# Assessment of non-cost barriers to renewable energy growth in EU Member States - ***AEON***

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# Table of contents

# Executive Summary

The accelerated deployment of renewable energy technologies has become a major priority for public policy makers across the globe.

In the last two decades, most of the debate concerning the promotion of renewables was focused on the financial support schemes and on improving grid access conditions for renewable electricity. Of course, these are crucial issues which will continue to deserve serious attention in the future. However, during the last few years, the importance of tackling non-financial and non-technical barriers to renewable electricity, heat and transport has gained the attention of many policy analysts.

In June 2009, Directive 2009/28/EC on the promotion of the use of energy from renewable sources, entered into force. The articles 13, 14 and 16 of the Directive contain a number of requirements for Member States to address or remove non-cost barriers to the increased deployment of renewable energy sources. This study presents among others an overview of these barriers in all EU Member States; their history, their impact on renewable energy deployment and suggestions for policy solutions, where feasible.

### *Benchmarking of types of barriers*

In summary, our review suggests that the following nine major issues in the Union could be identified. We have ranked these issues in order of severity, divided over three groups based on the number of impacted technologies, number of impacted stakeholders, their geographical diffusion, the extent the barrier blocks renewable energy deployment, the amount of feedback we received during the study, etcetera.

**Most severe types of barriers:**

- Administrative hurdles like planning delays and restrictions, lack of coordination between different authorities, long lead-times in obtaining authorizations, severe costs for obtaining permission, etcetera. Broadly speaking, this issue is considered to be the most severe for various reasons:
  - in principle, all technologies, even small-scale systems, are impacted;
  - their presence in almost every Member State, as evidenced for instance by the absence of a one-stop shop option for most countries and/or technologies;
  - administrative barriers one way or another increase both the (transaction) costs for the developer and the society as a whole (many authorities involved, (in)coherence of administrative procedures and framework, management of protests and legal cases, etcetera);
  - insufficient spatial planning and/or strong social opposition to renewable deployment may lead to application rejection, and consequent full actual project development blockage.

Typical established indicators evaluating the efficiency (or better lack of efficiency) of the administrative process include:

| | |
|---|---|
| No presence of a one-stop shopping scheme | Circa 85% of the Member States; still many authorities involved in Greece, Bulgaria, Romania, etc. |
| Lead time for collecting all permits (excl. build integrated technologies) | Roughly between 26 to 52 weeks on one hand (Germany, Latvia, Sweden and the UK) and 3 to 6 years (e.g. Greece, France, Hungary, Italy and Spain) on the other hand |
| No exemption from authorization of small-scale systems (mostly build integrated) | ~40% of MS for roof top photovoltaics and solar thermal and even ~70% of MS for geothermal heat pumps |
| Costs for permitting (administrative process) | ~30% of overall costs for small roof-top PV projects; for larger projects it is roughly ranging between 50-100 k€ in the East (Poland, Estonia, Bulgaria) and 200-400 k€ for The Netherlands and Italy, for instance |
| Estimated typical number of permits required (excl. small-scale systems) | Between 1-2 (Germany, Denmark, Italy) and more than six (Bulgaria, Portugal and Romania); sometimes going up to over 40 (wind energy in Greece and Cyprus) |
| No exemption from authorization small-scale systems | ~40% of MS for roof top photovoltaics and solar thermal and even ~70% for geothermal heat pumps |

A key solution is a stable administrative framework including:

- one-stop-shopping: a single regulatory contact point, also for larger facilities such as the Dutch *Rijkscoordinatieregeling*;
- bound decisions: authorities have to grant permission subsequent to a complete application process, denial or delay subject to various legal options for the applicant;
- strictly defined time periods for objections, reactions to objections and issuance;
- restriction of eligible protests to stakeholders impacted by the installation;
- authorisation exemptions for small RES systems, and
- unambiguous permitting conditions that have to be met by applicants, etc.

The German legal system includes several of these favourable elements. Other requirements are clear guidelines and training for civil servants and the inclusion of local stakeholders in the planning and permitting process to avoid the risk of strong opposition.

- Barriers linked to grid connection and access affecting all RES-E technologies, are the second main obstacle - not so much in terms of the physical connection (where administrative and cost issues dominate), but limited priority access with regard to fossil power production, insufficient transport capacity linked to obsolete infrastructure, and limited interconnection capacity may block or at the least delay renewables development. Reasons include lack of grid capacity caused by the incentive to expand on economical reasons only, lack of RES spatial planning, insufficient design of networks with regard to the intermittent nature of renewables and lack of Trans-European Electricity Network strategy. Some characteristic inventoried indicators are:

| | |
|---|---|
| Frequent denial of grid connection by TSO and/or DSO | Circa 40% of the Member States |
| Lead time for grid connection | Ranging between less than six months (Denmark, Finland and Bulgaria) and over three years (Italy, Poland, Portugal and Spain) |
| No presence of an efficient plan for the reinforcement of the connection capacity within the country | Over 60% of the Member States |
| No presence of an efficient plan for the reinforcement of the interconnection capacity with neighbouring countries | Over 60% of the Member States |
| | |

In various countries (Austria, Belgium, Czech Republic, Greece, Netherlands, Portugal, Romania, Slovakia, Spain and the United Kingdom) grid connection is frequently denied. In addition, in Poland connection terms are not issued and examination of filed applications is often suspended. The country is clearly lacking a long-term strategy for grid expansion. Denial of new applications is also observed for the Czech Republic (mainly for solar). In Greece, because of an unstable authorisation process, the connection process can take many years.
Acceptable solutions include harmonized European regulatory frameworks, the availability of sound national energy plans and possibly the introduction of more strict regulations including maximum costs for grid connection and sanctions for TSOs and DSOs. Concrete examples of best practice include Finland (clear rules for both grid operators and applicants); Sweden (no permit for RES plants for grid connection) and Germany (an efficient sanction system for TSOs and DSOs upon grid connection denial).

- Issues related to limited information and awareness include a lack of general knowledge on RES benefits, poor dissemination of support measures, poor knowledge dissemination of pilot and/or demonstration projects and insufficient funding for awareness campaigns. This is ranked to be important since cultural acceptance, and a positive image of RES and its benefits are at the base of all policy development. Quantitatively, our survey suggests at least ten Member States inhibit insufficient quality of information on public support measures; six could be entitled "average" and only 11 countries are evaluated at best as "sufficient". Lithuania is a good example for the proactive reassessment of the provision of information on renewables. A draft law on renewables includes a separate section for a regulation on information and awareness raising. The envisaged provision would assign the responsibility for information dissemination and awareness raising not only to the national ministries, but also to municipalities and other public institutions.

**Barriers imposing a medium to severe impact:**

- Specific barriers for the build environment are next, since circa 40% of the final energy demand in Europe is consumed in buildings. Aspects include absence of renewables obligations for the sector, exemplary role of public buildings neglected, missing attention for spatial planning and the tenancy/building ownership dilemma. Renewables obligations (as present in Germany, Ireland, Portugal, Spain and Slovenia) taking into account past experiences are recommended, accompanied by a

reduced focus on costs while tendering demonstration projects in public buildings. With regard to spatial planning, it is recommendable to include in action plans (e.g. NREAPs) provisions aiming at creating favourable pre-conditions for the use of active and passive solar energy, biomass and geothermal energy in buildings not served by district heating systems. Options for the implementation of renewables / energy efficiency regarding the tenancy and building ownership dilemma include:

- facilitating landlords the passing of a part of the investment costs to the tenants;
- if rent monitoring schemes are available, considering the overall energy efficiency of the building, including the use of renewables, as an increasingly important factor to determine the value of the rent;
- facilitating the activities of Energy Service Companies (ESCOs) by creating a clear legal framework and,
- making it easy to distinguish between the ownership of a building on one hand and of energy equipment installed inside or on the top of the building on the other hand (i.e. legal certainty in this areas facilitates ESCO willing to operate for instance a micro CHP or a solar system on buildings owned by third parties).

- The low qualification, and the lack of reliable certification schemes for installers considered to be a serious barrier in many countries, particularly for the heating and cooling sector. Bad practice examples are many Eastern European countries, including Greece. In the latter, stakeholders complain about the absence of a certification body and of guidelines for planners or architects, and about a general lack of training. This is experienced as a significant barrier to RES deployment, though Greece is with Cyprus actually the leader in solar thermal among hte Mediterranean countries. The existence of certification schemes is not a guarantee of the qualifications of the installers, at least in the short term: For instance, the UK study shows that several appointed certification bodies certify RES installers in several locations throughout the country. However, market players of international companies active in the renewable heating sector find that the average level of training on renewables in the UK is under average. Quantitative indicators in this field are:

| | |
|---|---|
| Availability of certification schemes or equivalent qualification schemes for installers | Yes 27%; only partially 23 % and No 50% |
| Presence of sufficient training on RES issues during the formal education of installers, planners and architects | Yes 20%; only partially 8 % and No 72% |
| | |

- Missing policy options to increase the share of renewables in district heating and cooling, not to mention the absence of facilitating the initiation and expansion of new district heating systems are a missed opportunity. First, subsidy regulations frequently discriminate the production of green electricity as compared to heat, albeit the potential of in particular sustainable combined heat and power production. Lack of incentives for district heating operators, of obligations, of technical know-how and of price regulations further limit the application. The effects of the EU $CO_2$ Emission

Trading Scheme and of the Energy Performance of Buildings may have a mixed effect upon District Heating. AEON research suggests that near 60% of the Member States does not include policies increasing RES share in existing networks. On the contrary in Denmark, for instance, utilities including DHC operators are obliged to gradually increase the efficiency of their energy supply structure. This has been one of the main drivers for the exceptional development of solar and biomass district heating in Denmark. Similar obligations are being introduced in some other countries, like France, but are not yet a standard policy instrument.

- Technical specifications included in support schemes may not be the most severe barrier, but they could lead to barriers to trade and even full market blockage for a specific technology. An example is the uncertainty of sustainability of vegetable oils incineration, and subsequent exclusion from financial support. For heat pumps and other renewable energy equipment for building integration in France, even if already validly certified according to the European standards, still needs to obtain an additional French certification before it can be installed. A useful strategy is further removal, unification and simplification of regulations, where they come on top of European schemes. Another best practise is to establish specific minimum efficiency thresholds for waste incineration (ca. 22% in The Netherlands).
- Renewable gas network issues are a matter of primary importance in the development of renewable energy sources in Europe. Biogas from various feedstock has quite some potential, is still developing and the presence of various cost-linked and technical barriers may conceal the appearance of non-cost obstacles. Our research suggests non-cost problems are in the area of *inter alia* discriminating support schemes (i.e. preferred feed-in tariffs for green electricity, or even complete missing subsidies for biogas as an end-product), administrative issues with regard to permitting and natural gas grid connection and missing general technical knowledge on upgrading, compression and grid injection. The introduction of green certificates as in The Netherlands could mitigate the subsidy dilemma while simultaneously guaranteeing biogas origination.

