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Policy Profile: Encouraging Use of Renewable Energy by Implementing the Energy Performance of Buildings Directive

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ABSTRACT
The introduction of the EU Energy Performance of Buildings Directive (EPBD) paves the way for, amongst others, extra incentives for renewable energy, such as a 'renewable energy' accreditation to accompany the energy certificate, or an explicit indication of the share of renewable energy in the output of the energy performance calculation. This article seeks to appraise the possibilities for encouragement of the use of renewable energy sources (RESs) by benchmarking experiences in this field in five member states. On the basis of these experiences opportunities for the incorporation of renewable energy incentives in energy performance regulations are presented and recommendations for creating synergy between renewable energy and energy performance regulations are formulated. Copyright © 2006 John Wiley & Sons, Ltd and ERP Environment.

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Benchmarking Energy Regulations for Buildings

ENERGY PERFORMANCE POLICY IS A WAY OF INCORPORATING ENERGY STANDARDS INTO BUILDING regulations. Its recent importance is illustrated by the fact that the European Commission is now urging all European member states to introduce energy performance policies for the building sector ultimately in the year 2009 (European Energy Performance of Buildings Directive – Directive 2002/91/EC, for short: EPBD – published 4 January 2003). One of the expected benefits of energy performance policy is that it can help to introduce such innovations as solar thermal systems and photovoltaics. This paper explores the possibilities for combining the implementation of the EPBD with encouragement for the use of renewable energy sources. The research presented in this paper is based

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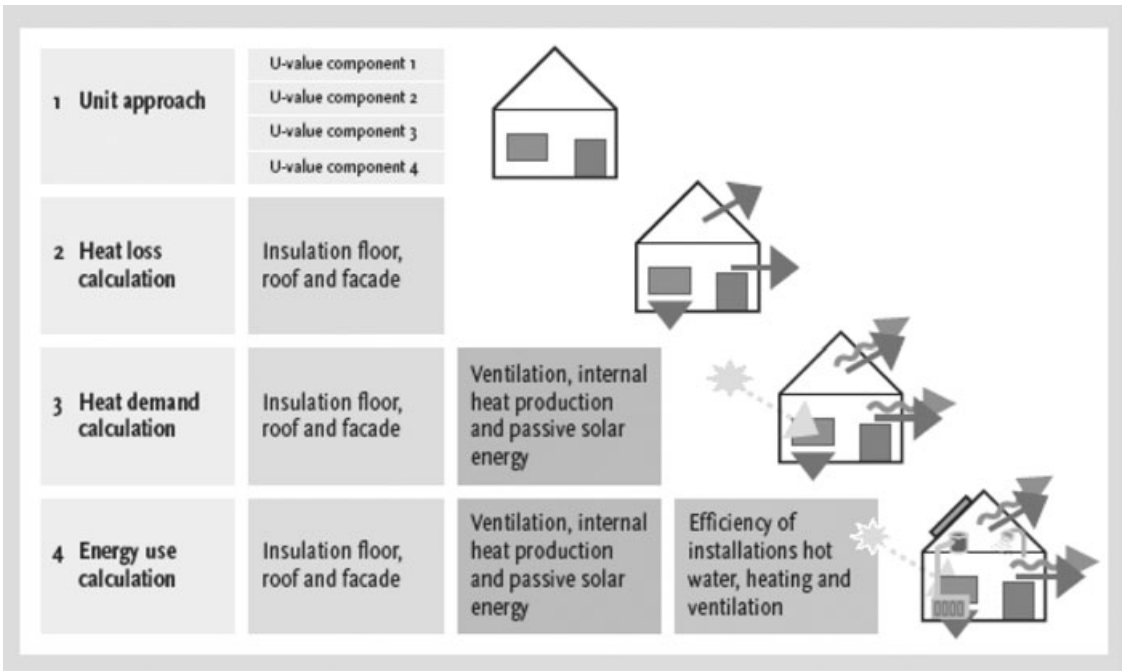

Figure 1. Four approaches to developing energy regulations for buildings. (Source: Beerepoot *et al.*, 2004.)

on the outcome of the European Altener project Build-On-RES,[1] which aimed to learn from existing knowledge by benchmarking experiences in the field of energy regulations for housing and policy instruments for encouragement of using renewable energy techniques in buildings.

