smil shows that a large American house in the year 2000 consumed energy which would have required 6000 slaves in ancient times.¹⁶ It remains to be seen, if one accepts the concept of industrial revolution, how and why these transitions and energy-breaks happen. The advantages of certain types of energy and the drawbacks of others (technical characteristics, price, sustainability) apparently provide sufficient explanation. Coal is more abundant than wood (at least in some countries) and has a strong calorific power; electricity is more flexible and more effective than coal; natural gas performs much better than coal gas; oil is a concentrated energy well adapted to motor vehicles, etc.

¹⁴ François Caron, *Les deux révolutions industrielles du 20^e s.* (Paris: Albin Michel, 1997). Also, François Caron, *La dynamique de l'innovation. Changement technique et changement social (16-20e s.)* (Paris: Gallimard, 2010).

¹⁵ Astrid Kander, Paolo Malanina, Paul Warde, *Power to the people. Energy in Europe over the Last Five Centuries* (Princeton: Princeton University Press, 2013). Roger Fouquet, Peter J.G. Pearson, "A Thousand Years of Energy Use in the United Kingdom", *The Energy Journal*, vol.19, n°4, 1998.

¹⁶ Vaclav Smil, "World History and Energy", *Encyclopedia of Energy*, vol. 6, 2004, 558. He adds that in the 19th century, a landowner would have needed 3000 workers and 400 horses.

Yet, coal was known long before Watt's engine (preceded by that of Newcomen), city gas was born around 1800,¹⁷ electricity was not unknown since Volta and Faraday at the beginning of the 19th century, oil had been used for a long time but for low energy-consuming uses. In this list it is implied that energies were competing and that the best adapted ended up winning. But it would be equally justified and instructive to study the forms of energy from a *complementary* angle. On the one hand it is clear that energy transitions concerning the means of production are rarely substitutions. All the research shows on the contrary that sources of energy accumulated, in varying proportions. Transition signifies in reality the arrival of a new source of energy on top of the preceding energies. Coal continued to be used a lot at the end of the 19th century even if the second industrial revolution is supposed to have been based on oil and electricity. Complementarity is as apparent in the uses: before 1914, electric motor cars seemed to have as bright a future as motorcars with an internal combustion engine. In fact, the energy system became as it were more complex, unbalanced, then once again balanced. This is what Schumpeter had already said: "New does not come from old, but appears aside of old, competes against it until it destroys it".¹⁸ Thus complementarity is often a stage of what one could call the many facets of energy transition. This is especially true since the men of the time compared, and experimented. Societies hesitated just as we hesitate between solutions the advantages of which are not properly assessed. Towards 1800, it was not obvious to choose a lighting mode. The development of electric lighting was in effect curbed by the invention of the incandescent mantle which gave city gas a real advantage in terms of brightness as well as very competitive prices.

The theme of transition is still very topical and it pleases historians for it contains the notions

¹⁷ See Jean-Pierre Williot's thesis, *Naissance d'un service public : le gaz à Paris* (Paris : Editions Rive Droite, 1999).

¹⁸ Joseph Schumpeter, *Capitalisme, socialisme, démocratie* (Paris: Payot, 1951), 40. It is the familiar notion of "creative destruction".

of time and change. But insofar as everything is transition, passing from one state to another, the term must not be overused. It should lead to some comparative studies so as not to wear out the concept too soon. Technical qualities, prices and commercial skill have all played a part in these stages of choice. But one can add an essential factor, hardly quantifiable but quite real: the field of images, positive or not. The media and public opinion can thus tilt decisions. For example, the rivalry between electricity and city gas at the end of the 19th century is reflected even in the Parisian music-hall: this opposition became a popular theme which showed very soon that the modernity of electricity had won over the old-fashioned image of city gas. The opposition between renewable energies and nuclear power also emerges through the development of strong images: the sun shines for all versus nuclear power marked with an original stain, the bomb. The contestation of nuclear energy in Germany was carried out with a sun on which was inscribed “Nein Danke”. The energy tipping point is thus a question of opinion. To explain the enthusiasm or mistrust requires an in-depth study of society. The image can anyway be double, which does not make interpretation simpler: coal in the 19th century is perceived as indispensable, it is the “bread of industry”, “King Coal”, but it is also feared and deplored. The black towns of England or of the Ruhr harbour both an extraordinary activity and a certain despair. Oil may be “black gold” but it is accused of deteriorating both social relationships and the environment in the production areas. As a counterpoint, the peak of praise was no doubt reached around the fin-de-siècle electromania (in France, one celebrates the ‘Fairy electricity’)¹⁹. Every society, at a given time, prioritizes its preferences concerning energy according to criteria which are not always objective.