**Barriers considered having a minor impact:**

- Lacking measures for promoting energy efficient equipment may lead to needless energy losses thus limiting the full potential of sustainable heat production, in particular for heat pumps and energy production from biomass. Improved attention is needed for establishing minimum Coefficient-of-Performance values for heat pumps, and biomass conversion efficiency thresholds taking into account the whole chain efficiency.
- According to the national reports, only three Member States (Denmark, Estonia and Finland), have already fully implemented the requirements of Art 13(6) of the Directive concerning the promotion of efficient equipment, which indicates specific requirements particularly for biomass heaters and heat pumps. However, many Member States have implemented similar provisions with the same goals, though with different parameters or wording. For instance, Germany sets stricter efficiency requirements than those required by the Directive for biomass burners: at least 86% efficiency for burners up to 50kW, at least 88% for burners above 50kW.
  Of course, the promotion of the efficient use of scarce biomass resources, and of efficient heat pumps that avoid an excessive increase of the electricity consumption

are very important. However, in general, this issue seems not to be considered as one of the main barriers for the development of renewables;

The above mentioned issues and their component forming barriers have been worked out in a structured way in the subsequent chapters of the report.

### *Benchmarking of Member States*

An overall ranking of the EU Member States is available in Appendix II.

It must be stressed that this ranking is highly subjective, because it is based on assessments that are partly subjective, and it compares barriers indicators that are qualitatively different. Therefore, this ranking is a mere summary of the results of the specific questions researched in this study. While it can be used as a first, broad indication of the barriers for renewables deriving from the national administrative frameworks, it should not be seen as an objective measurement.

# 1 Introduction

Renewable energy is assuming an increased importance across Europe (and indeed across the world) due to security of supply issues as well as environmental and dependency concerns. The European Union is often regarded as an international frontrunner concerning the development, promotion and implementation of renewable energy policy and technology.

However, a variety of financial, technical and administrative barriers may block, hinder or else at the least delay RES deployment. The objective of the present study is to inventory per technology the abiding non-financial and non-technical barriers in all Member States and to suggest feasible policy solutions, where possible. This chapter will briefly outline the context, methodology and sources of information.

## 1.1 Policy context and background

The present study will be an important tool for supporting the first phase of implementation of the Directive 2009/28/EC[1] on the promotion of the use of energy from renewable sources, which entered into force in June 2009.

The current review will support amongst others:

- The Commission when it will evaluate the National Renewable Action Plans (hereafter: NREAP) according to article 4(5) of the Directive;
- The governments of the Member States during the last phase of drafting their National Renewable Action Plans;
- Legislators and stakeholders who will be accompanying and supporting the implementation of the Directive in the different Member States;
- Associations providing information and consultancy on renewable energies for the political decision makers on local, regional, national and international levels, and
- Project developers (indirectly, as a result of the various actions of the Commission subsequently to this study) being hampered by various institutional and non-institutional barriers while carrying out the project development cycle.

The articles 13, 14 and 16 of the Directive 2009/28/EC contain a number of requirements for Member States to address or remove non-cost barriers to the increased deployment of renewable energy sources. Such barriers include, for instance:

[1] Directive 2009/28/EC of the European parliament and of the council of 23 April 2009: on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

- Authorisation, certification and licensing procedures which are unnecessarily or disproportional discouraging investments in plants or infrastructure for the use of renewable sources, including procedures that are not transparent, lengthy, costly, badly coordinated between different administrative bodies or discriminatory (both offshore and onshore wind, biomass & (organic) waste incineration, hydroelectricity, etcetera);
- Absence of coordination among the various institutional stakeholders (authorities, Ministries, municipalities, public funds or even Member States) in particular for very large renewable power production facilities (municipal waste incineration, for instance);
- Technical specifications or certification procedures for equipment which constitute a barrier to trade (photovoltaics, solar thermal, heat pumps and biofuels);
- Lack of consideration for the use of renewables and their integration into district heating networks, when planning new industrial or residential areas (e.g. biomass district heating networks, integration of heat pumps with conventional heat supply or geothermal energy (idem));
- Lack of appropriated certification schemes for equipment installers (small-scale solar thermal, biogas), testing equipment and of transparent information available to the public concerning the installers' qualification;
- Lack of market transparency and market prices not including the external costs of energy;
- Poor knowledge dissemination of e.g. support schemes, pilot or demonstration projects (e.g. tar removal for biomass gasification, direct-drive for wind turbines);
- Decentralized renewables facing problems with grid issues (access and transport, grid codes, interconnection, difficulties in cooperation between DSO and TSO, etc.);
- Old-fashioned (environmental) legislation tailored to the use of fossils instead of innovative sustainable supply, and
- The absence of a level playing field for renewable energy technologies, in general.

In many cases, the reduction or the removal of non-cost barriers can be considered as a low-hanging fruit within the repertory of instruments that can be used to promote renewable energies. Financial incentives always represent a cost to somebody, be it the taxpayers, the energy consumers or somebody else. On the contrary, the removal of barriers is in many cases a *win-win* solution, which results in a more rapid deployment of renewables and thus in a cost reduction through economies of scales, without causing a cost to anybody.

### *Non-intentional barriers*

Such *win-win* situations very often happen in the case of non-intentional barriers. For instance, at least until a few years ago, in the Belgian region of *Bruxelles Capitale*, there was no administrative procedure in place for the permitting the drilling of geothermal resources. This was not due to a negative attitude towards geothermal, but simply to the fact that such permitting had never been awarded, probably due to lack of demand. However, such a situation may become an insurmountable obstacle: for building developers, time is money, and if they face such an administrative lack of clarity, they will most likely choose not to apply for a permit or not to start construction works at all - and this may lead to the permanence of such a non-intentional barrier.

Another example is the *German 1000 PV roof programme* and its associated public subsidies. Although it was technically implemented successfully, no additional industrial capacity was build up for a while and commercial sales slacked.

The purpose of this study is to identify as many as possible intentional barriers in each Member State, and explain how they could be removed.

*Intentional barriers*

Intentional barriers always have a motivation. There may be more or less sound arguments, and more or less strong and legitimated interests in society, that are in favour of maintaining such barriers.

A good example is the Environmental Impact Assessment (EIA) that may be a necessity from the perspective of protecting the natural environment and local habitat (pollution, bad labour conditions, smell, excessive noise and so on), but can be lengthy and costly for the applicant, most often the project developer. Another example is the grid access in case of biogas, for example. Regarding biogas, it may be costly to meet the specifications for natural gas thus hampering grid injection (not so much in terms of connection but rather upgrading, pressurizing, cleaning, *Wobbe* index, etc). [2]

The responsible legislator or regulator has the task to weigh the importance of these arguments and interests in comparison with the importance and urgency of promoting the use of renewable energies. The adoption of the Directive 2009/28/EC has changed the basis for this political evaluation in favour of renewables, as every Member States has adopted an ambitious renewables target.

In the case of intentional barriers, this study not only identifies them but suggests precise and practical reforms to reduce or remove them. Further, it also provides a qualitative assessment of the reasons why these barriers exist, of the positive and negative consequences of their removal or reduction, and if possible a quantitative estimation of the benefits of their removal in terms of growth of renewable energy deployment.

## 1.2 Sources of information and methodological issues

A preliminary analysis of the existing literature (COM 2005, COM 2008, EU benchmark 2009, OECD 2007, OPTRES 2007, PROGRESS 2008, ADMIRE REBUS, PV LEGAL 2010, Create Acceptance, RE Directive etcetera) has been carried out in the first phase of this project. [3]

As a result, a large set of issues (eventually ten) that may constitute relevant barriers were identified. Questionnaires were developed and used as a guideline for the research and the structured interviews with stakeholders in the different countries. Research and interviews were usually carried out with an open approach, i.e. first asking for the barriers perceived by the stakeholder, then asking specific questions on these barriers, and at the end asking

[2] On the other hand, examples exist (some specific Environmental Impact Assessment rules, water framework directive, etc.) of implementing "intentional barriers" which allow both RES development and compliance with the rules, so no inevitable trade-off.

[3] Ad interim deliverable: Overall description of issues version 1.2 (January 2010).

whether some of the potential barriers identified at European level, but not yet mentioned by the interviewee, were relevant as well. This approach was chosen because it seemed more important to identify the actual problems, than trying to force a complex and heterogeneous reality into a rigid matrix established at European level. The consequence of this approach is that a large portion of the information gathered in the national reports refers to peculiar issues that cannot be summarised and compared at European level.

During the first phase of the project, the consortium also defined a set of potential qualitative and quantitative indicators. The information gathered in the national reports based on these indicators was very useful as a basis for the qualitative analysis. Unfortunately, for most indicators, it has not been possible to gather enough reliable information to allow for a significant quantitative benchmarking.

On one hand, this is due to the methodological complexity of translating the impact of e.g. administrative procedures into costs and/or time that are necessary to comply with the procedures. Some practical examples of these difficulties are discussed below. Also in projects dedicated exclusively to administrative barriers (PV Legal, Wind Barriers), the exact definition of significant and feasible quantitative benchmarks has shown to be very difficult. At the moment of closing this report, the project Wind Barriers has not yet published the results of its survey, but it has been possible to integrate some results from the PV Legal project, that are going to be published in May 2010.

On the other hand, reliable and comparable data on the impact of for instance administrative procedures in terms of costs and/or time are simply not available in most countries. For this reason, it was necessary to ask affected stakeholders for their subjective evaluation. However, their assessment of costs/times varies strongly, not only depending on the technologies and sizes of the projects, but also showing a strong variance: each real life renewable energy project, each bureaucratic dossier, and each civil servant have their own peculiarities. A meaningful quantitative benchmarking of the situation in different EU Member States would have been possible only by interviewing a statistically significant number of stakeholders for every specific size and kind of renewable installation. This task would have gone beyond the time limits of this project.

Therefore, most of the analysis below is based on qualitative analysis carried out by the authors of the national reports, who have filtered the main results of the analysis they have performed in each country.

A last remark to draw the attention of the reader is that the severity of the barrier in each country is not proportional to the number of problems mentioned in the relative national chapters. On the contrary, some of the countries with less (administrative) barriers, like Germany, have been described more in detail. Each national report has been researched and written produced by a specific set of authors, who may have found more or less information.

# 2 Issue 1- Administrative Procedures (Golder / eclareon)

## 2.1 Introduction

In 26 of 27 EU Member States, administrative procedures have been indicated by the majority of stakeholders consulted in the framework of this project as the most important *non-cost barrier* among those treated in this study, at least for larger projects, mainly in the area of renewable electricity and cogeneration.

