PROMOTING RENEWABLE ENERGY IN BUILDING REGULATIONS: CONFRONTING THEORY AND PRACTICE

M. Beerepoot[1]

[1] *OTB Research Institute for Housing, Urban and Mobility Studies, Delft University of Technology*
P.O. Box 5030, 2600 GA Delft, The Netherlands, e-mail: beerepoot@otb.tudelft.nl

ABSTRACT

The European Commission has expressed the wish to harmonize energy regulations in the building sector and at the same time has formulated goals for promoting the use of renewable energy sources. This paper studied the possible synergy of these two targets. To make a first step in this research topic renewable energy techniques are considered as environmental innovations for which incentives, being a public good, is dependent on governmental intervention, like energy policy instruments. Scientific research in the effectiveness of different types of policy instruments in promoting innovations, showed that a combination of both regulations and (financial) incentives could be a better way of promoting environmental innovations than by regulations only. Current energy regulations, and especially energy performance regulations, the type of regulations that are striven after by the European Commission for harmonization, have been studied with a focus on the methods used to promote renewable energy techniques. In all cases, regulations are a "stand-alone" policy, not combined with incentives to go beyond the specified regulation level. More research in this field will be needed to be able to judge the effect of financial incentives combined with energy regulations, but this first inquiry shows that such combinations seem to be an interesting way of modernizing regulations and promoting renewable energy innovations.

KEYWORDS

Energy policy, energy regulations, promoting innovations, EC draft directive COM(2001)226, energy performance, renewable energy sources

INTRODUCTION

The increasing interest in energy savings in the built environment, caused by the Kyoto protocol, and the targets EU member states have formulated in promoting the use of renewable energy sources, have heightened the need for re-examining energy policies and energy regulations in this sector. As the European Comission finds this subject of very high importance, it has recently suggested harmonization of energy regulations for the building sector. In April 2001 the European Commission has presented its draft directive COM(2001)226 on the subject of energy performance of buildings (European Commission, 2001). One of the main purposes of this draft directive is to develop a common methodology for energy regulations for buildings within Europe, based on the concept of calculating the energy consumption of buildings and setting energy performance standards. This methodology is widely known as the "energy performance method".
The combination of the ambition of the EU for harmonized energy regulations together with the ambitions that the EU and most of the member states have in promoting renewable energy sources has lead to the research described in this paper. This paper tries to investigate the

maximum promotion of renewable energy sources by means of (harmonized) energy performance regulations.
Research in possibilities for promoting renewable energy sources by means of energy regulations is rare. Scientific research in effectiviness of policy instruments for stimulating innovations in general exists, but this has not yet been applied to the promoting renewable energy innovations in the building sector.
Therefore, this paper identifies existing energy performance regulations in EU member states and the way they reckon with renewable energy sources. These data are confronted with theories on promoting innovative techniques, like renewable energy techniques are, by means of policy instruments. The confrontation between theory and practice will lead to conclusions about the extent to which these two correspond to each other for the new house building sector.

RESEARCH METHOD

Techniques making use of renewable energy sources are in this paper considered as environmental innovations (see literature review). Stimulating RES has therefore been interpreted as stimulating environmental innovations. Effectiveness of policy instruments in development of environmental innovations is a topic that has been examined by a number of scientific studies. We will start this paper with a literature review of research that studied effects of policy instruments on environmental innovations.
Next, based on a study covering energy regulations in 11 northern EU member states, member states making use of energy performance regulations are identified. These data are derived from (Beerepoot, 2002), that discusses energy regulations in 11 EU member states into detail.
After identification of member states already using energy performance regulations, the type of energy regulations that is aimed at by the European Commission, specific attention will be paid to the methods that are used for reckoning with renewable energy sources.
Finally, scientific research and theories in stimulating innovations by policy instruments are confronted with energy performance regulations in practice and their way to include RES.
This confrontation of theory and practice will result in conclusions and recommendations on how to promote renewable energy techniques by means of energy regulations in the building sector.
The research described in this paper is partly based on Ph.D. research at Delft University of Technology and partly on the interim results of the Build-On-RES project, a research project co-funded by the European Commission in the framework of the Altener programme. In the Build-On-RES project, that started January 2002, five member states cooperate in identifying possibilities for promoting the use of renewable energy sources by means of energy performance regulations.