¹⁹ On imagination and electricity: Alain Beltran et Patrice Carré, *La vie électrique 18-21^e s. Histoire et imaginaire* (Paris: Belin, 2016).

ENERGY, AN INSTRUMENT OF POWER²⁰

Energy resources are not distributed equally throughout the world. As a consequence some countries export while others have to import more or less massively. The first consequence is that transportation of energy has developed since the 19th century. Wood was well adapted to transportation over land or by rivers for varying distances but rarely internationally. Coal opened a new era. Some countries benefited from their coal resources. It is well known that the proximity between coalfields and consumer areas in Great Britain was a decisive element for the “take-off” of the country and that the part played by English canals need not be demonstrated. The importance of coal is also mentioned in the recent work of Peter A. Schulman²¹ who shows that the preoccupation with the supply of coal led the Americans very early on to the notion of “energy security”. France did not benefit from such advantages: her coal was of inferior quality and transport was costly. The country was the first importer in the world between the two wars. Hydrocarbons followed this movement, amplifying it. Oil and natural gas (the latter can be liquefied and transported in tankers) draw a map of transport which gives 20-21th century energy a global and geopolitical dimension.²² Oil remains today the most transported product. As a consequence, the straits of Malacca, the straits of Ormuz and the Suez Canal, are and remain places of tension which underlines the fact that energy transport reveals itself to be a fragile, as well as a strategic cord. In wartime, the energy blockade has proved to be quite effective. Underwater war in 1917 cut France from its oil supply. This attack almost cost the country the final victory. During that same war, central powers, rich in coal and poor in oil, tried in vain

²⁰ Jean-Claude Debeir, Jean-Paul Deléage, Daniel Hemery, *Une histoire de l'énergie. Les servitudes de la puissance* (Paris: Flammarion, 2013).

²¹ Peter A. Shulman, *Coal and Empire. The Birth of Energy Security in Industrial America* (Baltimore: John Hopkins University Press, 2015).

²² Jean-Pierre Favennec, *Géopolitique de l'énergie. Besoins, ressources, échanges mondiaux* (Paris: Technip, 2009).

to stock up on oil, hence the importance of a country like Rumania, the only country in Europe to possess significant oil resources. The conflict between the United States and Japan, even before Pearl Harbour, started with the refusal of the Americans to supply oil to the Empire of the Rising Sun. Hitler's aims in war were not strictly speaking to do with energy, but his offensive towards Baku and Mesopotamia clearly had oil as an aim. Finally, we know the Germans, for lack of oil, developed a successful chemical industry in order to obtain synthetic oil. As a matter of fact, the technical history of weapons²³ is that of a race for power: an 18th century canon represents a kinetic energy of 300 000 joules against 20 joules for a traditional bow.²⁴

12 Outside periods of war and international crises, there is, according to Montesquieu: "a general rule, which is that wherever the mores are gentle there is trade, and wherever there is trade, there are gentle mores".²⁵ In the case of energy, the traditional function of a transport network is of course to connect a buyer to a seller, customers to providers. If we follow Montesquieu it is a commercial, neutral and pacified link. However, the example of the transport network for natural gas in Europe in the second half of the 20th century enables us to draw apparently contradictory lessons. It is a network which effectively links East and West of Europe, the distant resources of Russia with the western borders of Europe. During the cold war, exchanges between the communist East and the capitalist West upset the American President who considered that his European allies were too dependent on Moscow. Nevertheless, this network developed independently of the oppositions between the great powers, following a mostly economic