For the building sectors, administrative barriers may be relevant in some countries, but they usually are not crucial. Issues like the energy performance regulations and renewable obligations (see Chapter 4 below), the information of end users and of relevant professional groups (Chapter 6), and the certification of installers (Chapter 7) are in general more relevant. As for the electricity sector, the only exception was Ireland, where the main perceived barrier refers to social opposition (NIMBY) against the expansion of the power grids necessary to integrate higher shares of renewables (Chapter 8).

*Boundaries and structure of this chapter*

However, it is not possible to draw a distinct line between the two issues: NIMBY is a social and political phenomenon, embedded in a legal, economical and cultural context. In many cases, therefore, the national reports have included under administrative procedures also those legal conditions favouring the capacity of NIMBY opposition to effectively delay and block projects.

In fact, many of the stakeholders consulted, interpret the concept of “administrative barriers” broadly, including all kind of difficulties experienced with public institutions, but also opposition of third parties.

The purpose of this chapter is not to summarize the large amount of detailed problem descriptions mentioned in the national reports. In most cases, problems and solutions concerning administrative issues are peculiar to the specific legal and political context. The value of generalisation is therefore limited.

After some methodological notes, this chapter identifies the existing common denominators and tries to draw some general conclusions.

This chapter is structured in three parts:

- Barriers affecting all kinds of renewable energy systems;
- Barriers affecting large scale systems;
- Barriers affecting small scale / building integrated systems.

For each of these parts, the most important problems mentioned in the national reports are highlighted. We believe that the qualitative analysis of this summary can be a useful guidance for anybody who is working to reduce administrative barriers for renewables at European, national and local level.

*Methodology*

A series of general methodological issues are discussed above in the Introduction. This section refers to those issues specifically relevant for Issue 1 (Administrative Procedures).

When trying to compare the length and/or the costs of administrative procedures in different countries, a number of methodological problems arise, among them:

- It is **necessary to define standard kinds and sizes of renewable energy projects to be compared**, because it does not make sense to compare the administrative procedure for a small pellet oven with a 100 MW biomass plant. For instance in this project, we tried to gather date about the administrative procedures for:
    - Wind onshore, 2MW, 80m height
    - Biogas plant < 2MW
    - Biomass < 2MW
    - Biomass > 10MW
    - PV rooftop 1-3kW
    - Solar thermal ~9m² collectors
    - Geothermal heat pump < 10kW

  However, the standards chosen never fit all administrative and market peculiarities of all countries and regions. The results from some countries may be misleading, because the indicator lies just above or below a threshold that strongly influences the permitting process. In other countries, the indicator may not be relevant, because it is not representative of the local market. Within the PV Legal project, which looks only at PV, up to 12 sub-segments were distinguished, with a considerable spread of results, showing that a more simplified segmentation would lead to non meaningful results.

- **Measuring the time necessary to go through a permitting procedure is tricky**. First of all, the time is not an independent variable, since it partly depends on the timeliness, precision and completeness of the documentation provided by the applicant. Moreover, it is not evident how the time of an administrative process should be defined. The day of the first application is not a reliable indicator, because in some cases the formal application is "light" and is filed as soon as the project starts being conceived, in other cases the applicant would work weeks or months before submitting a formal application. Also the end of the process is not always easily identifiable. Should the time for a possible appeal be counted? In some cases, a long time goes between the effective certainty of the authorisation, allowing the developer to start preparing the work, and the day of formal notification.
  Finally, it must be distinguished between the total time (from start to end of the process), the waiting time (time which could not be used in other processes for the same project) and the actively spent time (hours of work necessary to complete the process). The latter two indicators also depend on the efficiency of the applicant.

Without this distinction, the results would be blurred. Keeping the distinction makes an empirical survey heavier and more complex.

- **Measuring the costs is tricky as well**. The purely administrative costs (taxes, fees etc.) can be measured, but are often not relevant, because they are only a small fraction of the total costs caused by the permitting process.
  A large part of the costs consists of time of the staff. This varies according to company and even within companies. For instance, most companies interviewed in the PV Legal and in the Wind Barriers projects are not prepared to declare their staff costs, for confidentiality reasons. And many say they actually cannot quantify the costs of administrative procedures, as they are tackled by several departments and/or are accounted for as overhead.
  Finally, it should be distinguished between the costs by the administrative process as such, and the costs caused by the fact of having to comply with certain regulations or standards. Should the latter be considered? In any case, companies cannot always distinguish among them.

For all these reasons, a systematic quantitative comparison of administrative procedures between different countries has not been possible within the scope of this project, due to the lack of reliably comparable data. However, a lot of relevant knowledge could be gathered in this project. The consortium decided to describe and analyse barriers instead of measuring them. Where possible, quantitative results from other studies have been used in order to increase the reliability of the assessments.

## 2.2 Overview of main findings and barriers

### 2.2.1 Barrier 1.1 - Barriers affecting all kinds of renewables

This section discusses barriers that affect all kinds of renewable energy systems. The following sections look at barriers affecting large scale systems, or small scale / building integrate systems.

This chart (Figure 2.1) considers different possible sources of administrative barriers. For each of them, the chart shows in how many Member States this source has been identified as a relevant barrier to the development of renewables by the authors of the national reports.

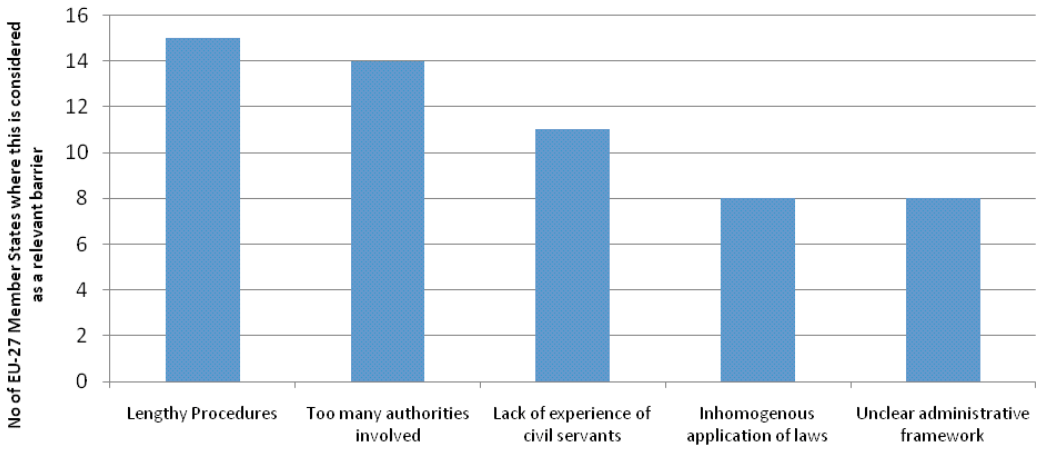


Figure 2.1 Sources of administrative barriers (all kinds of RES). Source: PV Legal project.

However, this chart shows the relative importance given to different sources of barriers by the hundreds of market players and stakeholders interviewed in the 27 EU countries. Due to the open nature of the interviews carried out, the values obtained are not relevant in absolute terms: for instance, lengthy procedures may be a problem in more than 14 EU Member States; there was not a common definition of what is an "excessive" number of authorities involved in the authorisation process. Moreover, stakeholders may have perceived certain issues as being especially problematic for the development of RES in their respective country. Therefore, they may have focused on these issues and neglected others, which still may be a barrier for a further development.

The chart shows that the duration of the procedures and the number of authorities involved in the authorisation process are considered as the most intense problems, followed at distance, by the lack of specific experience in renewables of the civil servants, by the inhomogeneous application of laws in different regions, or even in different individual cases, and by the lack of clarity of the administrative framework, including problems such as legal uncertainty, contradicting or unclear legal provisions, in transparent procedures, excessive margins of discretion of the administration and sheer extortion and corruption.

### *Lengthy Procedures*

Earlier reports have identified long lead time to obtain necessary permits as a key problem for the expansion of RES (OPTRES 2007). All in all, the national reports of the present study confirm this.

Lengthy procedures have been mentioned by stakeholders as a problem in the majority of the EU Member States, among them Austria, Bulgaria, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Slovenia, Spain and Sweden. As mentioned above, this list is not necessarily exhaustive. Due to the open nature of the interviews it is possible that lengthy procedures are an issue in other countries as well, they were simply not mentioned because stakeholders may have focused on other issues, which they considered more important. More detailed information can be found in the national reports.

According to the information gathered in the national reports, examples of good practice with comparatively rapid procedures are Sweden and the UK. In these countries, the time needed to obtain all the main permits for a 2 MW wind turbine are in the range of 10-18 months, while most of the other countries indicated ranges between 30 and 60 months. A bad practice example is France, with a range times between 60 and 84 months.
In France, delays may become even longer due to the legal system of tacit refusal: if the administrative authorities do not reply to a building permit request within the given delay period of five months, the permit request is tacitly rejected. The practice is however that project developers generally do not request reasoning for the refusal, but rather wait for the final written notice, which might even be positive. Some projects received a response up to five years after they filed the permit request

For the PV sector, rather reliable and comparable data have recently become available through the PV Legal project, based on in-depth interviews of numerous market players carried out with the same methodology in ten EU Member States. The following chart shows which share of the total time necessary to develop a small roof-top PV project must be spent waiting for the necessary authorisations.

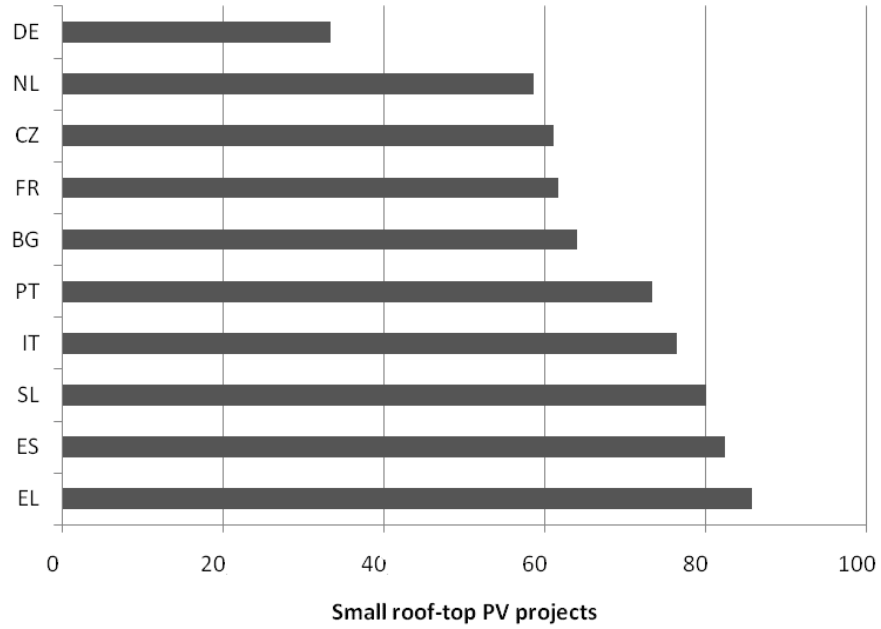


Figure 2.2 Waiting for permission as % of total project duration. Source: PV Legal project.

