

Chapter 2

Introduction and Objectives of the EduaR&D Project Carried Out by Fh-ISI

Energy plays a central role in the economy of both industrialised and emerging countries. Every country is facing three major energy-related challenges in this century and over the next decades especially:

- (1) The *share of fossil fuels in current primary energy use*, amounting to 80% globally and 78% in Europe, is likely to remain high during the next decades given the economics and limited acceptance of nuclear power and the (still) small economic potentials and market shares of renewable energies today and in the near future. This situation conflicts with the pressing need to reduce energy-related CO₂ emissions which are driving global climate change. These emissions cannot be sufficiently absorbed by the geosphere and have thus increased the atmospheric CO₂ concentration by 100 ppm or 35% since 1870. The *impacts of climate change are a major threat* to mankind in this century (IPCC, 2001, 2007).
- (2) Recognising the role of crude oil as an energy price setter on world markets, energy policy will have to pay more attention to the *peaking of oil production* which is expected *within the period 2015–2030* depending on many influences such as global economic growth, technical progress and early investment in oil exploration and production, substitution by natural gas and renewable energies or more efficient energy use. With declining oil production, *energy price levels are likely to increase substantially*. Within this context, the alternatives mentioned as well as CO₂ capture and storage from centralised fossil fuel plants will receive increasing attention as possible backstop technologies and as a way of reducing the pressure on oil demand and the risk of high energy price increases.
- (3) The increase in the price of fossil fuels is likely to be reinforced by the fact that the *oil production will be re-concentrated in the Middle East* where two thirds of the remaining resources of conventional oil are located. Given the present political instability in many countries of this region (often monarchies or dictatorships), there is some risk of oil price fluctuations in the case of longer supply disruptions. At particular risk is the transportation sector, as almost a hundred percent of the world's road, ship and air transport are dependent on oil.

This is why energy R&D and innovation policy will have to pay *more attention to speeding up the innovation processes and market penetration* of those technologies capable of meeting these challenges in the future and reducing the risks mentioned above.

However, the lack of financing available to substantially enlarge public funds for energy-related R&D and market diffusion policies is a major obstacle to meeting these challenges. One way to tackle this dilemma is to improve the efficiency of energy R&D and relevant innovations including market entrance and diffusion. However, little is understood about how to wisely select from among the myriad research ideas and proposals in order to reduce the risks of R&D funding and to maximise the outcome of public (or private) R&D funds.

2.1 Objectives of the EduaR&D Project

The project's objective was to develop a new method for identifying and prioritising important energy technologies and energy-relevant topics of energy research funded by the Federal Ministry for Economics and Technology (BMWi). Federal R&D funds should be more efficiently allocated by identifying detectable risks and supporting the stakeholder dialogue with comprehensive information.

The proposed methodology is based on four pillars:

- the heuristic concept of an innovation system identifying important actors and their networks of research and diffusion of the particular technology; this is done by patent analysis and bibliometrics, interviews and literature evaluation;
- applying the concept of product cycles and market diffusion in order to assess the status of a technology development (by patent analyses, interviews, and market analyses);
- using existing knowledge about factors of success and failures of R&D projects and
- extensive use of assessment tools for energy systems and energy economics (cost reducing potentials by experience curves, co-benefits, impact on national energy demand, potentials of emission reduction and others), but also using the tacit knowledge of experts and scientists in the particular fields of technology in research institutions and research laboratories in academia and industry.

The proposed assessment scheme is designed to work with quantitative indicators wherever feasible which could be aggregated using multi-criteria methods, but qualitative elements will certainly also be used.

The concept is being applied to four different case studies for which the Federal Ministry of Economics and Technology is responsible and which display very different characteristics with regard to size and state of development, i.e. CO₂ capture and storage of large fossil power plants, several industrial furnaces, three types of fuel cells, and passive solar houses and buildings with their specific technical equipment. If quantification is difficult, semi-quantitative methods are being used (by scaling).

The selection of the technologies to be assessed in detail has been performed on the basis of R&D policy-relevant criteria such as position in the technology cycle, large or small technology, energy-economic relevance, type of company and research institution involved and perceived risk of the R&D project. The assessment methodology and its interim results and first tentative recommendations were to be discussed in an international workshop on February 21 and 22, 2006 where experts in research in academia, industry and administration from the various technical areas and policy fields had been invited.

On the basis of the assessment tool finalised after the 2006 workshop the identified case studies were evaluated using specific tools available at the Fh-ISI such as energy system models to perform sensitivity analyses, multi-criteria assessment to aggregate the figures of the indicators and statistical methods.

A final report including conclusions on the practicability of the assessment scheme and recommendations for further R&D activities should terminate the project (see this report).

Reference

IPCC Intergovernmental Panel on Climate Change (2007). *Climate Change 2007 – Mitigation of Climate Change*. Fourth Assessment Report. Cambridge: Cambridge University Press.



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