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Assessment of the national energy research strategy

Summary of the report produced, on behalf of the OPECST, by Anne-Yvonne Le Dain, MP.

This report is part of the evaluation of the National Research Strategy, entrusted to the OPECST by Article 15 of law n ° 2013-660, dated 22 July 2013, on Higher Education and Research. It focuses particularly on the energy aspect of this strategy, which results in the preparation of a separate document, provided for in Article 183 of Law 2015-992, dated 17 August 2015, on energy transition for Green growth: the National Energy Research Strategy (SNRE). In accordance with these provisions, Anne-Yvonne Le Dain, MP, was responsible for evaluating the latter, in anticipation of its publication. After a brief study, which led to her meeting over fifty French and foreign actors directly involved in energy research, Anne-Yvonne Le Dain formulated a dozen guidelines and fifteen priority recommendations to guide further work on this strategy.

The Context of the assessment

The SNRE became available on the website of the Ministry of the Environment on 2 January 2017, before being officially published in its Official Bulletin on 25 January 2017. While this publication was completed within the expected timeframe, in practice it left only a few weeks to study this document, whereas a thorough evaluation of the previous strategy, published in May 2007, required a year-long study.

Taking into account the parliamentary calendar – with the work of the National Assembly ending in the first quarter of 2017 – OPECST decided to anticipate the publication of this document by entrusting Anne-Yvonne Le Dain, MP, with the evaluation of the future strategy. Even before this decision, on 26 May 2016, OPECST organised a hearing on "The integration of renewable energies into the electricity grid". In the months that followed, despite uncertainty about the progress of the document, about 15 participants involved in energy research were heard individually. Following the publication of the SNRE, on 9 February 2017, the OPECST organised a second public hearing on "The challenges of energy research".

In addition to these hearings, the evaluation is also part of OPECST's recent work on energy issues, notably the reports in 2011 on the future of the nuclear sector, in 2013 on the hydrogen sector, in 2014 on alternative techniques to hydraulic fracturing and regulatory barriers to innovation in energy conservation in buildings, and the hearing of the President of the Scientific and Technical Building Center (CSTB) on 13 December 2016.

Despite the anticipation of this evaluation by the OPECST, its scope is necessarily limited by the short time elapsed between the publication of the SNRE and the presentation of the corresponding report. It must therefore be considered as a first step in the evaluation of this strategy, a step which it would be desirable to extend, during the Fifteenth Legislature, in particular to take stock of the conditions of implementation of the SNRE and, consequently, taking into account the recommendations made in the context of this initial evaluation.

The SNRE : a solid working foundation

The approach to the development of the SNRE, placed, like that of the previous strategy, under the dual responsibility of the Ministries of Energy and Research, was based on two bodies: a Permanent Secretariat and a Monitoring Committee.

The Permanent Secretariat, set up at the beginning of 2015, brings together the services of these two Ministries. The National Alliance for the Coordination of Energy Research (ANCRE) and the Environment and Energy Management Agency (ADEME) have also participated in its work.

The Monitoring Committee brings together participants in the work of the Permanent Secretariat, as well as the Ministries of Agriculture and Industry, four of the five research alliances, public research organisations, companies and other organisations. This committee, which met three times in 2016, was consulted on the methodology and the lines of work, as well as on the proposed strategic orientations and the document itself.

In accordance with the law, the regions were also consulted, through the Association of Regions of France. The National Energy Transition Council and the Higher Energy Council were also asked for their opinions.

At the various hearings organised in the framework of this study, none of the interviewees expressed criticism of this process of elaboration. Unlike the previous SNRE of May 2007, that of 2017 really appears as the result of collective work. Nevertheless, it would probably be

desirable for the rest of the work devoted to the implementation of the NREM to find the appropriate modalities to allow a more direct participation of researchers in the process of elaboration, as well as the business world, including SME-SMIs and ETIs.

The lack of shared vision and objectives

Despite the extent of the consultation organised prior to the vote on Law n° 2015-992 of 17 August 2015 on the Energy Transition for Green Growth, there is no widely shared view in France of the future of the country's energy system. The issue of energy remains a polemical question, subject to dogmatic and predictable conflicts.

Thus, the subject of energy is only rarely approached in terms of fundamental national issues, such as the reduction of greenhouse gas emissions or of the energy dependence resulting from the persistent use of hydrocarbons. Most of the exchanges seem to crystallise around an artificial opposition between nuclear energy and renewable energies.

However, these two modes of electricity production appear complementary. By becoming more flexible, nuclear power has adapted to the intermittencies of wind and solar power. Moreover, electricity amounts to only about one-quarter of final energy consumption, far behind oil, and at a level equivalent to that of gas.