In the best performing country (Germany), authorisation procedures require less than 40% of the total time needed to realise the project. But in nearly all of the countries, this value is higher than 60% and ranges often even between 70 and 90%. The variation is impressive and confirms the impression of many stakeholders that most of the waiting time is not due to the fact that public authorities are effectively carrying out necessary controls, but rather to the fact that the dossiers are “sleeping” for long periods.

The discussions with stakeholders showed that many of them perceive a lack of political will to reduce the unjustified waiting times. Strategies could include:

- Providing a fast lane for renewable energy projects, as it is foreseen in some countries for other kind of projects of high political relevance;
- Capacity building of the public administrations involved (more staff, training of the internal staff, easier acquisition of necessary external expertise);
- Obligatory time limits for answers, possibly leading to tacit approval.

The latter approach has been already proposed (PROGRESS 2008). In most Member States, obligatory times of response of public authorities in permitting procedures do not exist. Where they exist on paper, they may often be ignored in practice, like in Hungary and Italy. The sanctions for the administration not respecting the deadline are too weak, if they exist at all.

The sanction, which would really lead to a more rapid deployment of renewables would be tacit approval. Most project developers would support this idea. However, some of the lawyers with direct experience in renewable energy projects interviewed within the framework of this study, expressed their scepticism (see report on Germany): they argue that tacit approval can lead the public administration into the dilemma of either authorising projects without the time to examine them adequately, or find artificial reasons to refuse authorisation. The latter would tend to increase administrative barriers. And the former might be welcome in the short term for the individual project developers, but it may fire back in terms of support of the public opinion in the long term.
Alternatively, a more flexible approach can be the introduction of a general principle that administrative proceedings should take place swift and without wilful delay, with legal clauses empowering project developers to sue public administrations not following this principle.

*High number of authorities involved in permitting*

In many Member States, stakeholders complained about the excessive number of authorities involved in permitting procedures. This is the case among other in Belgium, Cyprus, Estonia, Finland, Hungary, Ireland, Italy, Latvia, Luxembourg, Poland, Romania, Slovenia, Spain and Sweden. As explained above, it must be highlighted that this list is not necessarily exhaustive due to the open nature of the interviews, which were conducted with national stakeholders.
Stakeholders often complain that the different public authorities do not communicate sufficiently with each other.

In several cases, for instance in Cyprus or Slovakia or Italy, dozens of different public offices must give their approval, leading to waiting times of several years.

The fresh findings of the national reports in the present study confirm that only a minority of the EU Member States have introduced a one-stop shop, thus assigning one central agency the task of coordinating the authorisation procedures, thereby providing assistance to the applicants. This idea had been proposed already by previous studies and policy papers (COM 2005, COM 2008, OPTRES 2007, PROGRESS 2008, EU benchmark 2009).

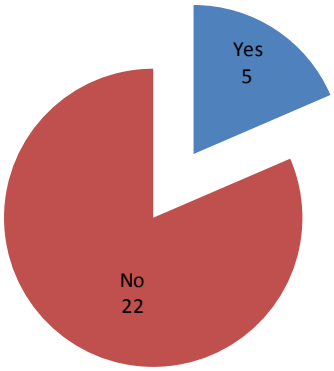


Figure 2.3 Pie diagram including the number of Member States with one-stop-shopping.

The countries mentioned as having a one-stop shopping scheme for the permitting of large scale renewable energy projects were: Denmark, Finland, Germany, Sweden and the United Kingdom. Italy is not included for the reasons explained below.

Stakeholders from those Member States that have introduced a one stop-shopping system generally praise this development. In particular, in Germany, the system is considered as very effective in most cases.

However, the importance of this indicator as such should not be overstated. In some countries, the permitting procedures can be very lean even though several administrations must be involved like for instance in Ireland. On the other hand, in Italy a single authorization procedure exists in theory. However, de facto, the central agency must obtain authorisations from up to 50 (!) administrative bodies. A one-stop shop usually can be a very useful instrument, if it effectively reduces the total cost of the process for the applicant in terms of uncertainty, time, effort and money.

### *Lack of experience*

In several countries, the lack of specific expertise in dealing with renewable energies has been identified as an important barrier for their development. The civil servants dealing with the permitting procedures are not familiar with renewables. This leads to confusion, delays or unmotivated denials of authorisations. This barrier has been reported in the Czech Republic, Estonia, Germany, Hungary, Ireland, Italy, Latvia, Poland, Romania, Slovenia and Sweden. As explained above, due to the open nature of the interviews, this list is not necessarily exhaustive. Moreover, the impact of this barrier differs from country to country. In Germany for example, this problem was mentioned only for biogas technology on regional level. In Italy and in Poland this kind of problem was reported with particular intensity for several technologies. Technologies likely to be affected are among others small hydro (Slovenia, France), larger or locally unusual biomass or biogas installations, but also wind power remains an exotic issue for the administrations of several countries and regions. All this is based on anecdotal evidence: no objective measure for the severity of the problem could be identified.

Possible solutions include the allocation of all similar authorization processes to the same office, which can thereby quickly gain experience and improve the procedures. An example is the *Federal Maritime* and *Hydrographic Agency* of Germany that is responsible for all off-shore permitting procedures. The centralization of processes however may lead to other problems: If the central body lacks of staff, a high number of application could lead to a bottleneck.

Therefore, a logical consequence of the ambitious targets adopted in the Renewables Directive 28/2009/EC should be that Member States invest the necessary resources to train and motivate their civil servants dealing with renewable energy authorisations. Specific guidelines and training programs could be envisaged.

### *Inhomogeneous application of laws*

Stakeholders from several Member States, including Austria, France, Germany, Italy, Lithuania, Spain, Sweden and UK complain about inhomogeneous and partly unpredictable patterns of application of laws. As explained above, this list is not necessarily exhaustive, because stakeholders in other countries may not have mentioned this issue as relevant in comparison with others. Depending on the region, on the municipality or on apparently random factors, the same legal provisions are applied or implemented differently. Another frequent problem, particularly in Italy, is the extreme and often contradictory fragmentation of political competences among different political levels (regions, provinces, municipalities). All this leads to higher costs of compliance and legal uncertainty.

To increase transparency and reduce the costs related to this kind of arbitrariness, Member States can consider adopting more detailed legal provisions, or publishing interpretation guidelines, as proposed by the Commission and in other studies (COM 2005, COM 2008, OPTRES 2007 and PROGRESS 2008). This idea is widely supported by associations and project developers. Lawyers, on the other hand, often advise against more detailed legal provisions. They point out that this may hinder arrangements between administration and project developers in individual cases.

It must be noted that, in some cases, the frustration of market players facing a fragmented legal framework is actually caused by the federal or regional structures foreseen in the constitution of the relative country, which is not specific to renewable energies.

### *Unclear administrative framework*

This section encompasses various issues reported by stakeholders, including problems such as legal uncertainty, contradicting legal provisions, excessive discretionary powers of the administration and corruption.

- Broad margins of discretion for the administration;
- Unpredictability and lack of transparency;
- Corruption.

Barriers of this kind were identified in Bulgaria, Finland, France, Hungary, Latvia, Lithuania, Slovenia and Slovakia. Due to the open nature of the interviews and the wide range of this topic it is possible that these barriers are relevant in other countries as well.

One example of very broad margins of discretion of public authorities is the principle of tacit denial, which has contributed to the very high rates of refused permissions in France, considered as one of the main barriers for the development of renewables in that country. When the legal framework is blurred, project developers have no legal means to enforce their projects.

One good practice example in this field is the introduction of so-called “bound decisions” in Germany: This means that in the authorization process, the administration has no discretionary power. If the requirements for the permission defined by law are fulfilled, the permit authority has no choice than to grant the permission. Other strategies include general principles of good administration.

### 2.2.2 Barrier 1.2 - Barriers affecting large renewable energy systems

This section looks at barriers affecting large renewable systems, like wind parks, large biomass or geothermal plants.

The next chart considers different sources of administrative barriers. For each of them, the chart shows in how many Member States this source has been identified as a relevant barrier to the development of renewables by the authors of the national reports.

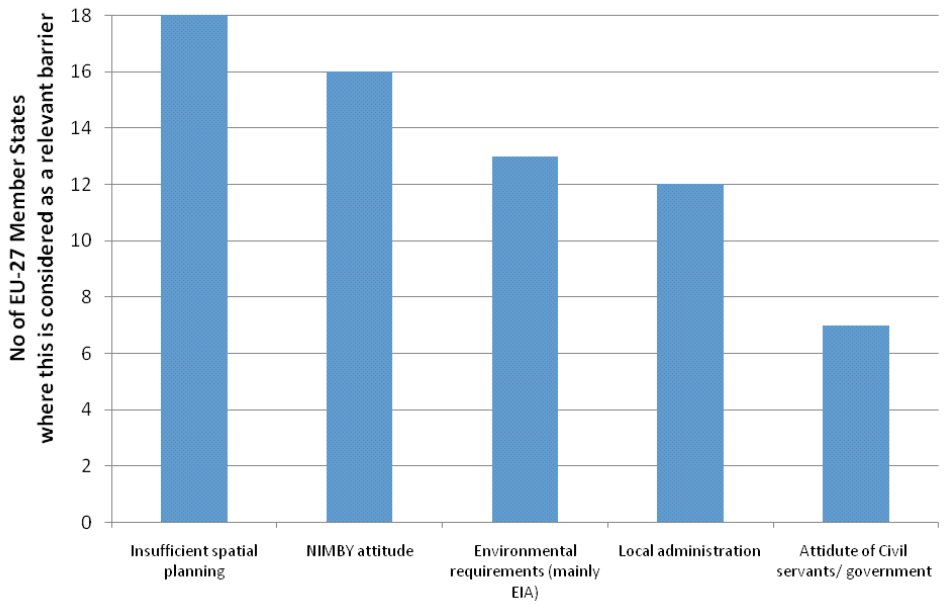


Figure 2.4 Sources of administrative barriers (large systems). Source: PV Legal.

As explained above, these numbers are not necessarily exhaustive. It is possible that the identified administrative barriers for large systems are an issue in other countries as well; they may have not been mentioned, because stakeholders may have focused on other issues, which they considered more important.
In addition, in this case, the value of the chart does not lie in the absolute values, but in the possibility to compare the importance of the different barriers, as perceived by the numerous stakeholders interviewed in the different countries.

