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Marc Delepouve, Anne-Frédérique Paul

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Toward a Responsible Research

MARC DELEPOUVE & ANNE-FRÉDÉRIQUE PAUL

In the view of some, thanks to research, technological innovation, and markets, humanity will be able to move beyond the environmental crisis; the forward march towards technological progress has become ineluctable and, because of its articulation with markets and companies, constantly increases well-being as well as the quality of life on earth. Others believe that research and technology have become sources of destruction of both well-being and the quality of life and even actual threats to humanity's survival; it is therefore necessary to slow down and perhaps even to put a stop to research, especially its technological component. This point of view has been gaining ground since the dropping of atom bombs over Hiroshima and Nagasaki on 6 and 9 August 1945 and the subsequent publication in 1962 of Rachel Carson's book *Silent Spring* that exposed the dangers of pesticides for both health and the environment. Today, it has been reinforced due to the global environmental crisis.

We do not agree with either of these positions. Against the first position, which regards technological progress as closely connected to the market, we say that the results and applications of research have a considerable impact on both human societies and daily life in the short, medium and long term. Consequently, the choices regarding the priorities and objectives of research, as well as the quantity and allocation of financial and human means, are eminently political. They cannot possibly be left to the laws of the market and to the needs of private companies.

Against the second position, we say that we do not have at our disposal the scientific knowledge or required technologies and techniques needed to confront the environmental crisis and, more specifically, to initiate the necessary and urgent energy transition. We are not living in an ideal world in which, over a short period, behaviours, economic production, and consumption could change radically; we are not in a world detached from the social and geopolitical relations of force, without domination, without greed ... We are aware that neither in 2015 nor in one, two, or three decades could this ideal world become reality, even though to move closer to it we need to pursue positive and consistent transformations. The optimal

theoretical use of available technologies and techniques is impossible. Moreover, even if their use became possible, the available technologies and techniques would not allow us to respond satisfactorily to the different challenges of the energy transition (see chapter two). For example, generalising the use of renewable energies would require us to answer the question of what is to be done when rare-earth elements are exhausted and what to do with the waste.

Assessment of the situation

Initiated on 1 January 2014, the 2020 Horizon programme⁷² brings together the European Union's different sources of financing for research and innovation. It is organised around three key priorities: 'excellent science', 'industrial leadership', and 'societal challenges'. The term industry is to be understood as all activities of companies, including internet services and education. There are seven societal challenges, including:

» *'Secure, clean and efficient energy' (excluding fossil and nuclear);*

*'climate action, environment, resource efficiency and raw materials'. A specific objective is also added: 'The era of seemingly plentiful and cheap resources is coming to an end: raw materials, water, air, biodiversity and terrestrial, aquatic and marine ecosystems are all under pressure. [...] There needs to be a decoupling of economic growth from resource use.' 'The objective of the Societal Challenge 'Climate action, environment, resource efficiency and raw materials' is to achieve a resource – and water – efficient and climate change resilient economy and society, the protection and sustainable management of natural resources and ecosystems, and a sustainable supply and use of raw materials, in order to meet the needs of a growing global population within the sustainable limits of the planet's natural resources and eco-systems.' 'Helping to build a green economy – a circular economy in sync with the natural environment – is part of the answer.'*⁷³

The overall framework is the European research space, launched in 2000, whose 'main objectives

⁷² <<https://ec.europa.eu/programmes/horizon2020/h2020-sections>>.