RESEARCH IN EFFECTS OF POLICIES ON DEVELOPING INNOVATIONS

Renewable energy techniques are in this paper considered as a specific type of environmental innovations, because one of the main purposes of promoting renewable energy techniques consists of preventing CO_2 emissions and climate change, resulting in a better environmental quality. Environmental quality being a public good, no market price exists and supply would be too low without governmental intervention. Compared with normal innovations, generation of environmental innovations therefore depends on framework conditions, specifically by means of governmental policies.
The effects of environmental policy instruments in development of environmental innovations have for example been studied by (Kemp, 2000). On the basis of a number of econometric

case studies, Kemp discusses the pros and cons of several types of environmental policy instruments and their influence on encouragement of innovation and diffusion. He states that the policy instrument “regulations” have proved that experiences in effects on development of new, more efficient technologies are mixed and often negative. Regarding the policy instrument ”subsidies”, Kemp states that in some cases uncertainty about the demand for new technologies may call for the use of subsidies. However, evaluation studies of energy subsidies have shown that a relatively high number of “free-riders” (investors who would have bought the technology anyway) reduce the effectiveness of this policy instrument. This conclusion is confirmed by a study in The Netherlands on the effectiveness of energy subsidies, that states that in some cases the percentage of free-riders can be 50% (de Beer et al., 2000). Regarding the policy instrument “communication”, Kemp states that this can be useful for addressing information problems but that in general they are considered to be additional policy instruments, not substitutes for other policy instruments like regulations or financial instruments. Kemp suggests that there is no single best instrument in terms of technological innovation. His conclusion is that policy instruments should be combined with one another to benefit from synergetic effects. A combination of standards with economic instruments is particularly useful since it combines effectiveness with efficiency. An example of such combination is a system of tradeable permits.

The possible effect of energy performance in terms of technological innovation has been examined by (Weber, 2001). Weber states that energy performance regulations are preferable to component based regulations because they enable flexibility within a building in choosing the most market efficient combination of energy efficiency measures in realizing the standard. Weber continues with stating that regulations provide very strong incentives to reach the pre-specified regulation level but few incentives beyond. In order to solve this problem regarding energy performance regulations, he suggests that energy performance requirements should be progressively increased. To illustrate this idea, the Dutch method of energy performance requirements is quoted. In The Netherlands, energy performance requirements have been introduced the first time in 1996. Standards have successively been tightened in 1998 and 2000.

A study by (Schot, 1989) discussing the environmental technology policy instruments in The Netherlands already indicated in the late 90’s that hardly any relations existed between different types of policy instruments such as regulations, financial instruments and communication instruments. Schot states that policy should be focused more on developing clean technologies and prevent easy “end-of-pipe” solutions. Governmental policy instruments on its own are however not sufficient according to Schot. He suggests the development of instruments that approach the problem from different angels, like different type of actors. As an example Schot mentions the development of networks of actors that can learn from each other.

ENERGY REGULATIONS IN 11 NORTHERN EU MEMBER STATES

In (Beerepoot, 2002) an overview of identities of energy regulations in 11 northern European member states has been described. Member states that have been considered in this study are Belgium, Germany, France, The Netherlands, Denmark, Sweden, England and Wales, Ireland, Luxembourg, Austria and Finland. The study describes the state of affairs of energy regulations on April 2002.

In this paper, we will focus on the energy performance method as a specific type of energy regulations, since this type of regulations is aimed at in the European Commission draft directive COM(2001)226. (Beerepoot. 2002) describes that five of the eleven considered member states use the “energy use calculation” or ”energy performance method” as a method

for complying with energy regulations. These member states are Germany, France, The Netherlands, England and Ireland. In Germany and France, this method has been recently introduced as the only method for showing compliance: in France in 2001, in Germany in February 2002. In The Netherlands the energy use calculation was already introduced in 1996 and is since then the only method for showing compliance.
In England and Ireland, the energy use calculation is one of the three methods possible for showing compliance with regulations. In Finland and Flanders (Belgium), energy use calculations as a method for compliance with energy regulations are currently being developed but since they are not yet implemented they will not be discussed in this paper.