logic.²⁶ Conversely, Ukraine, in conflict with Russia over the tolls for the natural gas transiting through its territory, suffered supply cuts which consequently affected a certain number of countries in central Europe. Hence the present construction of a whole series of pipelines meant to insure the continuity of supply while avoiding Ukraine. The political dimension of the networks²⁷ (their justification?) must not escape us either.²⁸ The gas and oil network which linked the "sister countries" to ex-USSR ("Droujba", the oil pipeline of Friendship) had both a political and economic dimension: it was a means to reinforce the weight of the USSR. And featuring prominently among the major works planned by the European Union are networks for the transport of gas and electricity which should create more solidarity between European countries.²⁹

FROM THE DISTRIBUTION NETWORK TO THE CONSUMERS

The distribution of energy is essential data which has probably not received all the research it deserves., The small companies which delivered coal and wood before the construction of networks are still a recent memory and have probably not disappeared from developing countries. For long, grocers delivered oil in five-litre jerry-cans. But soon the gas pump replaced bulk. A pump became a petrol station, a meeting place if not a place to live, the symbol of a civilization of the car and mobility which has recently taken an electrical turn.³⁰ Some blind spots remain,

²³ Clifford E. Singer, *Energy and International War. From Babylon to Baghdad and Beyond* (New Jersey: World Scientific, 2008).

²⁴ Vaclav Smil, *Energy and Civilization. A History*, op. cit., note XXX, 364.

²⁵ Charles de Secondat de Montesquieu, *De L'esprit des lois*, Book XX (Des lois dans le rapport qu'elles ont avec le commerce considéré dans sa nature et ses distinctions), chapter 1 (Du commerce), (Paris: Gallimard, 1995), 219.

²⁶ Per Högseius, *Red Gas. Russia and the Origins of European Energy Dependence* (New York: Palgrave MacMillan, 2013). Jeronim Perovic, *Cold War Energy. A Transnational History of Soviet Oil and Gas* (London: Palgrave MacMillan, 2017).

²⁷ A classic on the electric network: Thomas P. Hughes, *Networks of Power. Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983).

²⁸ An interesting reflection: John G. Clark, *The Political Economy of World Energy. A Twentieth-Century Perspective* (New York: Harvester Wheatsheaf, 1990).

²⁹ Vincent Lagendijk, *Electrifying Europe. The Power of Europe in the Construction of Electricity Networks* (Amsterdam: Aksant, 2008).

³⁰ Joanne Brady, "Electric Car Cultures: An Ethnography of the Everyday Use of Electric Vehicles in the UK" (Master Thesis, Durham University, 2010).

outside the mesh of our knowledge: the businesses providing home delivery for fuel and bottles of liquefied gas... From the end of the 19th century, urban networks became regional then changed into national networks.³¹ The ultimate electrical network is a universal network (like the post office or the telephone) branching out towards every customer. Its construction, its integration in the landscape deserves to be known. Especially as these distribution networks have become (more) intelligent: the integration of renewable energies and of digital capacity opens the way for *smart grids*, *smart cities* and intelligent meters. A network which, in spite of its highly capitalistic weight, has to adapt to transformations of a technical, legal and competitive order. Today's historians must analyse these 2.0 or 3.0 networks which are evolving as we watch. And they must understand the countries where there are no networks, or else embryonic ones, but which have other forms of distribution.

14 And at the end of these networks of varying sizes, there is the consumer. What would energy be without the consumer? Left aside for a long time, he has become the customer and as such can choose and has to be listened to. He may be industrial, agricultural, urban, isolated, etc. In each of these different economic or geographical positions, he will think differently.³² Thus the chronology of the electrification of rural areas is quite specific according to the different European countries. On the side of industry, needs can be impressive: businesses known as electro-intensive (electrochemistry and electro-metallurgy) have needs comparable to those of a town. At the other end of the scale, households were not, for a long time, really preoccupied by energy, because it only represented a small share of their budget. However, more recently, one discovers that a sizable share of the population lives in a state of energy insecurity, a new division in society which the authorities

are increasingly taking into consideration. The more modest homes are in general described as “energy leaks” and this is where an important effort must be made which has as much to do with sound economy as with social justice. Finally, this customer is also a woman. Studies on energy still do not take gender into consideration very much.³³ No doubt, some thought has been given to task sharing but household appliances do not seem to have revolutionized male-female relationships.³⁴ Reflections on the contemporary world³⁵ show clearly that energy policy is not a neutral entity.³⁶ The roles attributed to women and men in the supply and use of energy are often different, the hardest tasks often falling to women. Going back in time, it is very probable we would find the same segmentation.