⁷³ Horizon 2020: Work Programme 2014–2015, p. 5, <https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-climate_en.pdf>.

dove-tail with the Lisbon strategy in order to prioritize scientific excellence, competitiveness and innovation promoted by improved cooperation and coordination of all involved players⁷⁴. So, from its very beginning the European research space supported the Lisbon strategy and its key driver of shaping Europe as ‘the most competitive and most dynamic area of the knowledge economy by 2010, able to combine durable economic growth with a quantitative and qualitative increase in employment and improved social cohesion.’ Today, that same space has become part of the Europe 2020 strategy, launched in 2010 and organised around seven initiatives including :

» *“Innovation Union” to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.’*

» *“An industrial policy for the globalisation era” to improve the business environment, notably for SMEs, and to support the development of a strong and sustainable industrial base able to compete globally.⁷⁵*

In essence, the Horizon 2020 European project for research and innovation relies mostly on calls for projects to be answered by research entities seeking European financing. These calls for projects require cooperation between research entities but only with a small number of partners. They are thus intended to reduce the fragmentation and overlapping of technological research characterised by a market approach. They in addition create a competitive environment that goes against the nature of research and that negatively affects necessary cooperation. In accordance with this logic, they require public-private partnerships that are focused on the short-term profit requirements of private entities. Finally, under pressure from the UE and the European governments, research on energy transition is focused on technology, while in fact the transition cannot be limited to technological aspects alone.

Finally, European research on energy transition suffers from the following disorders:

▶ Contradictory motivations – financial greed and focus on the short term, on the one end, and, on the other, a focus on societal objectives taking into account the medium and long term, with

the first consideration increasingly dominating the latter objectives.

▶ Economic and financial competition between nations and private enterprises. The result is a lack of coordination, a fragmentation, and dispersal of research (all the more so on an international scale), and therefore a waste of the financial and human resources dedicated to research. This situation generates industrial secrets during the research process and in the use of the results, and leads to patents that increase the cost of applying the results and limit their utilisation.

This situation is the direct result of the political choices of the EU and European governments that have given priority to international free trade and to the international free circulation of capital; the consequences have been domination by transnational companies and economic competition between nations. One of the key weapons used in this competition is innovation, more specifically a commercial kind of innovation, guided not by democracy but by the international market and by the greed of the companies and that of their owners (individuals or legal entities). Finally, the choices regarding research priorities, means allocation, and overall organisation are increasingly guided by the requirement to defend and strengthen the competitiveness of Europe’s regions, and are increasingly dominated by transnational companies.

In such a context, it is not surprising to see the difficulties, even the quasi-paralysis, that humanity feels when confronted by climate change, the turning upside down of the earth system and the urgency of an energy transition. These are real difficulties that must be resolved and not eluded by trying out geo-engineering solutions that aim to manipulate both climate and the environment on a global scale, with unpredictable outcomes due to the extreme complexity of the earth system. One such manipulation would be to send chemical compounds (such as sulphur) up into the atmosphere in order to reduce the absorption of solar energy by the weather system. IPCC has issued warnings about this technique called SRM: ‘SRM is untested and is not included in any of the mitigation scenarios. If it were deployed, SRM would entail numerous uncertainties, side effects, risks and shortcomings and has particular governance and ethical implications. SRM would not reduce ocean acidification. If it were terminated,

⁷⁴ <http://www.horizon2020.gouv.fr/cid74154/objectifs-perspectives-eer.html>

⁷⁵ Communication from the Commission, Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth, p. 5, <<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>>.

there is *high confidence* that surface temperatures would rise very rapidly impacting ecosystems susceptible to rapid rates of change.⁷⁶

Opposed to this techno-scientist flight forward, research has played and is still playing its vital role of whistle blower. The urgent need for a global and solidary mobilisation of humanity is based on research results (see chapter 3, part 2). But even there, we can see emerging difficulties. IPCC scenarios are built on foundations of sand, and their media and political instrumentalisation show that there are problems in terms of scientific communication and expertise.