RENEWABLE ENERGY AND ENERGY PERFORMANCE REGULATIONS

Energy performance calculations used in England and Wales (SAP calculation) and Ireland (Heat Energy Rating) show several resemblances, with the Irish method appearing to be a simplified version of the English SAP calculation. Energy performance methods in The Netherlands, France and Germany have each been developed on its own and therefore show considerable differences in approach. The energy performance methods existing in Germany, France, The Netherlands, England and Ireland, differ in the extent to which they address to subjects regarding renewable energy sources.
Table 1 shows elements that are being addressed in energy performance regulations in the five countries. The table shows eight elements of renewable energy sources that can be applied in the building sector on the scale of an individual dwelling or apartment building. The choice for considering techniques on the scale of the individual dwelling or apartment building is connected with the scale that is used for the energy performance method. The eight categories have been identified in a discussion during an expert meeting organized in the framework of the Altener project Build-On-RES.
The overview in table 1 shows that utilizing passive solar energy is rewarded in energy performance regulations in all five member states.
Solar hot water systems are included in energy performance regulations in The Netherlands, England and Germany. In France, solar hot water systems will be included in the “Methode de Calcul Th-C”, but up to now the timing of this integration is not yet known. In Ireland, solar hot water systems can be considered when using the energy performance method (Heat Energy Rating), but in that case additional calculations are necessary. The integration of solar hot water systems is different for every of the energy performance calculations used. For example, in The Dutch Energy Performance Method, surface and orientation are input data in the calculation, in the English SAP calculation, only the surface of the solar panel is required.
Solar space heating systems are included in an integrative way in energy performance calculations The Netherlands and in Germany. In France, solar space heating systems will be included in the “Methode de Calcul Th-C”, but up to now the timing of this integration is not yet known. In Ireland, solar space heating systems can be considered when using the energy performance method (Heat Energy Rating), but in that case additional calculations are necessary.
The acknowledgment of photovoltaic (PV) energy systems is included in the Dutch energy performance calculation only. When applying photovoltaic panels, the electricity produced by photovoltaic (PV) energy systems is extracted from the electricity use calculated for lighting, fans and auxiliary energy for the heating and hot water system.
Heat pumps are rewarded on a wider scale, at least 4 of 5 member states consider heat pumps. Heat recovery from ventilation air is considered in France, The Netherlands and Germany. However the question whether this technique makes use of a renewable energy source is disputable. Techniques like wind power, hydropower or biomass on a small scale are not

considered in any of the energy performance regulations. These techniques are however still very experimental on the scale of a dwelling or apartment building (in contrary to higher scales like a building location).

Renewable Energy Sources addressed:	Methode de calcul Th-C (introduced 2001) France	Energy Perform. Coefficient (introduced 1996) Netherlands	SAP calculation (introduced 1995, up-dated 2002) England & Wales	Heat Energy Rating (introduced 1995?, up-dated 2002) Ireland	EnEV (introduced 2002) Germany
Passive solar	Passive solar	Passive solar	Passive solar	Passive solar	Passive solar
Active solar for space heating	*(Active sol. sp. heating to be integrated soon)*	Active sol. sp. heating		***By making additional calculations***	Active solar space heating
Active solar for domestic hot water	*(Active sol. dom. hot w. heating to be integrated soon)*	Active sol. dom. hot w. heating	Active solar for domestic hot water	***By making additional calculations***	Active sol. dom. hot w. heating
Photovoltaics		Photovoltaics			
Wind power small scale					
Hydro power small scale					
Geo thermal power small scale	Heat pump	Heat pump	Heat pump	***By making additional calculations***	Heat pump
Bio mass furnace					
Other ….	Heat recovery balanced vent. systems	Heat recovery balanced vent. systems			Heat recovery balanced vent. systems

Table 1 Renewable energy in energy performance regulations in 5 EU MS

Table 1 shows that the Dutch method is integrating the highest number of RES techniques, especially because it is the only country that includes photovoltaic energy systems in its energy performance calculation. The extent to which renewable energy sources are promoted in energy performance regulations in the above mentioned five member states is in all cases limited to the integration of RES techniques in the calculation method. None of the five member states use incentives like a specific bonus for renewable energy techniques. All energy performance methods used in the five member states set a regulation level that must be met in order to comply with energy regulations. None of the energy performance methods foresees in an incentive for going beyond the specified regulation level.

