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Evidence from RD&D spending for renewable energy sources in the EU

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Abstract

This paper aims at giving a critical picture of the expenditures in research, development and demonstration (RD&D) for renewable energy sources (RES) in the EU-15 Member States. By providing this objective a number of performance indicators are proposed, evaluated and discussed. RD&D performance is measured in terms of RD&D intensity, e.g. spending per unit of GDP, as well as with regard to RD&D output such as the number of patents in the different sectors of technology.

The evaluation of the funds spent can help the rationalisation of the efforts made to support renewable energy RD&D and facilitate the joint investments in RD&D activities. This perspective is essential for facing the increasing competition that the EU industry meets in the international markets for RES. The knowledge and rationalisation of the RD&D spending in research activities is the starting point for a common approach to strengthen the EU industry in this field of expected strong growth.

Keywords: R&D expenditure; Innovation system; Research policy

1. Introduction

The key issues for increasing the use of renewable energy actually relate to making these technologies cost-competitive and integrating them into the existing system.

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In absolute figures, the renewable business sector is still small. It is at least partially a high-tech sector with emerging technologies depending on the results of research, development and demonstration (RD&D). The RD&D effort in the field of RES in accordance with national and European policies on energy, and EU Framework programmes have made available considerable funding allocated for developing RES technologies. Complementary national RD&D programmes exist, with emphasis on different RES topics, according to national resources and preferences. The future success of renewable energy technologies can only be assured if efforts in research, development and demonstration are maintained or strengthened for the next years with emphasis on an improved co-ordination of different programmes.

Today's most promising RES technologies with regard to future potential are based on solar energy, biomass, wind, hydro power and geothermal energy.

Photovoltaic solar energy conversion is the most expensive form of renewable energy at present but exhibits the highest learning rates. It holds the largest long-term potential, and can be easily integrated into existing electricity systems. Many national and international research programmes in photovoltaic technology set out goals to achieve a certain cost and efficiency target within a certain time. The research is focused on materials development, production technologies and integration into buildings.

For biomass, the priority is the development of integrated approaches from sustainable biomass procurement to fuel production and use. Further needs for R&D exist in the entire chain of biomass use, from the resource production, supply, upgrading to a fuel, the storage of the fuel, the feeding system to the conversion reactor and the energy recovery for heat and/or electricity. With regard to the conversion systems, thermochemical processes like combustion, gasification and pyrolysis as well as biological processes like fermentation and anaerobic digestion will have to be further developed.

At present, wind energy compared with traditional energy sources is competitive at very good sites, even without the compensation for the environmental advantages. In this context, the role of R&D concerns developing and evaluating participation models and policy instruments, development of new materials for rotor blades and innovative control algorithms, tackling the challenges of the large-scale off-shore application of wind technology, reducing acoustic noise emission, gradually extending or modifying the existing distribution grid so it can absorb a large amount of electricity generated at a large number of locations distributed over a large scale.

Hydro power holds the largest share of renewable electricity production. Large-scale hydro power is technically mature and its R&D requirements are generally being well taken care of. In the case of small hydro power, the main technical thrust is to improve the cost-effectiveness of the technology for use on the more common low-head sites.

With regard to geothermal energy, the major efforts in research and development relate to the application of new technologies such as hot-dry-rock techniques for electricity production.

Finally, it is widely recognised that technical progress is a necessary, but not sufficient condition for the large-scale integration of RES.

Non-technical parameters play a major role in the process of their market penetration and in many cases they are supposed to be the most important barriers for RES development. They are either of a political and legislative nature or relate to institutional