Benchmarking existing experiences in member states can be helpful in finding creative solutions for implementing European Community law. In terms of the EPBD, a small number of member states are already experienced in energy performance regulations for buildings. For this research we choose to make an inventory of energy regulations in five member states that have experience with energy performance regulations in one way or another: The Netherlands, Great Britain, Denmark, Belgium and France (Beerepoot *et al.*, 2002). In describing energy regulations in member states we distinguish four main types of energy regulation according to Beerepoot (2002): the unit approach, the transmission loss calculation, the heat demand calculation and the energy use calculation. This categorization is presented in Figure 1. The energy use calculation is also known as 'the energy performance' approach.

Figure 2 shows that energy performance regulations are in place in the Netherlands, France and England & Wales.[2] France introduced them in 2001. The French system differs fundamentally from the Dutch system: in France adherence to energy performance requirements falls under the principle of 'good workmanship' and is not governed by a system in which calculations are approved or checks are performed to confirm that these requirements have been met. In England & Wales, energy performance regulations – commonly referred to as SAP (Standard Assessment Procedure) – have been around since 1992. However, SAP exists alongside two other systems for showing compliance with energy standards in building regulations. Up to now, SAP has seldom been used in practice because it is regarded as relatively complex compared with the other two systems, one based on insulation requirements for

[1] The Build-on-RES project was initiated by the OTB research institute for housing urban and mobility studies and was executed with five partners from five EU member states. For more information see www.buildonres.org

[2] Though energy regulations are largely similar in the three parts of the UK (Scotland, England & Wales and Northern Ireland), we have concentrated on England & Wales.

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Categorisation of energy regulations for new housing in five EU member states

	Unit approach	Transmission loss calculation	Heat demand calculation	Energy use/ performance calculation
Belgium		Flanders (1993): "K-level": dwellings only Wallonia (1996): Option 1: "K-level": dwellings and non-domestic buildings Brussels (2000): "K-level": dwellings and non-domestic buildings	Wallonia (1996): Option 2: heat demand calculation	
France		(Transmission loss calculation GV: until 2001)	(Heat demand calculation BV: until 2001)	Option 1: Energy Performance Regulations + Thermal comfort in summer T_{ic}. (Reglementation Thermique 2000; 2001)
	Option 2: Simplified procedure with "technical solutions" (Reglementation Thermique 2000; 2001)			
The Netherlands		(Until 1996)		Energy performance regulations (1996, current standard for housing: 2000)
Denmark	Option 1: Max. U-values (BR '95/BR-S 98)	Option 2: Transmission loss calc. (BR '95/BR-S 98)	Option 3: Energy frame / Heat demand calc. (BR '95/BR-S 98)	
England and Wales	Option 1: Elemental method (+ minimum SEDBUK efficiencies) (Ap. Doc. L 2002)	Option 2: Target U-value (+ possible correction factor for boiler efficiencies and passive solar gain) (Ap. Doc. L 2002)		Option 3: Carbon Index Method: SAP calculations (Ap. Doc. L 2002)

Based on framework in: Beerepoot, M., 2002a

Figure 2. Energy regulations for new housing in five EU member states. (Source: Beerepoot *et al.*, 2004.)

building components and one on a heat loss calculation. A broader European study revealed that the Netherlands is unique in Europe, as the only country that has experience of energy performance regulations as the sole means of regulating energy since 1995 (Beerepoot *et al.*, 2002). Figure 2 also shows considerable differences in the type of energy regulation in each country. Until 2006, in Flanders (Belgium) the energy performance requirements for new buildings have been based on heat loss calculations; hence, only the insulation of the shell of a building is considered, and there are no requirements for ventilation or heating.

Our research revealed that some initial steps have recently been taken to formulate energy performance requirements for existing housing (Beerepoot *et al.*, 2004). England & Wales and Germany have started imposing minimum levels of insulation when building components are renewed. Germany has gone farther by setting a maximum U value of $1.5\,W\,m^{-2}\,K^{-1}$ for replacement glass and a minimum Rc value of $3.5\,m^2\,K\,W^{-1}$ when constructional alterations are made to a roof. The German regulations also state that heating systems dating from before 1978 must be replaced by December 2006 and that heated space adjacent to an unheated attic must be fitted with roof insulation by the same date. In England &

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Wales insulation requirements have been formulated for replacement windows and doors and standards have been set for the yield from replacement heating systems. England & Wales monitors these requirements by awarding certificates to the firms that fit the components and systems. The certification system is managed by trade organizations, such as FENSA for glass and doors, and CORGI for heating systems. Denmark is also turning its attention to existing buildings, but has not imposed any energy performance requirements. However, it has applied an obligatory system of energy labelling since 1997: every building, when sold or leased, must have an energy label indicating its average expected energy consumption compared with an energy performance calculation. The Danish system of energy labels is largely similar to the energy certification system for existing buildings in the EPBD.