In energy regulations other than energy performance regulations, sometimes attention is paid to renewable energy sources. In Finland, new energy regulations, to be implemented in 2003, try to stimulate use of renewable energy sources in a very specific way. In 2003, the energy performance calculation, is expected to be introduced as a third method to show compliance when the already existing two methods fail to do so. The energy performance calculation must demonstrate how much extra energy the building would consume as compared to the reference situation of maximum U-values in method 1. The extra energy used must be multiplied by 1.3 and must come from renewable energy sources.

Sometimes, extra regulations are established separately from energy regulations, like in Denmark, where all new social housing is obliged to implement solar hot water systems. Next to energy regulations, many member states try to promote the use of renewable energy techniques by means of policy instruments like financial incentives (fiscal incentives or subsidies). In all cases, such subsidies exist separate from energy regulations and mostly exist of a certain financial grant that reduces the actual costs of a technique making use of renewable energy.

An example of policy instruments based on communication was used in France before the introduction of the new energy regulations, when specific solar labels existed for new housing.

SYNTHESIS OF THEORY AND PRACTICE AND CONCLUSIONS

It seems to be clear that energy performance regulations should be preferred above component based energy regulations in order to enable flexibility within a building in choosing the most market efficient combination of energy efficiency measures. Energy performance regulations are in general considered to provide more incentives for development of innovations than component-based regulations. Energy performance regulations should then be the only method for compliance, tough. A co-existence next to component-based methods, as exists in a number of member states, seems not recommendable since this will probably cause building developers to seek the route of fewest resistance.
However, the analysis of energy performance regulations in five EU member states and the way they account for renewable energy techniques show a number of interesting elements when comparing with scientific research in effectiveness of policy instruments in promoting environmental innovations. The literature review suggested that combinations of policy instruments, such as regulations, financial incentives and communication, could be more effective in encouraging environmental innovations like renewable energy techniques (Kemp, 2000; Schot, 1989). Regarding energy performance regulations, it was stated that incentives for going beyond the specified regulation level are needed to promote innovations. (Weber, 2001) suggested therefore a regular tightening of standards, but effectiveness of such "step-wise" tightening is disputable. The Dutch example that Weber mentions does not show an ideal situation. Since the Dutch government decided last year not to tighten the standards in the near future, no incentive exists anymore. A far more interesting type of incentive seems to be a financial incentive for going beyond the regulation level. Such a combination of policy instruments in energy regulations has up to now never been explored. Combinations of energy performance standards with financial incentives for going beyond the standard and labeling schemes as a communicative incentive seem very interesting to explore. In the framework of the Altener project Build-On-RES, the subject of this research and possibilities for combinations of policy instruments in order to promote renewable energy techniques will therefore be further explored.

References

Beerepoot, M. (2002). *Energy regulations for the building sector,* OTB Research Institute, Delft

De Beer, J.G., et al. *Effecitiviteit energiesubsidies* (Effectiveness energy subs.), Ecofys, Utrecht

Eichhammer, W., Schlomann, B. (1998). *A Comparison of Thermal Building Regulations in the European Union*, Fraunhofer Institute for Systems and Innovation Research, Karlsruhe

European Commission. (2001). *Directive of the EP and of the Council on the energy performance of buildings in the residential and tertiary sectors (COM(2001)226)*, Brussels

Kemp, R. (2000). *Technology and environmental policy: innovation effects of past policies and suggestions for improvement*, MERIT, Maastricht

Schaefer, C. et al. (2000). *Effective Policy Instruments for Energy Efficiency in Residential Space Heating – an International Empirical Analysis*, EPISODE, Stuttgart

Schot, J. (1989). *Contouren van een milieutechnologiebeleid* (Contours of an environmental technology policy), in Milieu en Innovatie, Groningen 1989, 51-67.

Weber, C., Dicke, N., (2001) *Innovation, regulation and market penetration*, Presentation at the EnPeR workshop Paris 12 November 2001.