### *Insufficient spatial planning*

Insufficient or even hostile spatial planning has been named as a decisive barrier in a vast majority of Member States, including Austria, Belgium, Denmark, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Spain and Sweden. A potential reason why so many stakeholders have mentioned spatial planning as a barrier could be seen in the fact that interviewers explicitly asked for this potential barrier during the interviews.

Especially for wind power, this is a crucial issue for the long term development. A positive framework in terms of spatial planning can be important also for biomass and biogas systems, for geothermal plants or for small hydro power, though the latter is usually subject to authorisation from dedicated authorities responsible for the rivers. Spatial planning will become an issue also for ocean energy, as soon as it starts large scale deployment.

In every country there are peculiar legal and administrative aspects that have been analysed in detail in the national reports.

The following kinds of barriers have been reported:

- Spatial planning as such does not take place, creating uncertainty and a latent risk of finding no place for new renewable energy installations;
- Renewables are widely ignored in spatial planning processes, thus de facto excluded;

Hostile planning, i.e. planning deliberately designed to slow down or impede the development of renewables has been reported in some regions, for instance some German *Bundesländer*.

### *NIMBY attitude*

Social opposition, ranging from spontaneous neighbourhood protests to professional campaigns and legal suits at national level, have been mentioned as an increasingly severe barrier by stakeholders from both emerging and mature markets, among them Belgium, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Poland, Romania, Spain, Sweden and the UK. Of course, slowing down the administrative procedures is one of the most important legal means for NIMBY groups to effectively oppose the realisation of a project. It is therefore possible that stakeholders in other countries face this barrier as well, but they did not mention it, because they found other issues more important.

A variety of possible approaches to mitigate social opposition:

- **Cooperatives**: Stakeholders from the Netherlands suggest to include local stakeholders, like residents, financially, e.g. by local co-ownership, in particular for wind energy. An example of this is the innovative (from a marketing and financing point of view) offshore wind *Zeekracht* project. Also in Denmark, a very high penetration of wind was achieved also thanks to the wide diffusion of co-operative schemes, enabling people to invest in the wind park close to their own town or village. Danish project developers complain, however, that nowadays the compensations that must be paid to neighbours of wind parks create a financial burden and constitute a barrier;
- **Participation and involvement**: Another way to engage local stakeholders is to involve the local population from the very start of the planning process and encourage their participation (Create

Acceptance 2007). The first step is to provide more general information on renewables in general (see Chapter 6 of this study), thus creating a positive cultural environment. The relationship between the additional local impact and the avoided import of fossil fuels must become more evident;

- **Restriction of legal means**: Other stakeholders propose a reduction of legal means that can be used to oppose a project, and to limit the subjects who can actually make use of them. Of course, this may be a solution in the short-term. However, this could jeopardise the overall positive reputation of renewables in most Member States. Moreover, protest groups may find other means to express their hostility (demonstration, sit-ins, etc.), which can cause risks too.

The NIMBY issue is further discussed in a forthcoming Commission study. More information will be available under www.rebelgroup.com/reshare.

### *Environmental protection*

In many Member States, among them Austria, Belgium, Czech Republic, Denmark, Estonia, Germany, Italy, Lithuania, the Netherlands, Poland, Portugal, Slovenia and Spain stakeholders complained about environmental requirements, in particular the Environmental Impact Assessments (EIA) and the Water Framework Directive (WFD). As mentioned above, because of the open nature of the interviews, it is possible that these barriers are relevant in other countries as well, but were not mentioned by the stakeholders, as they may have focussed on other issues, which they considered more important.

In general, the criticism refers to the general implementation rules of the EIA and the WFD in the country, but often also about the fact that the environmental benefits of the renewable energy systems are not taken into account properly. In Italy, there have been complaints that regions apply different criteria when assessing whether or not an EIA should be applied. In the same way, it was reported that the EIA procedure is not conducted in a uniform way. A frequent request in the national reports is that clearer guidelines should be published, determining if and how an EIA has to be carried out, as it was also suggested previously (COM 2005, COM 2008, OECD 2007).

In some cases, stakeholders also pointed out that EIAs are mandatory also for small systems (Czech Republic, Lithuania, Poland, and Spain). In the past, some local authorities have required EIAs even for small roof-top solar energy systems.

### *Local administration*

Stakeholders from Austria, Belgium, Czech Republic, Denmark, Germany, Latvia, Lithuania, the Netherlands, Romania, Slovakia, Slovenia and Sweden reported their impression that certain local administrations oppose the deployment of certain renewable energy sources. It is possible that this barrier is relevant in other countries as well and that it was not mentioned by stakeholders, because they rather focussed on other issues, which they considered more important. The perceived opposition may have different causes: influence of conventional energy pressure groups, opposition of the local population and fear of negative impact on tourism. Such a deliberate opposition of the local authority is considered as very difficult to overcome.

As mentioned in the report on Austria concerning wind, the opposition of the regional administration is de facto hindering the development of wind power in whole regions. In

these cases, the legal administrative requirements as laid down by law cannot be considered as such a barrier, as long as the political decision makers and therefore also the responsible civil servants are not showing a favourable attitude towards wind power development. In other words: without political and administrative good will, nothing goes. Similarly, some Czech regions adopted law practically banning wind power in their area, though these laws have been abrogated by the Supreme Administrative Court, but other regions are trying to re-introduce a similar ban.

**Stronger enforcement at higher level:** Some stakeholders suggest that the government at national or regional level should increase pressure on the local administrations. Plan laws should be changed to ensure that municipalities designate areas for use of RES technology (mainly wind). Local authorities that fail to do so could be penalized. The political feasibility and sustainability of such a strategy has to be demonstrated;
**Engaging municipalities:** A promising approach is to get municipalities involved. For instance, tax laws could be amended to ensure that municipalities directly benefit from renewable energy projects in their area.

### 2.2.3 Barrier 1.3 - Barriers relating to small RES systems

Some issues concerning building integrated technologies are treated in Chapter 4 below, including: the weakness or absence of renewable energy obligations for new buildings, the exemplary role of public buildings, and problems concern tenancy and property laws.

*Permitting for building integrated technologies*
Legal-administrative barriers can have a severe impact also on the development of small and building integrated RES systems.

According to the information provided by the national reports, in circa half of the Member States (Austria. Belgium, Czech Republic, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovenia and UK), small building integrated solar (PV and ST) energy systems do not require any authorization, except of course for monument protected areas, at least in theory. For some countries (Cyprus, Malta, Luxembourg) no information was provide by the national reports on this point. Even though in some of the countries still requiring an authorisation, this may be provided swiftly, the very existence of the procedure may discourage potential investors.

However, some of the Member States listed above as non requiring an authorisations are de facto still creating barriers. For instance, the Czech national report explains that for small solar installations up to 5 kW, no building permit is required: however, the building owner needs to obtain a declaration from the authority stating that the building permit is not required. This procedure can take 4-5 months. Larger rooftop installations from 100-200 kW may require a waiting time of 1 to 1.5 years. Also in a number of Italian municipalities, this procedure can de facto become a relevant barrier, because the effort to obtain the authorisation is high in comparison with the small volume of the investment.

Some further examples: in Bulgaria, the DSOs can slow the process by requiring the municipality to scrutinize a simple roof-top PV installation with the same procedure used

to authorize major building projects is to be built. In Greece, the use of micro CHP is seriously hindered by the high number of authorizations requested. In Poland, building integrated biomass and heat pumps need to be authorized, and this is perceived as a barrier. In Slovenia, geothermal drilling does not need any permit for depth up to 30 meters, whereas the same drilling would need an authorisation in many other countries.

The fresh results of the PV LEGAL project show that, even for small (usually < 5 kW) roof-top PV projects, the legal administrative costs make up more than 30% of the overall costs of the project, in some cases even more than 40% (Italy) and more than 60% (Bulgaria).

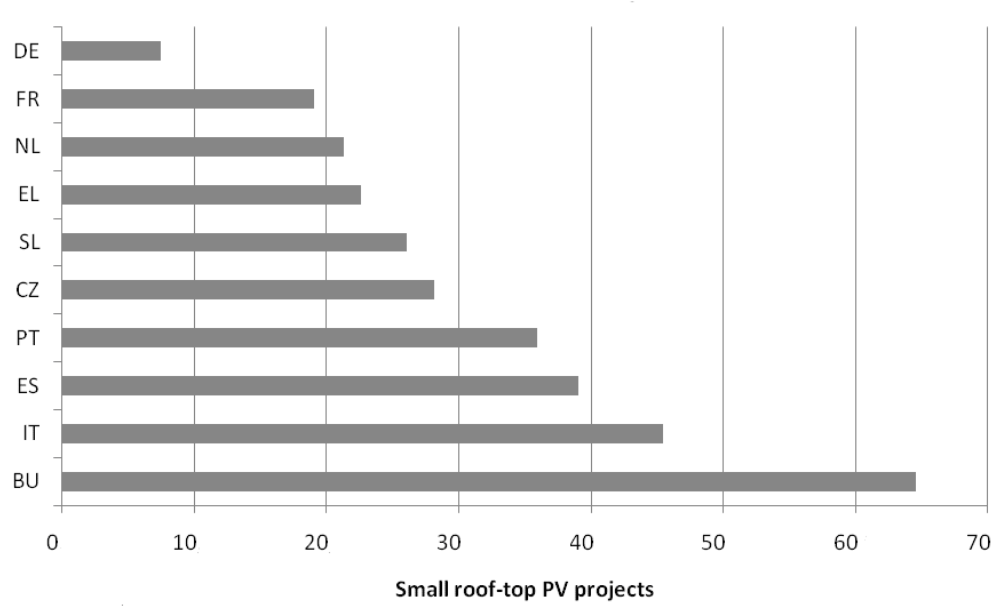


Figure 2.5 Costs of permitting as % of total project costs. Source: PV Legal project.

The Commission and other reports have suggested that there should be lighter procedures for small projects (COM 2005, COM 2008). Stakeholders from nine different member states have identified as main problem that small renewable energy systems are discriminated because they are subject to the same procedures as large systems.

On average this barrier mainly applies in countries where the market for small installations is about to develop (such as Bulgaria, Estonia, Hungary, Latvia, Poland, Slovakia, and the United Kingdom). However this barrier has been reported also in more mature markets such as Italy, Spain or Greece.

### *Areas under monument protection*

A prejudice widespread in many countries is that historical buildings, and particularly those under monument protection, should not be equipped with renewable energy sources, and can be exempted by any policy to promote renewables.