Moreover, in conclusion, R&D contributing to the energy transition is under-financed both in Europe and in the world at large. According to the United Nations Environment Programme (UNEP), out of a total GDP in excess of \$70,000 billion, humanity allocated \$11.7 billion of R&D funds for renewable energy, including less polluting energy sources as well as sources responsible for environmental problems (deforestation, waste, use of rare resources) and social problems (agriculture to produce bio-fuels replacing local production for local use, displaced persons). In other words, when humanity spends \$10,000, less than \$2 is allocated to renewable energy sources (RES) research. Given the importance of the challenge, such a low level of spending is absurd. The share of Europe as a region in global expenditure on energy transition research amounts to \$4.3 billion, or 36% of the global total, an amount that is less unsatisfactory than the amount spent by the rest of the world. Nevertheless, taken together, these expenses are extremely inadequate. Within the \$4.3 billion, the relative weight of company R&D is very large as it amounts to \$2.9 billion, the remaining \$1.4 billion coming from the public sector. Moreover, companies are very influential in the allocation of the public sector share of expenses. Such an influence, wanted by the political entities (European government and EU institutions) is the main cause of the defects and abuses of public research. China, which ranks in first place regarding renewable energy economy shows a different public/private balance with \$1.7 billion allocated by the public sector and \$0.7 billion by private companies. However, the industrial power of China in developing renewable energy sources relies on multiple factors, even if R&D is an essential area.

R&D financing for renewable energy sources expressed in US dollars⁷⁷

	Public sector	Private companies	Total
Europe	1,4	2,9	4,3
China	1,7	0,7	2,4
USA	0,8	1,3	2,1
India	0,1	0,2	0,3
World Total	5,1	6,6	11,7

Principles and propositions

A democratic European energy transition requires putting research at the centre of a plan encompassing several decades (at the least to 2050) and coordinated across Europe with the voluntary collaboration of non-European partners.

The goal is to make the end-to-end energy chain less polluting and less hungry for scarce resources, including RES, energy consumption, transportation, and storage. The energy system as a whole must evolve in this direction as quickly as possible while improving energy access for all and aiming at all the objectives outlined in chapter 3, part 1 here. This also includes the development of research in energy sources and systems for the future, with the long term in mind for present implementation. Far-reaching and coordinated research programmes are necessary for these areas. These programmes must also target concrete short-term results for implementation as well as medium and long-term goals. Adequate means must be provided for three time horizons. And these programmes must fit in an overall single scheme that incorporates all dimensions of the energy system. Finally, they must take into account the unpredictable and also call for democratic validation of the choices. What is needed is integrative planning (defining the energy system as a whole and not a sum of parts) over time, including periodic evaluation and changeable modules as the transition moves forward; only this can turn our definition of the transition into practical realisation.

⁷⁶ IPCC, fifth Assessment Report – Summary for Policymakers, <http://ar5-syr.ipcc.ch/topic_summary.php#node165>.

⁷⁷ Source : UNEP Collaborating Centre for Climate and Sustainable Energy Finance, Global Trends in Renewable Energy Investment 2015. Frankfurt School, <<http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2015>>

The transition towards RES requires research in order to reduce, even eliminate, the consumption of rare earth resources and its negative health and ecological consequences. For example, the alternators of wind turbines contain neodymium, a rare earth element that must be extracted and refined, resulting in adverse health and ecological consequences (numerous cancer cases near extraction sites as well as river pollution). The goal of research must be both to develop less polluting technologies for the extraction and refining of neodymium and also to find materials that can replace it.

Because of the importance of transition and its challenges, and especially because of the danger of a sudden acceleration of weather changes with unpredictable consequences for humans (weather disasters, destabilisation of entire regions, hundreds of millions of climate refugees, civil wars, and new forms of fascism), popular mobilisation must be global. Besides its technical and technological aspects, the transition must include a transformation of economic production, consumption patterns, societal organisation, ways of life, and thus a transformation of mentalities, values, and aspirations. The populations of the earth must own the transition. Each person must be convinced that the transition must happen, must support it, participate in it with solidarity and responsibility. In other words, the transition must be the result of a democratic process. In order to achieve this, Europe and its Member States must rethink their research policies, including research beyond technologies and techniques.

