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Effectiveness of policy measures in transforming the energy system

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Abstract

The effectiveness of public policy measures in creating energy impacts were investigated through 20 policy cases on renewable energy and efficient energy use. The policies were grouped into subsidy-type and catalyzing measures based on the use of the public financial resources. The policy cost of subsidies ranged from 1 €/MWh up to over 100 €/MWh, the feed-in tariffs being clearly the most expensive choice. The public measures that strive for catalyzing market breakthroughs lie in the range 0.1–1 €/MWh, but some business driven and procurement type measures could come down to even 0.01 €/MWh. The policy costs observed could decrease by 25–60% if accounting for lagging energy impacts. The better policy efficiency of catalytic measures is most likely due to a stronger market and business sensitiveness, understanding of market needs, and focusing more on the end-use sector with active stakeholder involvement. The magnitude of the energy impacts were in average larger from the subsidy instruments but a few end-use technologies linked to catalytic measures reached even higher effects due to the strong market penetration achieved.

Keywords: Policy cost; Policy measures; Energy impacts

1. Introduction

National energy policies in large have common factors such as mitigation of the green-house gas emissions, concerns about energy security and recently also about the oil price, providing energy economically, etc. Increasingly the broader frames or boundary conditions of energy policy are elaborated internationally, for example in Europe by the European Union, within the western industrialized countries by the International Energy Agency, globally by the United Nations or World Trade Organization, or through demand-supply conditions in energy trade influenced by producer networks (e.g. OPEC, Nord Pool electricity exchange). The practical policy implementation remains, however, much a national or local task. Past experience demonstrate that pure market forces, though being effective in resource use, have mostly a much too short sighted perspective to work out satisfactory solutions to the long-term energy challenges ahead. Public policies have therefore an important role to play in providing future directions and triggering necessary changes to achieve societal goals. These polices should ultimately lead to a market transformation from less acceptable or undesirable energy solutions to more ideal ones. Simultaneously the public sector is confronting pressure to reduce its expenditures and to produce services more cheaply which in turn will put more emphasis on impact driven policies and effective resource use.

The purpose of this paper is to investigate the cost effectiveness of public energy policy measures in bringing more efficient or renewable energy technologies to the market. The focus is more on voluntary type of policy measures that are associated with a direct cost to the public sector, for example financial support to a certain new energy technology solution. Policies of regulatory character such as ordinances, minimum performance standards, energy taxes, codes or obligations that address mostly the low end of the market without a clear budget line are excluded although there may be considerable administrative expenses as well as energy impacts associated to these. Furthermore, analysis of second-order financial effects such as tax revenues or macroeconomic interactions is outside the scope of this paper. An essential element here is assessing the energy impacts from the public measures and the associated public financial support which yield the

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policy cost. This should not be confused with the costs or cost-effectiveness of the different energy solutions which is related to the overall investments where the policy cost is just a part. There is obviously a linkage between the public and total costs as more expensive or embryonic technologies tend to require higher public support. Public funding also leverages private capital to achieve policy goals.

Programme or policy evaluations often touch the effectiveness question but mostly qualitatively or from a management point of view (International Energy Agency (IEA), 1998). The impacts are dealt mainly in the form of observed outputs rather than trying to assess the longer term impacts and cost effectiveness (American Council for an Energy-Efficient Economy (ACEEE), 1994; Grandell, 1999). Quantitative estimates on public allocations have been reported previously (Geller and Attali, 2005) and are also employed in this study (IEA, 2003). Some studies (FRES, 1998) have even looked on the cost-benefit ratios of public energy policy measures but have been restricted to the immediate effects. Energy policies affect on a long-term basis and therefore including delayed effects after the support schemes cease may be of importance when judging the overall effectiveness.

The analyses in this paper are based on 20 case studies from various countries covering a range of different policy measures and technologies. The paper starts by presenting shortly different energy policy measures and their link to the commercialization process. This is followed by an introduction to the case studies and an analysis of the market transformation strategies behind the policy measures. Lastly, the analysis results on impacts and public policy cost are presented.

2. Framework for analyzing policy measures and impacts

There is a variety of policy measures available for promoting renewable energies and more efficient energy use. For example the IEA databases (IEA, 2005) lists more than 30 different policies and measures employed in practice in the 25 IEA member countries. In broad terms most of these fall into some of the following five categories:

(1) legislative and regulatory policies;
(2) research and technology development;
(3) fiscal measures;
(4) information dissemination and awareness raising;
(5) other assisting or voluntary measures.

Performing a comprehensive comparison of all possible measures were outside the means of this study and the inaccessibility of representative data may turn out to be decisive in any case. Pure regulatory measures obliging the market to undertake improvements on its own cost (e.g. building standards, directives) and those involving no public support were excluded here as the effectiveness definition would not be well applicable in this case. Such measures are often designed to capture the most cost-effective portion of the potential using commercially available solutions and may hence be the least demanding. Strong regulatory measures may encounter opposition if public market interventions are otherwise avoided.

In this study more emphasis was put on policies meant for enhancing market penetration and uptake of new technologies on a voluntary basis which could be most relevant for achieving larger improvements on the market on a long-term run. A few examples of measures attached to the low market end were included as these represent a kind of voluntary variant of legislative actions. Such measures could be important in overcoming soft market imperfections preventing the implementation of better technology, e.g. lack of information, social capital, etc.

Table 1 shows the 20 cases used for the effectiveness analysis. This set of cases covers a broad range of polices used in different countries and also fulfils the data requirements of the analyses to follow. A more detailed description of each measure is given in Appendix, which also shows the references used for each case. The cases cover both renewables and more efficient use of energy in different countries. The policies focus on different energy sectors and final energy forms as well. There are both energy production and energy end-use technologies involved. The public incentives can be consumer or company oriented or general market support.

Nearly all the policies in Table 1 are related to market deployment or to accelerating the market uptake. R&D does not appear alone but its outcomes are utilized across many instruments and in some cases it is even integrated into the instrument. For example, in technology procurement the technology development would be quite essential. Moreover, relating the support-intensive instruments such as capital grants or feed-in tariffs to learning processes and learning investments (Wene, 2002) would increase the weight of both private and public funded R&D. Pure R&D isolated from markets is nowadays exceptional and may be found in basic science related areas, for example nuclear fusion or solar satellite power.

One important differentiating factor among the policies is the magnitude and focus of public financial support. Two major types of instruments were distinguished: subsidy and catalyzing support. In subsidy-based measures the investments in new or better technology are supported financially and the impact is largely based on the level of public support. The catalytic instruments are more innovative and aspire to catalyze the commercialization process and market breakthrough of the new technologies rather than subsidize deployment. The subsidy instruments have a stronger macro(economic) dimension whereas the catalytic measures are more micro(economic) by nature.

Examples of subsidy instruments are capital grants, feed-in tariffs and to some extent the green certificates. With time as the new technology gets cheaper with increasing volume, the support may reduce and finally be withdrawn. However, if cost competitiveness is not fully reached, government support may be needed for a longer time