However, this idea is historically not founded and will not last long. Keeping the historical heritage alive is part of the European culture. Most historical buildings still in use have already endured the introduction of running water, centralised space heating

(and sometimes cooling), ventilation electricity and telecommunication networks. If they would have not, they would be unusable ruins. It is not understandable why the development of buildings from the Middle Age should be concluded with an oil era technology of the mid 20th century. In any case, sooner or later, most of these buildings will have no alternative than to be heated (and cooled if necessary) with renewable energies. Moreover, nice demonstration projects on historical buildings can contribute to a positive image of renewables.

In fact, there is a significant potential for deployment of renewable energies also in historical buildings under monument protection. A number of pilot demonstration projects have been realised, under very different architectonical and geographical conditions, and often with very good results also in aesthetical terms (New4old 2010). A notable example is the following project:
http://www.forumforthefuture.org/greenfutures/articles/Medieval_castle_solar_power.
However, many public authorities responsible for authorizing modifications of buildings under monument protection refuse in principle any renewable installation that may be visible from outside, including of course solar.
Other authorities are more flexible. Nevertheless, also in these cases the unpredictability and the lengthy of this authorisation often discourage potential applicants and investors.

Reducing this unpredictability can be a positive instrument. For instance, the municipality of Venice in Italy is in the process of issuing guidelines, that will set limits, but also positive define under which conditions solar energy systems should be permitted installed in the historical centre of Venice (Agire 2010). In this specific case, these guidelines will remain non binding: according to Italian law, any authorisation for areas under monument protection must be issued by the local branch of the competent authority (*Sovrintendenza alle Belle Arti*). However, it will be a signal of political will and can be a help and orientation for the civil servants of the *Sovrintendenza*, who have little know-how on solar energy.

During the research of this project, the consortium did not identify further similar examples of good practice. However, keeping into account that in many cases monument protection is handled at municipal level, there may be more. This subject is definitely worth further research.

## 2.3 Best Practice elements and recommendations

### 2.3.1 Examples of best and worse practice

As described above, it is only hardly possible to select the administrative procedure of one Member State as best practice for others. Varying administrative procedure and specialities within Member States might render the implementation of the best practice administrative procedure in other Member States impossible. Nevertheless it appears that certain Member States provide for a general administrative framework with specific RES rules, favouring the further development of RES. A leading example in this regard is Germany; the advantages of the German model may be summarized as follows:

- **General administrative principles:** The German legal system provides for tools to increase the efficiency of administrative procedures:

- **the principle of expedition of proceedings:** This principle specifies that administrative proceedings should take place swift and without wilful delay;
- **the administrative inaction suit:** This legal remedy allows for legal actions at administrative courts if the administrations does not react to complaints in due time. The only downside is that the legal proceeding can take years which weakens this instrument.

- **Bound decision:** In the authorization process, the administration has no discretionary power. If the requirements for the building permission are met, the permit authority has to grant the permission. In case of rejection, the German judicial system provides for a broad range of legal remedies and independent courts;
- **No authorisation is required** by the German building codes for many small systems (such as most of roof top PV systems, solar thermal systems). The project developer may, but is not obliged to notify the administration in order to obtain confirmation that his project does not infringe any building regulations;
- **One-stop shopping** is possible for some smaller technologies (e.g. PV), if an authorisation is required at all. Most of the larger installations (for example wind farms, large biomass and biogas plants) are subject to the authorisation procedure according to the Federal Immission Control Act. This procedure is considered as rather complex, but it has a so-called "concentration effect", i.e. it includes also most other necessary authorizations (except from planning decisions, permissions according to the mining law and water protection law requirements). It therewith allows one-stop shopping for large installations as well. This makes the procedure very effective and it does not necessarily lead to longer lead times;
- **Preclusion effect:** During the authorization process, the public has the opportunity to file objections against the project within a defined period of time. Objections which are raised afterwards have to be ignored by the permission authority and the courts. This so called preclusion effect increases legal certainty for the project developer in a considerable way.

## 2.4 Recommendations

A stable administrative framework is the starting point of an administration that favours RES.

- Discretionary power of the administration has to be limited to an extent as to allow for citizens to comprehend administrative decisions;
- Subjective and corruptive administrative practice has to be ruled out by transparent laws and clear law-enforcement;
- Citizens must be enabled to rely on an independently and efficiently working court-system.

Exemption of small RES systems from any authorisation requirement should be introduced wherever possible. If this is not possible, one-stop-shopping should be introduced.

Clear guidelines and training shall enable civil servants to understand and treat applications of RES systems in an adequate way and reduce administrative procedures.

The local level (both citizens and administration on municipal level) should be taken into account in order to avoid the risk of protests, which may lead to severe administrative blockage.

## 2.5 Literature and sources


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# 3 Issue 2-Technical Specifications (for support) (Ecorys / eclareon)

## 3.1 Introduction

Broadly speaking, our review suggests that this issue is not perceived to be a severe obstacle by the majority of the stakeholders. From a quantitative point of view, the major part of the respondents replied that authorities do apply European standards where they exist. However, it should be admitted that in those cases where the issue is a problem, it may block the market to a large extent, indeed.

A few real examples of technologies and countries where it is a concern are:

- On top of European specifications come various **additional** national and/or regional certifications and/or regulations (e.g. French certification necessary to obtain a 10-year insurance; in Czech the certificate of compliance);
- **Absence of efficiency standards** or criteria, even though preferred by the sector (e.g. efficiency of on shore wind turbines – Netherlands);
- **Benchmarks that may be too strict**, such as the 5% primary energy savings for green CHP as compared with the reference in Belgium;
- Issues linked to **registration** on specific lists (usually managed by the energy agency or environmental authorities) in order to be eligible for subsidy (biogas feedstock; various technologies for the build environment in the Netherlands and Ireland);
- Pending a further elaboration of **sustainability criteria**, biomass plants in e.g. the Netherlands using primary vegetable oils and fats, fatty acids and glycerine are not eligible for exploitation subsidies (this is an example of full blockage);
- The presence of a specified **auditing institute** CRES (in Greece).

*General description of the issue and literature*

The renewables Directive 28/2009/EC includes various provisions that refer to the eligibility criteria for support schemes. If a financial support scheme or an obligation in buildings exists, the final user will usually choose products that are eligible for the support schemes and/or able to comply with the building regulation. Non-eligible products are de facto out of the market, even if it is not forbidden to sale them. Therefore, the eligibility criteria are decisive.

A clear example for problems arising in this area was the solar thermal market until a few years ago. Many EU countries offered support schemes. Each of them required the fulfilment of specific technical product requirements. Even after EN standards for collectors had been created (EN 12975 for collectors, EN 12976 for factory made systems), many EU Member States required their own certification. In certain cases, the national certification even required a new product testing.

At a certain point in time, a company intending to market a solar collector all over the EU should have repeated certification 11 times, and should have performed the same test three or four times.
Because these tests require several months, the effect of this were:

- High costs and waiting time for testing and certification;
- Most companies renounced to market products EU-wide (barrier to trade);
- Therefore: fragmented markets, protectionism;
- Consumers face higher prices, less choice and less competition among producers;
- Technical development is slowed down because it talks very long to test a new product.

And all this for a product that actually does not constitute danger to health or environment.

This problem was to a large extent solved, by the creation of the Solar Keymark, a EU-wide certification scheme of CEN. The Solar Keymark was created by the industry with the support of the European Commission. For reference see the literature section.

Today, a product with the Solar Keymark is accepted ass eligible in (nearly) all countries of the EU. However, at the beginning, a few countries did not accept it immediately.

*Boundaries*

The issue will be limited to eligibility criteria for support schemes the provisions refer to. Lack of standards is not something that the individual Member States can develop and standards should be developed at (at least) European level. In this study, we aim at inventorying issues that are sensitive to comments to the national renewable action plans. Therefore, in this study, we consider possible trade barriers between Member States, but not potential trade barriers between the Union as a whole and external entities.

Technical product requirements related to the quality of electricity or biogas fed into the grids are treated in another chapter of this study.

Biofuels may be included, if subject to support. One can think of specific domestic support (investments subsidies) for producers whose biofuels inhibit a carbon dioxide emission savings beyond Community standards. However, most likely this issue is limited to second generation biofuels, whose phase in the development cycle is (fundamental) R&D or pilot at best at this stage and the corresponding production volumes are relatively low. This type of support is outside the scope of this work.

*Relevant renewable energy sources*

In principle all renewable energy technologies subject to support measures are included, although to a lesser extent those supported by feed-in tariffs for renewable electricity or other support schemes based on the amount of electricity produced. This barrier may be most relevant for support schemes based on investment grants targeted at the final user, because this kind of support schemes is most likely to set technical product specifications that may (or not) create barriers to trade. Therefore, the technologies more likely to be affected are those that are building integrated (photovoltaics, solar thermal, biomass heat, geothermal, heat pumps, etc.) and biomass derived products.

*Relevant stakeholders*

Such barriers to trade are often (perceived as) protectionist measures. Impacted stakeholders amongst others are project developers, installers, manufacturers, exporters, importers, project financers, etcetera. Accountable are policy makers, authorities, etc.

*Overview of (ranked) barriers*

The starting point is that "Technical specifications of equipment (for support schemes or building regulations) shall be clearly defined, based on European standards and should not constitute a barrier to trade". The following barriers (from severe to less severe - the ranking is in accordance with the frequency as detected) were revealed:

*Barrier 2.1 – Weak (or absent) definitions of specification and/or no EU standards applied (where they exist)*

Technical specifications (most often at national and/or regional level) which must be met by renewable energy equipment and systems in order to benefit from support schemes are not clearly defined (or even completely absent). Further, specifications are not expressed in terms of European standards (including eco-labels, energy labels and other technical reference systems), though such European references exist;

*Barrier 2.2 – Barriers to trade / specified locations for certification*

These specifications impede in any other way the operation of the internal market. For example, specifications are (insufficiently motivated) too strict as compared to Best Available Technology or what could be reasonably achieved. In addition, specifications may prescribe, explicitly or de facto, where the equipment and systems are to be certified, for instance because that specific certification is de facto only available in that specific country.

*Possible (historical) reasons for these barriers*

The following reasons can be considered:

- National traditions, more or less motivated by specific national conditions;
- Intention to protect national manufacturers;
- Intention to create demand for national test labs and/or certification bodies (which often are involved in advising government on standards and certification issues);
- Simple lack of harmonisation, resulting in different procedures without any specific reason.

## 3.2 Overview of main findings and barriers

### 3.2.1 Barrier 2.1 - Weak (or absent) definitions of specification and/or no EU standards applied (where they exist)

This barrier is present primarily for **heat pumps** and energy from **biomass**. In a variety of countries EU standards are applied whereas on top of them there are various national and regional specifications, causing at least confusion, a reduced transparency and consequent increased (transaction) costs for the applicant. During our consultation assorted stakeholders -most often project developers- plead for a more simple, consistent and transparent set of regulations. This obstacle is apparent in France, Ireland and the

Netherlands and to a lesser extent in a few other countries (Austria, Belgium, United Kingdom, etc.). No EU standards are applied at all in Poland, Lithuania and Latvia.