First of all, research results related to global warming must be communicated to society by focusing on what is essential, namely the nature and the importance of the risks of a possible acceleration of the process (without forgetting to point out or, worse, without hiding the limits of scientific knowledge); it must also focus on the mobilisation required to limit climate change and its consequences. To achieve this, we need a new way to communicate and interpret scientific results. In particular, it is necessary to stop the quantophobia on which the long-term scenarios presented by the IPCC rely. These fictitious scenarios focus citizens' attention on a cold technical discourse that fluctuates in time and is thus not appropriate to developing true mobilisation. As for the orientations and financing of climate research, they must be directed towards the development of knowledge and no longer be diverted towards the construction of scenarios intended to serve a certain type of political communication.

The transition also requires political-science, economic, and social research. The capacity to project ourselves into the near future (10-20 years) while preparing the more distant future (20-50 years) must be developed. It is a matter of research but is also an issue that cannot be solved by the present

political and economic system because state policies are dominated by international markets and transnational companies and financial groups (banks, pension funds, and the like). It is thus necessary to conduct research on alternative models to end the domination of the market, of transnational companies, and of banks over political decision-making; this is the key condition for effective democracy and the creation of the capacities needed to prepare the future and develop human solidarity. It is also necessary to think of transforming economic outputs, consumption, and of the organisation of our societies and ways of life. It is indispensable to develop research on societal foundations and models based on the heritage of radical Marxist and anarchist thinkers, on the works of anthropologists and historians, as well as on the more recent and ongoing experiences of democratisation and emancipation. Finally, the energy transition will be democratic only if society at large becomes more democratic. Research must be undertaken to analyse the current processes that weaken and endanger democracy in Europe. To reverse the trend, research must contribute to democratic renewal, for example contributing to the development or the improvement of citizen empowerment schemes based, among other things, on the analysis of different formats for discussion and deliberation and suggestions as to how they can become more dynamic or be renewed.

It is also a matter of understanding and providing concrete definitions of what constitutes a democratic energy transition for Europe. What does it include? What does it bring us? What are its consequences? From this perspective, research could result in broader knowledge and understanding of how its findings can be integrated in the various European models of energy transition. It must also present tools and useful data in order to compare different models and make choices. Research in psychology and social psychology can be directed towards the exploration of processes that engage individuals, as well as towards ownership and representation processes.

In order to become fully engaged in these research directions and to be able to effectively face the challenges, the EU and the countries of Europe must

comprehensively revise their research policies. First of all, the decisions on priorities, research topics, and the amount and allocation of financial and human means must be grounded in democratic debates and decision-making; all researchers must be asked to contribute and their specificities must be recognised. Within such a framework, scientific activities must be undertaken by all involved in a responsible way, focusing on collective and individual scientific freedoms without interference from private companies or political actors. However, science must not be an ivory tower, especially since it is illusory to think of 'scientific people' as pure intellectual creatures; they are first and foremost human beings, likely to make mistakes and work within their human limitations. Therefore, the very dynamics of technological and scientific research must move in total transparency and visibility, in permanent dialogue with society, and with the due respect to ethical limits. Finally, democratic debates and choices must precede and the constantly accompany the determination of the development (or non-development) of the use of research results along with their actual realisation once the decision has been made.

To conclude, the actual implementation of this democratic research policy, which is necessary to

confront the social and ecological challenges of our time, can only move forward and be fully deployed within the context of a social, economic, and political transformation of Europe; the values of solidarity and of collective and individual responsibility must be liberated so that they replace the neoliberal so-called norms and become the engines of human implication for all, and certainly for all researchers

Science does not tell us what to do. At most, scientific results can serve as alerts that convince us to take action. Science can provide us with a space, A, of things we can do, a space, C, of things that cannot be done, and a more or less broad space, B, of things that could or could not be done. In no case does science tell us what to do; this is part of the human decision-making process (for example in the democratic domain). At best, science, technologies, and techniques allow us to determine a field of virtual possible scenarios, the outputs of which are then 'released in society and nature' and then modify 'reality' understood as psychology, societies, and environments. The field of the different possible scenarios is only able to modify 'reality' when the outputs are applied following a choice (or a non-choice).