The absence of a broad consensus on a few simple principles does not make it possible either to win the support of the French or to give a clear direction to energy research — while our German neighbours, because they share a vision of their energy future, are willing without protest to pay double the price for their electricity in order to subsidise renewable energies.

The lack of such a vision explains, at least in part, the multiplicity of objectives and orientations assigned to SNRE. It would therefore seem desirable in all respects for the Government to be able to define and communicate a clear vision of the country's energy future so that it can be shared by a large majority of our fellow citizens.

Indeed, the objectives of energy research cannot be summarised as a recapitulation of national or international orientations in terms of energy transition and the fight against climate change. Obviously, French research will not solve alone all the scientific and technological challenges linked to the energy transition, in France and in the world.

Nor is it by scattering its efforts that it can best contribute to it. It is obviously not a question of abandoning whole sections of French research in this field overnight, but of concentrating sufficient resources on those areas where it is the best positioned, scientifically and industrially, to strengthen this advance, in order to lead to applications which will create new jobs.

Therefore, it is up to the Government to define a precise and limited number of objectives for French energy research, taking into account both the vision of the national energy future and the international character of energy research, in the context of the fight against climate change.

Accelerating research and innovation

Achieving the two-degree reduction targets of global warming and those set out in the Energy Transition Law for Green Growth will require real scientific breakthroughs in the field of energy. While "scientific breakthroughs cannot be brought about by decree", past examples of the occurrence of such breakthroughs may allow us to identify some conditions likely to favour their appearance.

Firstly, the creative process is not limited to a cumulative and interactive recombination of existing knowledge. Of course, some discoveries are incremental in nature and result from the improvement of acquired technologies or the deepening of already consolidated lines of research. But the most decisive ones involve exploring new, more uncertain and even hazardous scientific approaches.

Therefore, long-term funding should be favoured, leading to the selection of the best researchers, through peer review, rather than working in a project logic with predetermined goals. They should be given the opportunity to adopt new approaches, where appropriate, when those initially chosen prove to be unsuccessful.

For over a decade, French research funding has tended towards a gradual strengthening of the share of project financing. An intermediate formula, to rebalance long-term funding, could consist of selecting the best researchers rather than projects. While it exists in the United States, such a mode of financing is relatively uncommon in France.

Secondly, the separation between basic and applied research is relatively recent in the history of science, which includes numbers of examples of research directed towards a specific objective leading to major theoretical discoveries, with the reverse being equally true.

In order to blaze new trails of progress, it is often necessary for research organisations, schools and universities to transcend the dichotomy between basic science and applied science, which has gradually become established in the current vocabulary. This dichotomy appears to be not only artificial, but deleterious to the development of science, and even to the impact of science on the economy. In reality, there is only good research and bad research, as well as applications of research.

This is particularly true for a major challenge such as the fight against climate change and for energy transition. The creation of transversal structures combining

upstream research with technological research, and even industrial players, appears to be particularly suitable to the emergence of incremental discoveries and breakthroughs, as well as to the acceleration of their applications

Thirdly, in spite of all the measures that can be taken, particularly in the framework of the implementation of the SNRE, to facilitate the emergence of breakthrough innovations, the question of resources remains pivotal.

In 2015, France, along with the other countries signing the Paris agreement, committed itself to a race against climate change which requires a profound change in the modes of energy production and consumption over a very short period of time.

In the framework of the Innovation Mission, along with twenty-one other countries and the European Commission, France decided to double the amount of public investment in sustainable energy research and development for the 2015-2020 period. This budgetary commitment, which has yet to be achieved in France, has already taken effect in other countries, for example in the United States, where the budget for energy research is expected to be supplemented by an additional $4 billion up to 2020.

Given our country's major role in these negotiations, failure to implement these commitments would put it in a difficult position and would also have an impact on France's competitiveness in the industrial sector compared with the countries that honour them.

Identification of priority research axes

The SNRE lists a very large number of research paths, in the technologies to be developed, in the necessary basic sciences as well as in the human and social sciences, which will enable future innovations to be accompanied.

This proliferation does not make it possible to identify possible priority paths, to measure the distance remaining for each of them or to measure the financial and human resources required to follow them and reach their end.

The identification of these priorities could stem from the specific needs of French energy transition. In this respect, France has an immense advantage: its territory extends over all the continents, latitudes and temperatures. It therefore has the means to explore and manufacture all the forms of energy, and all the associated technologies.