Let us leave the industrialized world: here, the consumer is still generally unknown. For modernization (a very vague word) did not take place following a single model, derived from 19th century Britain and 20th century United States. What do we know of energy use in the course of thousands of years of history in Punjab or Southern Africa? To tell the truth, very little: probably because of the scarcity and incompleteness of sources, possibly also because Western or local historians have not yet integrated the “energy” dimension as central to the understanding of

³¹ Alain Beltran, Fabien Roques, Michel Derdevet, *Énergie. Pour des réseaux électriques solidaires* (Paris: Descartes, 2017).

³² David E. Nye, *Consuming Power. A Social History of American Energies* (Cambridge: The MIT Press, 1998).

³³ An examination of the articles published in *Gender and History* reveals this in spite of the excellent quality of this publication.

³⁴ Ruth Schwartz Cowan, *More Work for Mother. The Ironies of Household Technology from the Open Hearth to the Microwave* (New York: Basic Books, 1983); from the same author: “How the refrigerator got its hum”, in Donald A. Mackenzie, Judy Wajcman, *The Social Shaping of Technology* (Milton Keynes UK: Open University press, 1999), 202-218. By the same author, “How the refrigerator got his hump”, Donald A. Mackenzie, Judy Wajcman, *The Social Shaping of Technology* (Buckingham Open University), 202-2018.

³⁵ For example ENERGIJA, Newsletter of the ENERGIJA International Network on Gender and Sustainable Energy, or published by the European Union, Martin Anfinssen, Sara Heidenreich, *Energy and Gender. A Social Sciences and Humanities Cross-Cutting Theme Report* (Cambridge: Shape Energy, 2017).

³⁶ Riitta Rätty, Annika Carlsson-Kanyama, “Energy Consumption by Gender in some European Countries”, *Energy Policy*, 38/1, 2010, 646-649.

the evolution of societies. These regions are often only referred to in terms of delay and therefore of catching up. But didn't they live by adapting to environments where wood and water were no doubt scarce? We must for a moment distance ourselves from the industrial model, if only to understand it better. Adopting a world point of view³⁷ (global is probably very difficult) should enable us to envisage other routes,³⁸ other energy balances by relying on the new approaches of World History. If wood has decreased in the production of energy in Europe, China or India, the timeline of substitutions is not the same. Besides, the present world is also a very unequal world, where 10% of the world population monopolize around 45% of the consumption of energy. Did preceding periods, before the development of coal, experience such disproportions?

ENERGY, COMPANIES AND DEMOCRACY

16 One must not forget that the history of energy is also linked to the economic reality of companies. If many micro-companies have developed their activity on the scale of petty trade (for instance the installers, who remain largely unknown), what is striking historically is that the energy sector gave birth to very large companies. This was the case in the 19th century with the all-powerful mining companies, quite often linked to the railway companies: didn't the *Internationale* denounce the "steel and railway barons"? Then the oil sector gave birth to the Standard Oil Company or Shell, so formidable—practically retaining the monopoly—that the United States used their anti-trust legislation for the first time to break the John D. Rockefeller company into less powerful (in theory ...) companies. The post-war nationalisations in Europe created giants which were called British Gas,

37 See for instance: Alain Beltran, Léonard Laborie, Pierre Lanthier et Stéphanie Le Gallic (ed.) *Electric Worlds/Mondes électriques. Creations, Circulations, Tensions, Transitions (19/21st C.)* (Bruxelles : PIE Lang, 2016). Several articles are devoted to Africa, China, South America...

38 For instance, Rodrigue Lekoulekissa, *Electrification en Afrique : le cas du Gabon (1935-1985)* (Paris: L'Harmattan, 2011).