Science, technologies and techniques	Define a field of possible scenarios
Societal actors: individuals, communities, organisations	Make choices (according to very variable criteria)
Reality of the physical world: human, social, and ecological	Undergoes modifications (always different from expectations or imagined reality)

Appendix – More concerning what scientists can bring to the energy transition issues

Here we emphasise some research contributions required by our energy transition project.

1. **Understanding what is a socio-ecological and democratic energy system transition**, what it entails, and what consequences it can have. These contributions can take the form of a wide range of knowledge and/or of their integration in a model of an energy system transition.

2. **Situational reviews of the existing energy systems**, their interrelations, and their various involvements in other social⁷⁸ and/or ecological systems. These contributions take the form of a wide range of knowledge and/or of their integration in a global review of the existing energy system and/or its integration in other systems; the different dimensions studied include:

- ▶ an analysis of the global energy system, including its different existing constitutive energy systems, their components, the contexts and interrelations between the different constitutive energy systems, the present and foreseeable circumstances, the actors, the spatial pattern, the mobilised resources, the budget and time line, the involved powers and their relations, etc.;
- ▶ an analysis of the interactions between the existing global energy system and other systems (both social and/or ecological);
- ▶ an analysis of the psycho-social contexts, circumstances, and trajectories: individual and collective representations and acceptances of the issue, values, desires, and needs, and the capacity and willingness to act;

This review is an instrument for developing contributions towards designing a global proposal for an energy system transition, evaluating their possible outcomes, and comparing them.

3. **Concerning means and processes** the research contributions address:

- ▶ **means**: solutions and mitigation and/or remediation processes and procedures; adaptation processes and procedures; delaying procedures for gaining time for developing relevant measures; resources mobilised, etc.;
- ▶ and **general processes**: monitoring, adjustment, and governance processes; regulation systems, actors and what they do when and where.

The contributions can then be variously integrated into global propositions designed to **launch, sustain, monitor, and adjust** one given energy system transition.

4. **Prediction systems** of the possible outcomes of any proposed- or ongoing- process dealing with chan-

ging the energy system. These prediction systems deal with the potential consequences of the energy system changes:

- ▶ for the energy system;
- ▶ but also for the associated socio-technical, psycho-social, and ecological issues.

5. **Analysis systems of the proposals in a contextual fashion**, which compare and weigh the different proposals in order to help choosing which proposal to adopt.

6. **Empowerment and facilitating procedures** that contribute to the transition

For all activities, data from the following disciplines should be considered, as much as possible, by everyone and at all times:

- ▶ **Semiology** to help in discussing the issue of the energy transition because data and discourse analysis reveals that:
 - many words used convey many different ideas according to the person, the time, the context: they are both polysemic and labile, with blurred and shifting boundaries;
 - there is often confusion between means and goals in ways of talking and during various exchanges, and values are unexpressed;
 - there is often confusion between knowledge and beliefs in writings and during various exchanges;
- ▶ **Psychology** to help understand how people may become engaged in this issue since:
 - understanding something in itself is not enough to perceive what it at stake and to really perceive all its dimensions and implications;
 - intellectual understanding is not enough in 'feeling' for something: 'gut feeling' is one of the more potent motivations for action (whether for better or for worse, of course);
 - 'feeling for' is not enough to become mobilised to act: to act you must also have the capacity and the possibility to do so; these can be supported and one can develop them.
- ▶ **Educational sciences** (in the broad sense):
 - to help design effective and beneficial 'nudges' to help people deal with this issue (either contributing to the conceiving of the energy transition or to the transition itself) in a mutual and self-empowerment effort;
 - which is also empowerment to facilitate living in and with the changes that each and everyone will experience.

⁷⁸ Social is here used in its wider meaning, that is, including the economic, financial, and political dimensions.