However, French energy research is also part of a framework for European cooperation and international competition. It is therefore not intended to cover all possible avenues. Priority should undoubtedly be given to the most promising avenues of research, in terms of economic development and employment, and those for which France is in the best scientific or technological position.

Given the conditions under which the evaluation was carried out, it has obviously not been possible to examine each of the research areas covered by the SNRE. However, the recent work carried out by the OPECST on energy issues has made it possible to supplement, in part, the information gathered during the study. A second step in this evaluation should, in particular, make it possible to complete this first approach to the various research paths.

Conclusion

The SNRE, a document resulting from a structured consultation approach, is undoubtedly a solid basis for work which should enable French research to make significant progress in this field.

It aptly explains the context and the numerous constraints to be respected. It identifies four relevant strategic orientations, focusing on technologies, organising research and innovation, developing knowledge and skills, as well as governance of the strategy itself. It identifies, in a fairly comprehensive way, the various paths of research as well as the scientific and technological barriers to be lifted, by inevitably omitting certain avenues. It stresses the need for multidisciplinarity. Finally, it proposes fifteen strategic actions, with relevant exceptions.

However, this document does not fully answer the question of what is expected of a real research strategy, because of the lack of prior identification of the priorities set for energy research. As in the present evaluation, the work undertaken must therefore continue, in order to implement the structuring actions identified, to define, as already proposed by the OPECST in its 2009 evaluation report, by laying down a scale of priorities based on economic and scientific criteria and roadmaps, notably on the barriers to be removed and, finally, identifying and removing in advance the regulatory constraints on the deployment of innovations in the field of energy, for example in terms of the energy performance of buildings.

In conclusion, this report should be considered, in the context of its implementation, as a first step in the evaluation of the SNRE, which should logically be extended, during the next parliamentary term, by a second study designed to measure, in accordance with the law, the conditions for implementing the new strategy and taking into account the recommendations of the present report.

15 recommendations

1. The OPECST considers it important to encourage long-term research funding, oriented towards the selection of the best researchers, rather than projects, and giving researchers the possibility of reorienting their research, if necessary, subject to peer review.

2. The OPECST points out that France must respect its commitment under the Innovation Mission, made with

21 other countries and the European Union, to double its research efforts in sustainable energy over the period 2015-2020.

3. The OPECST believes that the Government should define and communicate a clear vision of the energy future of the country so that it is shared by all citizens.

4. OPECST invites the Government to define specific objectives for French energy research, taking into account both the vision of the national energy future and the international character of energy research in the context of the urgency of combating climate change.

5. The OPECST considers that a greater role must be given to the world of research on the one hand and to the business world, including SMEs and ETIs, on the other, in steering the National Energy Research Strategy and its implementation.

6. The OPECST strongly encourages stakeholders in the development of the National Energy Research Strategy to continue their work in order to implement the structural actions they have proposed in the framework of the first three orientations of the National Energy Research Strategy.

7. In particular, the OPECST encourages stakeholders, in line with the recommendations made in its 2009 report, to carry out a complementary task of defining internationally competitive national sectors by establishing a priority scale based on economic and scientific criteria, as well as roadmaps, notably on barriers to be removed.

8. The OPECST considers that further work should also be carried out to identify and remove upstream the regulatory constraints on the deployment of innovation in the field of energy, for example in the energy performance of buildings, consumption erasure, storage and mobility.

9. The OPECST renews the recommendation made in 2009, as part of the evaluation of the previous National Energy Research Strategy, for the creation of a National Evaluation Commission to present annually to OPECST a state of progress of French energy research. The first report of this committee could deal with the progress made since 2007.

10. The OPECST should extend this first assessment, carried out a few weeks after the publication of the National Energy Research Strategy, by a second study designed to measure, in accordance with the law, the conditions for its implementation as well as the present recommendations.

11. The OPECST considers that the Government must provide the means necessary for the continuation, after 2019, of the research work on the fourth-generation ASTRID reactor and the associated fuel cycle.

12. The OPECST considers that international cooperation in hydrogen-energy research should be developed, in particular with Germany, in fields such as materials, electrolysis, methanation and safety.

13. The OPECST encourages the development of new public research programs for the exploration of CO_2 conversion technologies such as methanation.

14. The OPECST encourages stronger support for research and innovation in order rapidly to achieve the objective of a vehicle consuming less than 2 litres per 100 km.

15. The OPECST recalls that priority should be given to building physics, in order to improve energy efficiency in this sector, and that the research resources in this field should be grouped together.

The report can be accessed on the OPECST site:
http://www.assemblee-nationale.fr/commissions/opecst-index.asp
http://www.senat.fr/opecst/index.html

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