ENEL, Electricité de France or, in the oil sector ENI, Statoil or Elf-Aquitaine. It is usual to find, in the first ten companies of a country, electricity, gas and oil companies. Emerging countries are not left behind with Petrobas, Aramco or the Chinese companies which have rapidly reached a global size. The power of these societies is both a socio-economic and political stake.

The development of these large companies and the global issues of energy at a time of global warming have recently increased the thinking on the theme of the relationship between democracy and energy. Timothy Mitchell received a warm welcome for his book *Carbon Democracy*,³⁹ even though some of his theses surprised his readers. Mitchell links the evolutions of democracy since the 19th century to the modes of production of energy and above all to the means of action of workmen. Thus the miners, strong in numbers and well organized, were able to lead decisive actions in sensitive places and weaken the most fragile production lines. However, the transition from coal to oil profoundly changed the situation. For oil is not a manpower industry, it is more scattered and transportation by boats or pipelines lends itself less to interventionism.⁴⁰ Consequently, the attempts at blockage or sabotage would be much more difficult with black gold, which has enabled large fortunes and trusts to develop, to conquer and monopolize power. But clearly it is around nuclear energy that the debate has become politicized in the most sensitive way. The decision to set up civil nuclear power plants was felt by many protesters in the 1970s to be non-democratic because it was imposed by a lobby made up of a few experts and heads of companies ("the

39 Timothy Mitchell, *Carbon democracy. Le pouvoir politique à l'ère du pétrole* (Paris: La Découverte, 2013), preface by Michel CALLON and Bruno LATOUR. By the same author: *Petrocratie : la démocratie à l'âge du carbone* (Alfortville: Ère, 2011). And also, Frédéric Denhez, *La dictature du carbone* (Paris : Fayard, 2011).

40 Among the huge literature on oil, one can mention that the theme of the excessive power of oil companies is to be found very early in Ida Tarbell, *The History of the Standard Oil Company* (London: W. Heineman, 1905) as well as in Lenin (Imperialism, the Supreme Stage of Capitalism, 1916).

nucleocrats”).⁴¹ Nuclear energy⁴² has become unwittingly the symbol of dangerous decisions imposed from above, disrespectful of the will of citizens and often motivated by “greatness”⁴³ and prestige. This criticism is one of the basics of political ecology which, from one European country to another, does not have the same characteristics. Nevertheless in Switzerland, Germany and France, the nuclear dimension in the protest against the major technical choices is often dominant.⁴⁴ The political front which demands more democracy is in fact quite heterogeneous: it gathers together left-wing activists hostile to profit (even in the case of public companies), NGOs which defend nature in all its forms, scientists who oppose engineers, certain media... The German *energiewende*⁴⁵ (energy watershed) acts in favour of giving up nuclear facilities following the conclusions of an Ethics commission headed by a clergyman. It would not be wrong to say that the struggle against nuclear energy is both the matrix of a certain dissent and the smallest common denominator between groups that are often seeking to unite. These different movements have had an echo in Germany and the Germanic world (Austria has no nuclear plant, Switzerland complains of those of its French neighbour). Nuclear energy in the vast array of means of production is not in reality a type of energy quite like others. Firstly on account of its military origin, giving man the power of

self-destruction.⁴⁶ Born of “Big Science”, nuclear energy requires important technical and financial means, a real policy tending in the best of cases towards more energy independence, in the worst towards proliferation. The first of these arguments has served in particular in France to justify a vast electronuclear program. The structure of development and the system which carries nuclear energy are denounced by a certain number of thinkers, in particular in Germany.⁴⁷ In a word, nuclear development would necessitate a powerful, centralised, technocratic state admitting no counter-politics in the name of science and progress. And so, in a symmetrical fashion, the opposition to nuclear energy puts forward renewable energies, decentralisation, local production, solidarity networks. To contest nuclear power means to combat the role played by the State as guarantor of security and of the continuity of public services. It is also to contest the omnipotence of technology that would lead the world to an impasse.⁴⁸ These notions can be found, condensed, in an important book, *Der Atom-Staat*⁴⁹ by Robert Jungk. The work followed on from many reflections by this former journalist on nuclear power. Jungk analyses the transformation of a state that chooses nuclear power (whether civil or military), as the convergence between Big Science, big capital and strong government. One of the main ideas of the book is that confronted with the permanent threat weighing upon nuclear power (accident, attack), the State must put in place a permanent state of emergency which by definition restricts liberties and modifies messages.