Drawing Attention to Renewable Energy in Energy Performance Regulations

The energy performance calculation takes account of the yields from installations that deliver heating, hot tap water and ventilation. It does not automatically cover all types of installation. The inventory of openings for including renewable energy in current energy (performance) calculations revealed wide differences in the importance that each country attaches to renewable energy applications (Buscarlet *et al.*, 2004; van Cruchten *et al.*, 2004).

Until 2006, regulations in Belgium accorded no importance whatsoever to renewable energy, while the Danish regulations rated only the utilization of passive solar energy. In England & Wales to date three methods for fulfilling the energy regulations exist. The third method, SAP, consists of an energy performance calculation. The first and second methods make allowances for exceptional cases, if a heat pump is used or a form of biomass. These were designed with the specific aim of promoting the use of these technologies. SAP covers the utilization of passive solar energy, solar thermal systems for hot tap water, and heat pumps. Solar thermal systems that help to heat space are not rated in SAP; nor are photovoltaic systems. The French method was introduced in 2001, but it was not until 2004 that it could be used for calculating the input of solar thermal systems (for tap water and heating). This procedure is not, however, incorporated in the general energy performance calculation, but is based on the 'f chart' principle, which is fairly complex compared with e.g. the Dutch approach. The Dutch energy performance method is the only one that addresses photovoltaic systems besides other applications such as passive solar energy, solar thermal systems and heat pumps. The Dutch system therefore offers the most possibilities for rating renewable energy applications. The French energy performance system is also expected to rate the application of photovoltaic systems soon.

The characteristics of methods for calculating energy performance were also inventoried and analysed in the research. Significant differences came to light. The English method, SAP, asks the user only for the number of square metres of collector surface in the case of, say, a solar thermal system. Other conceivable factors – such as angles, orientations and yields – remain constant. The French method, on the other hand, asks the user for a whole range of information, including heat storage characteristics such as the volume and the heat loss coefficient of the reservoir. It can also incorporate specific features of the collector – the heat loss coefficient and the solar gain factor, though these are also covered by default values. The Dutch method for calculating the energy performance of housing is positioned midway between the English and French method. The factors influencing solar thermal systems are limited to collector surface, orientation and angle, shadow and yield resulting from the heating needs of a building. The general basis for calculating the contribution of solar thermal systems is the 'solar load ratio' in the Netherlands, Belgium and England & Wales, and the 'f chart' in France. The German method – which was also studied – is based on a totally different principle involving a simulation-based correlation.

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Incorporating Incentives for Renewable Energy in Energy Performance Calculation

The implementation of the EPBD will demand a response from all the member states, including those that have already enacted parts of the directive (e.g. the Netherlands). The renewed focus on energy regulations in all the EU member states should create scope for synergy in the promotion of renewable energy. A first condition for encouraging the use of RESs when implementing the EPBD is that it must be possible to calculate the contribution of RES equipment. When this condition is fulfilled it is possible to look for encouragement of RESs in relation to the calculation of the energy performance of a building. Our research in the framework of the Build-On-RES project strove to identify synergy opportunities, concentrating particularly on ways in which current or future energy policy can be used, combined or adjusted without too much effort in order to boost the use of renewable energy. We found two examples of instruments that can be combined with energy performance calculation relating to renewable sources: one in Finland and one in Germany. Finland introduced energy performance regulations in 2003. One of the conditions is that energy that is consumed over and above the set level must be generated from renewable sources. The German system, which dates from 2001, includes a rule that says that if the input from renewable sources exceeds 70% of the total energy consumption there is no need to meet the energy performance requirements. The original intention behind this rule was to provide a means for rating renewable energy applications when the system was still in its infancy and there were no definitive arrangements in this area. Now, it could also be regarded as an incentive for innovative applications of renewable energy. Although, strictly speaking, a wind turbine in a building does not figure in the energy performance calculations, it can still be rated under this rule. A more developed form of regulatory policy, which has not yet been applied, is to give preferential treatment to renewable energy sources in the calculation core of the energy performance. It has occasionally been said that the Dutch energy performance calculation delivers inordinately good results for heat supply and that this is partly due to political choices. Something like this could also apply to renewable energy applications.