- For **heat pumps** and other renewable energy equipment for building integration in France, even if already validly certified according to the European standards, still needs to obtain an additional French certification before it can be installed. This still is reported as a significant barrier by market players. In Czech, the Certificate of Compliance is required for all imported goods and is a sole responsibly of the importer. In Ireland the support system includes lists of registered products and installers that meet the relevant standards and accreditation requirements. A similar list is managed by energy agency Agentschap NL in the Netherlands (*Energielijst*). Besides application and administrative issues, this may lead to superfluous and expensive testing of the entire product range and increased transaction costs. Furthermore, various lists coexist for various types of subsidy programmes (investment subsidies, fiscal allowance) thus requiring harmonization. Further, in Belgium, different European norms are used and mixed up. The Flemish heating pump platform is in favour of a more uniformed norm system such as the ECO-label. The coefficient of performance (CoP) for all sources (air, water, earth) should be a correct theoretical reflection of reality and will make comparison possible and the CoP could be replaced by a calculation based on SPF (seasonal performance factor). In the United Kingdom for ground source heat pumps there is a weak formulated regulation as stated in the Building Regulations by the government. These regulations are designed to meet certain performance criteria, but a clause on quality control is missing. In Austria, even though for heat pumps and solar thermal systems European labels exist up to date only a few subsidy schemes refer to them. Some support schemes for photovoltaic systems refer to EN standards, while others do not set any technical requirements at all and so on;
- For **biogas**, amongst others in the Netherlands there is a **white list**[4] for all types of feedstock (energy crops, organic residues, etc.) entering the production process, however not all definitions on this list are clear. Moreover, it seems possible to process input products to better meet the needs of the list. Actually, some people even died because of the application of products that were not allowed. [5] The types of feedstock on these lists vary from country to country: we are not aware, however, if an European-wide white list exists or not. For solid biomass standards are not in use in various countries (Scandinavia, Baltic States). In Romania, when referring to biogas projects that are about to be financed there is confusion in terminology especially between biomass and biogas. This may lead to restriction of the eligible costs. Further, Best Available Technologies (BAT) are not listed in the legislation and each tender file might, but not always include references for BAT. Also, in Estonia, the lack of standards (in biofuel fields) and also stricter standards may lead to a situation, where it is too difficult to produce energy from renewable sources and therefore there is no motivation to develop this sector. In Finland, the promotional system for energy wood harvesting differs from normal wood harvesting. An impact of this is that the efficiency of harvesting is not at the level it should be;
- With regard to **onshore wind energy** in the Netherlands, private sector respondents actually prefer to have some kind of efficiency benchmark: unfortunately, the present SDE regulations stimulate installed capacity, not efficiency or produced MWh as a point of reference. This situation probably occurs in various other countries as well;
- In Belgium, nearly all stakeholders indicated that the technical specifications are clearly defined except for **grid connection**.

[4] Positieve lijst co-vergisting: http://wetten.overheid.nl/zoeken_op/BWBR0018989/bijlageAa/tekst_bevat_bijlage%2BAa/geldigheidsdatum_23-03-2010.

[5] http://www.energierecht.nu/www.delex-backoffice.nl/uploads/file/vrom%20covergisting.doc.

### 3.2.2 Barrier 2.2 - Barriers to trade / specified locations for certification

In some cases too ambitious (additional) specifications may lead to barriers in the sense that it is preferred by developers either not to apply RES at all or move to other countries, rather than meeting these standards; some examples of our study include:

- In Hungary, the open fund of ZBR (Green Investment Scheme) requires **heat pumps** with above standard CoP values of 3.5 (air), 4.5 (water and other type);
- For Estonia, the grid code is considered to be much more strict than European standards and it might be considered to be a barrier for **wind energy**;
- In Flanders the **Combined Heat and Power** (CHP) installation needs to save five percent of primary energy compared with the reference boiler or stove on natural gas. Due to technical reasons, CHP installations using renewable energy sources have a hard time reaching this 5% level[6];
- For the Netherlands, specific for (organic fraction of) **waste incineration**, the SDE subsidy requirement is a minimum monthly adjusted efficiency of 22 percent;
- Also for the Netherlands, in frame of the SDE regulation, producers of renewable electricity or gas from fermentation (**biogas**) and thermal conversion (incinerators) of **biomass** are required within three months after the calendar year to report on the sustainability of the deployed biomass. This means that, for instance, plants using primary **vegetable oils** and fats, fatty acids and glycerine (NTA7 8003: 2008 NTA 500, 550 to 559, 587 and 592), pending a further elaboration of sustainability criteria by the SDE officials, are not eligible (since no EU sustainability standards exist yet, this is not part of Barrier 2.1). For biomass in Belgium, where the CWaPE[8] is quite flexible when it comes on testing of different (new) kind of biomass products (and giving consequently the certificates), the VREG is not. Consequently, some companies decided to go to Wallonia for their biomass projects;
- Although not as straightforward, in the United Kingdom, an issue related to barriers to trade concerns the slight differences in technical specifications between Wales, England, Scotland and Northern Ireland. Although not a problem for local installers, this issue does form a barrier for installers active on UK-wide or international market.

With regard to specified locations for certification, examples from our study include Greece only; this suggests that (in contrast to the past) this is not a strong barrier in the EU anymore.

- In Greece, the **Centre for Renewable Energy Sources** (CRES) has the monopoly to perform a final check if the final installation has been constructed according to the plan given with the permitting application. This is clearly contrary to Article 13 (2) of the Directive. On the other hand, it is not perceived a strong barrier by the stakeholders.

## 3.3 Benchmarking and quantitative aspects

With the exception of Poland, Lithuania and Latvia the question: “Are specifications expressed in terms of European standards (including eco-labels, energy labels and other technical reference systems), if such European references exist?” was answered positively

6 VREG. 2004. Beslissing van de Vlaamse Reguleringsinstantie voor de Elektriciteits- en Gasmarkt.
7 In Dutch: Nederlands Technische Afspraak.
8 http://www.cwape.be/ and http://www.vreg.be/nl/index.html.

(see table below). Even for these differing countries, it was not perceived to be a strong barrier, basically.

Table 3.1 Members States that apply technical specifications in European standards, if applicable

| | EU 27 countries |
|---|---|
| Positive | Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, The Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain and the United Kingdom |
| Negative | Latvia, Lithuania and Poland |
| No data available | Luxembourg and Malta |

### 3.3.1 Best Practice elements

In general, the process description in the introduction on the history of the introduction of the Solar Key mark could be considered a best practice.

### 3.3.2 Examples of best and worse practice

Germany could be considered to be practice. In general, Germany is quick in adapting its technical requirements in order to recognise new certification schemes emerging at the European level, as shown by the examples of the EHPA label for heat pumps, and the Solar Keymark for solar thermal.

On the contrary, the situation in France where renewable energy equipment for building integration, even if already validly certified according to the European standards mentioned in the previous section, still needs to obtain an additional French certification before it can be installed in France is reported as a significant barrier by market players in the photovoltaic, solar thermal and heat pump sector. The origin of this barrier is the following: the French law (article 1792, Code civil) makes construction companies liable for any damage that may result from a building they have constructed, even in absence of specific faults of the constructor. This article applies to all construction components that are “inseparably connected” to the building, and thus also on parts of solar and of heat pump systems. This obligation lasts ten years from construction and is called “Décennale”. Of course, construction companies need insurance on this liability. Because this insurance is directly related to the French civil law, it is practically possible to obtain it only from insurance companies based in France. And they request in practice a French certification.

## 3.4 Recommendations

Our main recommendation simply is that all EU-27 countries adopt the provisions of the renewables directive 28/2009/EC. In various countries (e.g. Spain, France) the situation subsequent to taking up improved dramatically. Our analysis suggests still a few EU

counties (Poland, Lithuania and Latvia) are lagging behind in implementing the provisions with respect to technical specifications (for support) in their national legislation.

Further unification and simplification of the regulations is asked for by stakeholders in many countries and regions where regulations are in addition to national and/or European schemes. In case registration on a specific subsidy list is required by national law, equipment fulfilling EU standards should lead to by default listing.

Specific for the technologies linked to energy from biomass (biogas, biofuels, solid or liquid biomass for incineration or gasification etcetera), European standards with respect to sustainability are still lacking. Presently, this omission is partially being mitigated by the publication of various relevant DG TREN tenders. Some urgency of policy implementation in this field is required, though. Further, a harmonized European list for allowed feedstock for biogas production would be welcomed.

Finally, an EU label for biomass boilers has not been established yet, while such a development would be favourable for further market development.

## 3.5 Literature and sources

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# 4 Issue 3- Building integrated technologies (eclareon)

Circa 50% of the final energy demand in Europe is consumed in buildings. There is large potential for renewable energy use in buildings, often at good economic conditions. The integration of RES in buildings will therefore be a decisive field of action for reaching the renewable energy targets.

*Relevant renewable energy sources*

This chapter covers all renewable heating and cooling technologies, as well as electricity generation by PV, small wind turbines and biomass based micro-CHP.

*Contents of this chapter*

Certain subjects relevant for building integrated technologies are treated in other chapters of the present study:

- Authorisation procedures and spatial planning for building integrated technologies: see above, Issue 1 (Administrative procedures);
- Awareness raising and information: See Issue 5 below;
- District heating: See Issue 10 below.

This chapter mainly looks at the following subjects:

- Renewable energy obligations in buildings;
- Exemplary role of public buildings ;
- Tenancy and property laws;
- Other barriers identified in some national reports.

## 4.1 Overview of main findings and barriers

### 4.1.1 Barrier 3.1 - Renewable obligations insufficient

This section considers the state of development of renewable energy obligations for the building sector. Renewable obligations (hereafter: RO) are intended here as the obligation for the constructor of a building, or the owner of an existing building undergoing major renovation, to cover a certain share of the (heating) energy consumption of the building with renewable energies. The absence of a RO, or its insufficient design or enforcement, has been defined as a barrier within the detailed specifications agreed at the beginning of the present study.

The main legal rationale behind this argument is art. 13(4) of the Renewables Directive 2009/28/EC.