⁴¹ It is the title of a book of interviews by Philippe Simonnot (Grenoble : Presses Universitaires de Grenoble, 1978).

⁴² Amory B. Lovins, *Nuclear Power. Technical Bases for Ethical Concerns* (Friends of the Earth, 1975) and *The Energy Controversy* (Friends of the Earth, 1979), etc. Lovins was translated belatedly in France even if his first book in this language was published as early as 1975. (*Stratégies énergétiques planétaires*, Christian Bourgois pub.)

⁴³ Stéphane Savard, Martin Pâquet (dir.), “Energie et citoyenneté”, *Globe, Revue internationale d'études québécoises*, vol. 13, n°2, 2010. Gabrielle Hecht, *The Radiance of France. Nuclear Power and National Identity after World War II* (Cambridge: MIT Press, 1998).

⁴⁴ For the Canadian example, see Ronald Babin, *L'option nucléaire : développement et contestation de l'énergie nucléaire au Canada et au Québec* (Montréal: Boréal Express, 1984).

⁴⁵ Craig Morris, Arne Jungjohann, *Energy Democracy, Germany's Energiewende to Renewables* (London - New York: Palgrave Mac Millan, 2016).

⁴⁶ See Martin Heidegger on *The Atomic Age*, in particular his 1955 lectures. More recently, Ulrich Beck with *La société du risque. Sur la voie d'une autre modernité* (Paris: Aubier, 2001), experienced an important success owing largely to the Tchernobyl catastrophe.

⁴⁷ We base ourselves in particular on a very clear and well documented text: Andreas Folkers, “Nuclear States, renewable Democracies?”, *LIMN*, n°7, 2016., (LIMN, http://limn.it//nuclear-states-renewable-democracies/?doing_wp_cron=1508318414.2110929489135742187500)

⁴⁸ This criticism is not new: one can think of Lewis Mumford : *Technique et civilisation* (Paris: Parenthèses, 2016), published in the United States in 1934.

⁴⁹ Robert Jungk, *Der Atom-Staat* published in French under the title *L'État atomique, les retombées politiques du développement nucléaire* (Robert Laffont, 1977).

18 With the arrival of NICT (new information and communication technologies) and the rise of renewable energies (essentially solar and wind power), the link was established between these new technical possibilities which free the citizen and the democratic aspirations which had been repressed for too long. Certain texts by Jeremy Rifkin⁵⁰ on the third industrial revolution highlight the disruption that should take place thanks to the technique of *smart grids*, *smart cities*, and exchanges between citizens. Consequently, if one follows Rifkin, the great companies of the energy sector are doomed to disappear. The author of the *Third Industrial Revolution* believes that a certain empowerment of territories is possible (which does not however mean self-sufficiency) thanks to the new technologies which make the sharing of data possible. A democratic and essential notion is put forward: the “collaborative commons”, sustainability, cooperation and the intrinsic worth of objects replace consumerism, competition and selfishness. The allusion to “commons” harks back to the farming practices of the Ancien Régime where part of the land (crops or livestock) was used in common by villagers. The consumer who was alienated would henceforth become “prosumer”, both *producer* and *consumer*. There would be the advent of a new society, more cohesive and more democratic. Finally, by both Mitchell and Rifkin, official experts are either denounced or disqualified. Indeed, according to these critical thinkers, the expert speaks “from somewhere” and is not objective. Expertise must be transferred to every citizen through a democratic and cohesive approach. Is not the speech of the engineer or of the representative of public powers the accomplice of the powerful?⁵¹ Conversely, is not the speech of the committed activist citizen by definition truer, more sincere and more effective? Energy is not

the only field in which these shifts are manifest. But these shifts are clearly symptoms of a society that—at least in part—no longer wants to reason as it did before.⁵²