Energy Performance-Related RES Policies

Earlier, we discussed the possibilities for encouraging RESs related to the energy performance calculation. However, many obstacles can hinder the use of RESs in residential buildings, even when this first condition is fulfilled. Governmental intervention is often considered necessary to tackle the constraints that hinder the pace at which the use of RES equipment is spreading. This section therefore examines policy instruments that can be used over and above – as well as in relation to – energy performance regulations in order to encourage the use of RESs. We distinguish three categories of policy instruments: regulatory (legislation), financial and informative. Searches were performed to uncover already existing examples in Europe and to spot new windows of opportunity.

Once the importance of greater penetration of RESs gains more recognition than it currently has, regulations can become an effective means of achieving that goal. In general, however, regulations are not a popular instrument in politics. In fact, they are often only considered when a problem is considered to pose a great potential threat to society and no other solution is available. Since climate change could pose such a threat, it is not inconceivable that efforts to promote more widespread use of RESs will gain even greater priority on the political agenda in a number of years.

With the above in mind, Figure 3 presents a number of options for regulations that could be combined with the introduction of an energy performance policy and that could accelerate the penetration of RESs in residential buildings. Generally speaking, the introduction of regulatory policy is often slow

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Options for RES regulations in an EP policy

Policy instrument	Pros	Cons	Examples
RES obligation when exceeding energy performance standard	No change in design freedom, while adding extra options for RES.	Violation of standards is tolerated (contradictorily signal)?	Finnish energy performance regulations (2003).
Obligation for percentage of RES in EP calculation	Guaranteed increase in percentage of RES used in buildings.	Less design freedom.	Barcelona Ordinance on the Application of Solar Thermal Energy Systems in Buildings (2000).
Obligation for application of RES techniques in specific situations: Combine PV with cooling system Obligatory solar thermal systems for social housing	Electricity demand & supply come together. Guaranteed cumulative production possibilities for innovative RES techniques.	Additional administrative control? In some MS, social housing is under strong governmental control; this is an example of a governmental monopoly (highest amount of pressure possible).	Preliminary idea Italy. Intention in Denmark in 2001, prevented by new government in 2002.
Energy performance standards building site	More RES options will be available when considering the scale of a building site. More design freedom when considering the scale of a building site, although minimum insulation levels must be set for building parts in order to prevent bad designs.	Administration costs will increase as authorities exercise more complicated design control. Tolerance of non-compliance can increase since building control will be more complicated.	Energy Performance of a building site (EPL) (the Netherlands, voluntary information policy).
Exemption from the obligation to meet energy performance standard (primary energy) if the percentage of RES is greater than a certain percentage of the total energy consumption (e.g. 70%, as in German EnEv)	Useful in the case of new RES equipment for which calculation algorithms do not yet exist. Saves time/money because EP calculation is not required (although some calculations must still be performed to check the energy concept).	Insufficient benefits for applicant. This can be interpreted as a wrong message: "when using RES, energy efficiency is no longer needed".	Energieeinsparverordnung (EnEv), November 2001 Germany.

Figure 3. Options for RES regulations in an EP policy. (Source: Beerepoot *et al.*, 2004.)

and sluggish. Target groups are difficult to win over and the policy needs a support base in order to be effective. But an example from Barcelona tells a different story. In 2000 Barcelona introduced a policy under which all new buildings had to be fitted with solar thermal systems capable of meeting at least 60% of the hot tap water needs. Close attention was paid to building a support base among the city's citizens and building partners. In 18 months the collector surface in the city rose from 1.650 m^2 to 14.027 m^2 and continued to grow afterwards at the same pace.

Some time ago, a proposal was made in Denmark to require social housing associations to install solar collectors on the roofs of their housing stock. Danish social housing associations own a large percentage of the country's housing stock and have a strong position on the housing market. Since that time, however, the government has changed and the idea has been rejected and abandoned.

Another approach, which originated in Italy but is still to be implemented, is to allow the purchase of a PV system only if an air-conditioning system is purchased at the same time. This rule would apply

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to climates with high cooling needs in the summer and ensure that the peak cooling consumption would more or less coincide with the peak yield of PV systems and thus spread the burden in power plants in the summer.

In the Netherlands another example was found, once mooted by the former State Secretary for Housing (Stromen, 2000). He took the view that the energy regulations for buildings were too limited in the long term and advocated the introduction of energy performance requirements for entire building sites. This would create more openings for the deployment of efficient generation technology, such as biomass plants or wind turbines.

Financial incentives are used quite frequently by governments to encourage energy saving or the use of RESs. Financial incentives fall into two basic categories. The first consists of levies or taxes to prevent undesired behaviour, or to compensate for environmental costs. The second category consists of subsidies or tax exemptions aimed at encouraging desired behaviour. Ideally, these two types of financial incentive should be in balance with each other: the costs of RES subsidies should be covered by revenues from RES taxes, or levies (Vermeulen, 1992). Financial incentives are often part of schemes that function separately from energy regulations. Administrative procedures can be complex and can discourage the use of subsidies. It would be interesting, therefore, to see what financial RES incentives may be proposed in combination with the energy performance regulations required under the EPBD. We present a number of existing examples and new ideas in Figure 4. Since the objective is to encourage the use of RESs, we focus primarily on positive financial incentives, such as subsidies or tax exemptions.

It is often said that energy performance regulations will – in themselves – prompt efforts to develop innovative techniques, provided that the energy performance standards are tightened regularly. However, decisions to tighten energy performance standards are political and are not, therefore, guaranteed to be made on a regular basis. In the Netherlands, energy performance standards for dwellings have not been tightened for six years now (2000–2006). The Netherlands' experience with tightening energy performance standards by taking one small step at a time indicates that this approach results primarily in product improvements, rather than product innovations. One possible solution to this would be to introduce a financial incentive that rewards energy performance that exceeds the standard. If that financial impetus were large enough, it could encourage the development of innovations or the use of RES equipment. This idea was introduced for a one-year period in the Netherlands (in 2002). The energy performance standard at the time was 1.0. Performances ranging between 0.9 and 0.8 were rewarded with 450 euros and those that fell under 0.8 were rewarded with 1100 euros.

A subsidy scheme that provides subsidies for dwellings that use RES equipment to meet a certain percentage of the heat demand could prove feasible. In that case, it should be possible to calculate this percentage of RES, using the energy performance calculation. At present, no such subsidy schemes exist.

In the Netherlands, mortgages with lower interest rates are available for homeowners provided their dwelling meets a number of conditions regarding sustainability. The conditions are quite stringent, requiring a long list of sustainable measures. However, the costs of these measures can be covered by the money saved with a lower mortgage. The Netherlands' mortgage scheme is paid for by means of a system of 'green investments', which allows parties to invest in 'green funds' that are exempt from investment taxation. These 'green funds' are, among other things, 'green investments', used for providing cheaper mortgages for sustainable buildings. This makes the system a closed circuit with hardly any governmental interference, since green funds and mortgages are managed by private banks. A similar scheme, specially designed to promote RES, could also prove feasible.

Land is often owned by governmental institutions and sold to private parties to start new land developments. This puts governmental institutions in a position to set conditions on the land they sell to private developers. However, for legal reasons, it has proven difficult for municipalities to impose conditions that are more stringent than those laid down by national law. In Belgium, housing developments

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Options for financial RES incentives in EP policy