ADAPTING CONTEMPORARY NOTIONS TO PAST PROBLEMATICS: ON THE TOPICALITY OF HISTORY

Needless to say, since the 1970s, the *issue* of energy has come to the forefront of national preoccupations, European and above all world-wide.⁵³ On the one hand, oil prices have undergone sudden rises and counter-shocks whereas stable prices had long characterized black gold. This instability raised the acute question of energy dependency/independence, whether for oil or gas. But the least one can say is that European reactions in the 1970s were not in unison. Energy-saving, global warming, the development of renewable resources, the destiny of nuclear power and fossil fuels but also the question of pollution⁵⁴...put energy issues at the heart of major preoccupations. The key word since the 1970s-1980s has become *sustainable*.⁵⁵ Certainly, the chronology of the raising of awareness and of environmental policies has recently given rise to perceptions that range from a scientific approach to (occasionally) a critical manifesto.⁵⁶ The very vocabulary takes

⁵² Benjamin Dessus, “L’énergie au défi de la démocratie”, *Alternatives économiques*, N°24, 2004, pp90/105.

⁵³ For example, David Howell, *Energy Empires in Collision. The Green Versus Black Struggle For Our Energy Future* (London: Gilgamesh Publishing, 2016).

⁵⁴ Geneviève Massard-Guilbaud, *Histoire de la pollution industrielle, France 1789-1914* (Paris : Editions de l’EHESS, 2010). A recent work: François Jarrige et Thomas Le Roux, *La contamination du monde. Une histoire des pollutions à l’âge industriel* (Paris: Seuil, 2017).

⁵⁵ Jose Goldemberg, Thomas B. Johansson, Amulya K.N. Reddy, Robert H. Williams, *Energy for a Sustainable World* (New Delhi: Wiley Eastern Ltd, 1988). A large share of the work deals with “developing countries”.

⁵⁶ As an example, Charles-François Mathis et Jean-François Mouhot (dir.), *Une protection de l’environnement à la française ? (19-20° s.)* (Paris: Champ Vallon, 2013). Céline Pessis, Sezin Topçu, Christophe Bonneuil (dir.), *Une autre histoire des trente Glorieuses. Modernisation, contestations et pollutions dans la France d’après-guerre* (Paris: La Découverte, 2013). Stefano Cavazza (a cura di), “Ambiente,

⁵⁰ For example, Jeremy Rifkin, *The Third Industrial Revolution. How Lateral Power is Transforming Energy, the Economy and the World* (New York: Palgrave Mac Millan, 2011).

⁵¹ There are interesting remarks in James C. Scott, *Seeing like a State. How Certain Schemes to Improve the Human Condition have Failed* (New Haven: Yale University Press, 1999).

on a meaning: solar,⁵⁷ wind power and geothermal power have moved from the word “new” to the words “clean”, “alternative” or “renewable”. Laying aside the risk of anachronism, we must avail of this topicality to put a series of contemporary questions to the past, and to give the questions of today the long-term analyses which are essential. The past nourishes the present, the present gives meaning to past events. Today, certain notions such as energy efficiency and energy intensity are part of a common reflection. These themes, operating perfectly, can be translated into the near or distant past with all due methodological precautions. In this way we may sometimes reach counter-intuitive conclusions.

20 The term disruption, sifting through history, is doubtless well adapted to certain characteristics of our time. For example, energy growth is no longer closely correlated to economic growth, as was the case for a long time. The world—with one or two notable exceptions—has decided to enter into a new energy transition. This wish is accompanied by an upsurge of statistics and studies that take into account the situation since the beginning of the industrial era (with the affirmation of the notion of Anthropocene).⁵⁸ Despite this historical detour, it is not certain that every country interprets the notion of transition in the same way. Certain costed objectives were put forward (for example by the European Union, by COP21 or at the time of the Paris agreement). Can the ambition of these figures rely on comparable historical data? In particular, the question of the downturn in consumption, programs in favour of renewables and the slowing down of nuclear power (in spite of the fact that it is carbon-free) give rise to serious fighting over figures. In fact, nothing can be taken for granted and some fossil energies still have a future, be it oil, natural gas and even coal. Seeing how complex things are today, to rely on