Policy instrument	Pros	Cons	Examples
Subsidy for performance that exceeds the standard			
1. Subsidy for better EP performance	1. Encourage more energy saving than regulated while offering same amount of design freedom (with the expectation of increasing use of RES).	1. Subsidy expenditure needs to be covered by tax (preferably from taxation regarding the same issue?) (Regulating Energy Tax?).	1. EPR-2002 (the Netherlands) (non- existent at present – mid 2004).
2. Subsidy for better RES performance	2. Encourage use of RES while offering same amount of design freedom.	2. Subsidy expenditure needs to be covered, by tax (preferably from taxation regarding the same issue?) (Regulating Energy Tax?).	
Subsidy for RES equipment automatically connected to submitting an Energy Performance calculation to Building Control	Administrative procedures can become more efficient. Subsidy application process will become easier, thus encouraging use of RES.	Subsidy expenditure needs to be covered, preferably from taxation regarding the same issue (Regulating Energy Tax?).	No examples available.
Cheaper (mortgage) loan for consumers who use more:			
1. Sustainable options	1. A relationship with building mortgage can be a strong financial incentive (new buildings).	1. If not directly related to EP calculation, more effort will be needed from architect/developer, which will prevent use of RES.	1. Green Mortgage (the Netherlands).
2. RES (related to EP in that it requires EP performance that exceeds the standard)	2. A relation with building mortgage can be strong financial incentive (new buildings).		
Land price policies: e.g. imposing (RES) conditions when selling land for housing development	Land possession is one of the few means of power that (municipal) governmental institutions can use to fulfil (municipal) 'green' goals.	Power of (municipal) governmental institutions to impose more stringent regulations that those in place under national law may be limited for legal reasons.	Some private initiatives in Belgium.

Figure 4. Options for financial RES incentives in EP policy. (Source: Beerepoot *et al.*, 2004.)

are often initiated by private parties who own land. Belgium has one known example of a private landowner (in Bassevelde, commune of Assenede in eastern Flanders) who set sustainability requirements in a land deal.

Information policies use fairly limited means of force. Rather, they aim to convince parties entirely by means of information about the benefits of certain behaviour. Information policies are often considered supplementary tools to other policy instruments, such as regulations or financial incentives. However, in situations where the parties involved are generally willing to change their behaviour but do not know how best to go about it information policies can be effective. We present a number of existing examples and new ideas in Figure 5.

Labelling is an example of an informative policy where additional information is used to convince parties of the benefits. One option to consider is that of introducing a RES label for dwellings that indicates the amount of RES used. The amount of RES could be expressed by means of the percentage of

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Options for RES information policies related to EP policy

Policy instrument	Pros	Cons	Examples
Explicit RES contribution in Energy Performance rating	Makes RES more visible as part of the energy performance of a dwelling.	Without any obligations.	
RES label	A RES label can be a marketing instrument/ selling point.	In a 'seller's' housing market, a RES label could be a relatively unimportant selling point.	'Solar dwelling label' (the Netherlands, 2003).
RES potential analysis	A RES analysis can provide insight into possible RES options and pay-back times, thereby seeking to promote RES.	Providing RES options and pay-back times can be too weak an instrument to change behaviour.	No example available in housing. (In NL, however, examples are available for municipalities and industries).
Establish RES agreement for new building site among all partners involved (municipality, architects)	Agreements make an intention more official.	Agreements are generally voluntary, making it easy to renege.	Danish municipality in Glostrup.

Figure 5. Options for RES information policies related to EP policy. (Source: Beerepoot *et al.*, 2004.)

heat demand met by RES equipment. It is quite easy to develop ranges of RES percentages and divide them into categories (e.g. 'A', 'B', up to 'G'), similar to the energy labels for household appliances. In the Netherlands, a 'solar dwelling label' exists. Although the name gives the impression that this is a RES label, the label covers a much wider range of aspects, such as the use of wood from forests under proper management ('FSC' wood).

The EPBD requires a feasibility analysis for alternative energy systems in new buildings that measure over 1000 m^2. The interpretation of what this 'feasibility study' should look like is very divergent per member state. In order to encourage the use of RESs, the feasibility study should be more than a checklist or a statement saying that the use alternative energy systems has been checked. This feasibility study can, of course, be extended to include smaller buildings. Another option is to explicitly stress the share of renewable energy in dwellings, as calculated in the energy performance calculation. In the Netherlands, RES potential analysis instruments do exist for some sectors, such as industry, municipalities and horticulture.

Synergy Between Renewable Energy and Energy Performance Regulations

The introduction of energy performance regulations as required by the EPBD offers a perfect opportunity to consider and introduce specific provisions to promote RESs. Since all member states have specific RES policies aimed at increasing use of renewables in the future, it is possible to create synergy between new energy policies for buildings when these policies are introduced.

In comparing energy regulations in five member states – the Netherlands, Denmark, France, United Kingdom and Belgium – in Build-On-RES, supplemented by information from Beerepoot *et al.* (2002), we found that experience with energy performance regulations – in the strict sense of making energy use calculations for buildings – is rather limited. Besides this, we found that to date RESs have not always been an obvious element in energy performance calculations, but rewards for using RES equipment in the energy performance method differ per member state.

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The design of energy performance calculation procedures is important. Renewable energy sources are a crucial consideration. Based on our findings, we would advocate an integrated energy performance calculation, where RES equipment is an option among many possible installations. Moreover, the calculation procedures for taking RES equipment into account should not be more complicated as compared to those for any other installation. In the near future, efforts to develop energy performance calculation methods could focus on devising additional arithmetical solutions to promote the use of RESs. Regulations in some member states favour CHP (combined heat and power) installations above regular installations due to political reasons. Similar solutions could feasibly be introduced for RESs.

In exploring options for combining energy performance regulations with regulatory, financial or information policies that promote RESs, we have encountered some interesting ideas. The option of establishing regulations to increase the use of RESs raises contradictory considerations. Politically speaking, the introduction of regulations is often unattractive, as regulations are felt to hinder competition and impose barriers. On the other hand, such regulations can be remarkably successful if sufficient attention is paid to public support for the scheme. Regulations will probably only be considered when a problem is felt to pose a serious potential threat to society and other solutions are not sufficiently effective. Since climate change could pose such a threat, it is not inconceivable that efforts to promote more widespread use of RESs will gain even greater priority on the political agenda in a number of years.

Financial incentives have been widely used to encourage RESs, often with subsidies specifically issued for RES equipment, such as solar systems. The combination of financial incentives and energy performance regulations could take the following forms: a subsidy for improvements over basic levels of energy performance rating or a subsidy for a specific RES contribution to the energy performance rating. Subsidies for RES equipment could be automatically linked to the submission of energy performance calculations to building control authorities, or of the energy performance certificate to the relevant administrative body. This would reduce the administrative burden for developers, or building owners. Subsidies appear to be a very attractive policy instrument, but may not be an effective channel for allocating government budget funds. For instance, subsidies that are awarded for well established techniques pose the risk of the 'free-rider effect': the subsidies may end up benefiting parties who would have used these techniques anyway.

It would be relatively easy to introduce guidance or labelling to promote RESs in combination with energy performance regulations. However, the effectiveness of such measures is difficult to determine and may prove to be fairly limited. A RES label combined with the energy performance rating or certificate can provide easily understandable information about RESs. Ideally, a RES label that shows the amount of RES used in a dwelling would be a marketing tool. However, it would have limited success in countries where the energy prices are low.

The Build-On-RES research project has resulted in recommendations for policy-makers who are working on the implementation of the EPBD (Beerepoot *et al.*, 2004). Some of these recommendations relate to concrete, technical aspects of the energy performance regulations; others concern additional policy measures, mostly combined with the energy performance calculation or the energy performance certificate.

- The calculations for renewable energy applications should be incorporated in the general energy performance calculations to ensure that equal attention is paid to renewable and conventional energy systems.
- The method for calculating energy performance must make provision for the use of future renewable energy innovations in buildings, such as wind turbines and biomass 'plants'. A start could be made by copying the German system, which dispenses with the need to meet the energy performance requirement if over 70% of the energy needs are covered by renewable sources.

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- The share of renewable energy in the energy consumption of private dwellings must be explicitly highlighted in the output of the energy performance calculations.
- Preferential treatment could be applied to renewable energy applications in the core of the energy performance calculation, or the authorities could make it obligatory to cover a percentage of the energy needs with renewable energy. These may sound like far-reaching forms of regulation, but they could offer realistic options, given the crucial importance of renewable energy in a climate-neutral energy infrastructure (in the longer term).
- Instead of subsidizing RES equipment, RES performance can be subsidized (e.g. subsidizing the percentage of RESs in the total estimated energy consumption). In introducing RES subsidies, efforts should focus on avoiding complicated administrative procedures (think combinations with the administrative procedures for building permit applications).
- A RES label could be introduced, automatically connected to the output of an energy performance calculation, or the energy certificate. This RES label could be issued for buildings that fulfil a certain energy consumption requirement (e.g. when RESs contribute *X*% of the total estimated energy consumption). The RES label can be used as marketing instrument and serve as a selling point.

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