a few historical trends is probably not the solution, but only part of it. For technology, politics and consumption do not evolve at the same speed. To turn to the last two or three centuries enables us to illustrate this reality. Not forgetting that, yesterday as today, social considerations cannot be left aside: an energy policy also has its contradictions. The NIMBY or BANANA⁵⁹ syndromes are there to prove it. Certain notions must even be reconsidered: what do the words progress, comfort, solidarity mean today? The feeling of anxiety, of a race against time, some would say a race towards the abyss, must not at all prevent us from taking the time to find in the past a history of energy capable of identifying the right definitions and of asking the most relevant questions correctly.

21 These lines are neither a program nor a balance sheet. A conclusion mainly: a great number of journals on energy exist, but few touch upon historical issues: one can mention however *Energy Policy* and *Energy Research and Social Science*,⁶⁰ which regularly contain retrospective articles. Of course, all the great general history journals have at one time or another published articles about the field of energy. There lacked however a journal devoted entirely to the question. And to start this editorial adventure, it is worth stating that the theme which will be addressed in the years to come is an essential element to understand the evolutions of past, present and future societies. History, which tries to analyse man in society, his efforts to dominate Nature and his wish to exceed his destiny limited in time, must enrich itself with the many facets of our energy evolution. Let us remember the words of the great French historian Jules Michelet,⁶¹ which can apply to the quest

Risorse energetiche e politica in prospettiva storica”, *Ricerche di Storia Politica*, XXI, 1, 2018.

⁵⁷ Denis Hayes, *Rays of Hope. The transition to a Post-Petroleum World* (New York: Norton, 1977).

⁵⁸ See the recent dossier in the *Annales Histoire, Sciences sociales: “Anthropocène”*, (April-June 2017, 72/2, EHESS-Cambridge University Press).

⁵⁹ “Not in My Backyard” ; “Build Absolutely Nothing Anywhere Near Anyone”.

⁶⁰ For example Roger Fouquet, “Lessons from Energy History for Climate Policy : Technological Change, Demand and Economic Development”, *Energy Research and Social Science*, vol. 22, 2016. Or Robert F. Hirsch and Christopher F. Jones, “History’s Contributions to Energy Research and Policy”, *Energy Research and Social Science*, vol. 1, 2014, 106-111.

⁶¹ Jules Michelet, *Extract from Introduction à l’histoire universelle* (Paris: Calmann Lévy, 1879).

for energy: “With the world began a war which must finish with the world, and not before: that of Man against Nature, of mind over matter, of freedom against fatality. History is nothing more than the story of this endless struggle”. The conquest of energy would thus be a concentration of the efforts to wrench man from the terrible limitations of his physical force. It can become the perfect symbol of *hubris*, like Prometheus seizing the fire—when the Gods would destroy us they make us believe there are no limits. It can equally be an object of pride since Humanity has been able to push back the limits and develop the strength necessary for its development. Today, doubt and fear certainly very often dominate. But if there are no *lessons* to be learnt from history, History can nonetheless give us sufficient knowledge and reflection for our contemporaries to be less disarmed and less arrogant. Consequently one can hope that

the approach of the present journal will interest the curious, honest minds of the 21st century, and not only the “academic”. An issue such as energy concerns us all. To avoid easy argument, it will be necessary to deepen knowledge, to listen and to understand. The subject of this journal is therefore broader than an academic discipline. It can be a place for knowledge and debate, to go beyond the controversies, to seek, firmly and modestly, a few historical facts to analyse and contextualize. History thus must be accessible, like an open book. Certainly it is the historian who writes, organises and chooses, but with the most critical mindset so as to reach the space in which a scientifically founded idea moves. Let us then leave the conclusion to a historian: “To understand is not to judge” (Marc Bloch), and to a philosopher: “We expect history to add a new province to the varied empire of objectivity”⁶² (Paul Ricoeur).

⁶² Paul Ricoeur, *Histoire et vérité* (Paris: Seuil, 1955), 24.

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