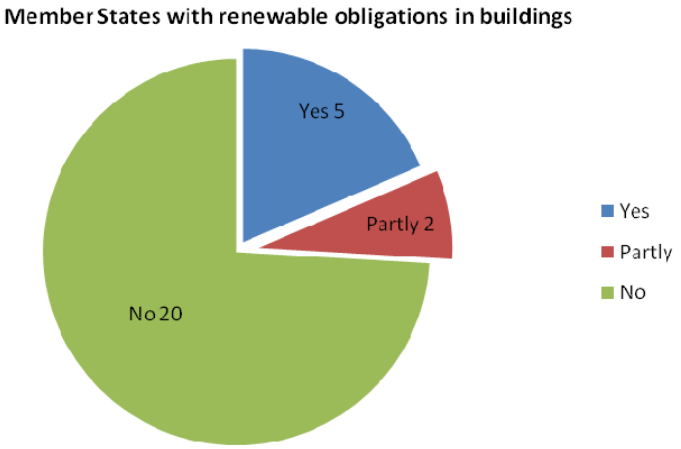
Further provisions in this area will probably emerge as a consequence of the re-casted Energy Performance of Buildings Directive, adopted by the European Parliament on 18 May 2010.

The idea of making the use of renewable energy in buildings obligatory sounded exotic until a few years ago. Until the adoption of the first local solar thermal obligation in Barcelona in the year 2000, this instrument had been used only in Israel, a country with an exceptionally high interest in reducing its dependence on imported energy. However, during the last five years, renewable energy obligations have been discussed and often adopted in a number of countries, inside and outside the European Union. According to art 13 (4), mentioned above, the implementation of some kinds of renewable energy obligation by the Member States will not be obligatory (due to the wording "as appropriate"). However, as of 2015, Member States will be asked why they have not taken measures in this direction.

### *Existence of renewable obligations*

At the moment, renewable energy obligations are implemented only in a small number of EU Member States.

Figure 4.1 EU Member States with renewable obligations in buildings; Source: own research (2010).




The countries considered here as having implemented a renewable energy obligation are: Germany, Ireland, Portugal, Spain and Slovenia. Austria and Italy are in the category "partly" for the following reasons:

Austria has been included in the list, though there is strictly speaking no renewables obligation. However, the Austrian regional governments (*Bundesländer*) offer the so called *Wohnbauförderung*, i.e. substantial subsidies or soft loans for the construction and the refurbishment of residential buildings. According to an agreement between the federal government and the regions, the latter are obliged to set criteria on energy efficiency and on the use of renewables as a condition for obtaining the subsidy. Virtually all residential building projects are planned in a way to be eligible for the *Wohnbauförderung*. For this reason, this clause is considered de facto as a renewable energy obligation.

In Italy a renewable energy obligation is foreseen at national level since 1991, and has been further sharpened by a law of 2006. However, these laws have never been implemented in practice. The law of 2006, in order to be applicable, required that the government would release "implementing decrees", which have not yet been adopted. At the same time, some regional governments adopted renewable obligations, which have then to be implemented by the local municipalities. Out of circa 8.100 Italian municipalities, 253 are reported to have adopted a renewable obligation, but not all of them are enforced in practice.

*Coverage of renewable obligations in buildings*

Some renewable energy obligations apply only to residential buildings (for instance Ireland, Austria), others cover a much broader range of buildings like hotels, swimming pools, offices, shopping malls etc. (for instance in Spain). Some are applied both to new buildings and those undergoing major renovation. This is for instance the case for Spain, some of the Austrian *Wohnbauförderung* schemes, and the German Federal State of Baden-Württemberg. Other renewable energy obligations only apply to new buildings, like for instance the federal Renewable Heating Law in Germany, the Irish obligation as well as many of the Italian municipal obligations.

If the obligation is applied only to new buildings, its impact is limited, because in 2020 and even a decade later, the vast majority of energy consumption will be originated in buildings that already exist today. However, applying an obligation on existing buildings can be legally and politically difficult in certain countries. To do so, it is necessary to precisely define the kind of "major refurbishment" which is associated with the obligation. If the definition is narrow, the coverage of the obligation remains very limited. If the definition is broad, for instance including any replacement of the main heating device, the additional cost of compliance with the obligation might discourage investments in energy efficiency measures.

*Enforcement and impact*

With the partial exception of Spain (and, looking beyond the borders of the EU, of Israel), the practical implementation of renewable obligations for buildings began very recently. In most countries, little information about the enforcement patterns and the impact of renewable obligations is available.

As for Spain, a number of teething problems have been identified by the stakeholders and are being discussed at political level. On the one hand, difficulties lead to a low level of enforcement, i.e. a high number of buildings that are legally exempted or simply ignore the obligation. This deficiency reduces the impact but does not create any direct damage. More worrying are the relatively frequent quality problems observed in systems installed under the obligation. This can lead to a loss of reputation for the very technologies that the obligation intended to promote. Most stakeholders argue that the general principle of the obligation is valid, but the rules and means of enforcement should be strengthened and a set of flanking measures should be introduced: financial incentives only for systems over fulfilling the obligation, information and training of architects, engineers, construction companies, installers and ordinary citizens, and random controls on the quality of the installation.

Usually, the renewable energy obligations define a certain share of the (heating) energy consumption of the building that must be covered by renewable energy produced in the building. In most cases, the obligation only refers to the production and demand of energy for heating and cooling purposes, which is the lion's share of the energy consumed in buildings (national study on Spain in this report, ESTIF 2007, ProSTO 2010).

### 4.1.2 Barrier 3.2 - Exemplary role of public buildings neglected

This subject has been analysed taking into account the provisions of art. 13(5) of the Renewables Directive 2009/28/EC.

The situation in the different countries is very variable. In some Member States, there is a long tradition of demonstration projects in public buildings, that are relatively numerous and visible. However, in most Member States, both in Western and in Eastern Europe, stakeholders report that there are "virtually no examples" (quoted for instance from the UK report in the present study) of renewables demonstration projects in public buildings.

*Impossibility of a quantitative comparison*

For various reasons, it is not possible to collect a significant set of reliable date allowing for a quantitative comparison of the situation in the different Member States.

The concept of "public buildings" is broad, and its boundaries are not clearly defined. In its colloquial meaning, it includes buildings used by a broad variety of institutions ranging from ministries and other government buildings, to tribunals, schools, hospitals, swimming pools, in certain cases also publicly owned companies, and many others, at national, regional and local level. There could be different interpretations, which institutions would fall into the category. The buildings may be owned or simply rented by the relative public institution, and this makes an important difference for the purpose of renewables demonstration projects.

Whatever the definition chosen, any significant sample would be constituted by diverse sets of buildings operated by different authorities. As a matter of fact, it is not possible to find reliable data about the number, or the share, of existing demonstration projects.

In most countries, it is easy to find anecdotal examples of best practice in individual buildings, or of bad practice, i.e. of recently constructed and visible public buildings without any usage of renewable energy. Several examples are reported in the national reports of the present study. However, on the bases of these anecdotes, it is not possible to quantify the share of "public buildings" which have some renewable energy project installed with a level of reliability that would allow for meaningful comparisons among different European countries.

*Expectations and reality*

Therefore, the evaluations expressed in the national reports are in most cases subjective statements of stakeholders about their own countries. In some cases, these evaluations apparently reflect the different levels of expectations more than the real situation.

For instance, one Austrian stakeholder complains that “only 2% of regional and 1% of federal public buildings are equipped with a solar thermal system”. One can understand that this is regrettable, since the potential for solar thermal use in Austrian public buildings is certainly much higher. However, the negative judgement of the Austrian stakeholder cannot be used as a benchmark for a comparison with other Member States, taking into account that nearly all other countries are very far from reaching similar levels of penetration of solar thermal in public buildings as in Austria. Interestingly, also in Germany some stakeholders were particularly critical on this point, though it is likely that renewables demonstration projects in public buildings are more frequent in Germany than in most other Member States.

Based on the experience of the authors, it is certain that the frequency of demonstration projects is higher in the countries that have a longer history or policies to promote renewables and energy efficiency for many years, like Germany, Austria, the Netherlands, Denmark and a few others. However, also in these countries, the largest majority of public buildings have no renewable energy systems installed, and thus there is a lot of potential to improve. Most Member States are strongly lagging behind in this area. In some countries, among them Slovenia and Italy, national governments have formally adopted policies or declarations to promote RES in public buildings, but these principles are usually not implemented in practice.

*Frequent barriers*

The implementation of demonstration projects in public buildings is often hindered by other policies and/or practices to which the public sector is bound. Among them:

- The managers of public institutions are bound by more or less strict requirements to choose the cheapest bidder and/or the cheapest solution: Renewables in buildings are often not the cheapest solution, except if a significant increase of conventional energy prices during the next decades is assumed. However, this kind of assumption usually goes beyond the scope of the duties of a civil servant;
- Focus on investment costs, lack of consideration for overall life-time costs: In some cases, renewables in buildings can already be competitive, if lifetime costs are considered. However, public procurement procedures give more consideration to the immediate investment costs than to the future operating costs;
- Lack of an explicit public procurement policy in favour of renewables, that can motivate and reassure civil servants willing to consider to invest in renewables;
- Budget: Of course, it is not enough to establish good principles at central level, if the individual public body is not provided with the budget to invest in renewables. Dedicated soft loans from public banks can be a solution;
- Visibility: It is important that the implemented demonstration projects are given appropriate visibility, both for the main purpose of motivating the general public, but also to reward the institution that chose to invest with a positive image.

### 4.1.3 Barrier 3.3 - Spatial planning

This subject has been analysed, taking into account the provisions of art. 13 (3) of the Renewables Directive 2009/28/EC.

Spatial planning can be a powerful means to promote the use of renewable energy sources, mainly in three areas:

1) Promoting or imposing the use of district heating based on renewable energy sources. This aspect is treated below in Issue 10 (District Heating).
2) Promoting the use of renewables in non-urban areas, for instance wind power parks, large PV plants, small hydro, ocean energy, as well as biomass and biogas, both in terms of production of raw materials and of sites for heat and/or power generation plants. All these points are not related to buildings and are treated above under Issue 1 (Administrative Procedures).
3) In urban areas spatial planning can contribute to create favourable pre-conditions for example for the use of active and passive solar energy, biomass and geothermal energy, also outside district heating systems. Some available tools are the positioning of buildings taking into account solar and/or heat pump resources, the obligation to (or incentive for) preparing the buildings for a later use of renewables, for instance by preparing pipes to the roof, that could later be used for solar collectors, or by foreseeing the necessary space for biomass (boilers, storage), or for solar thermal use (solar tank).

In the national reports, most or all the attention concerning spatial planning has been dedicated to issues related to large scale, non-building integrated technologies, such as wind parks, biomass or geothermal plants (see Issues 1, Administrative Issues above). A positive
The positive consideration of the needs of building integrated renewables as mentioned in the point 3 above is apparently not yet a common policy option. On example is the town of Vellmar in Germany that included the use of solar heat in the planning of a new development area as a condition for selling the municipal land on which the new development had to be built. However, no further examples have been identified in the national reports.

All in all, the absence of specific provisions as in point 3 cannot be considered as an important barrier, though when applied properly they could have an important positive impact. In China, for instance, before the introduction of a general solar heat obligation in new buildings, there was an obligation to install at least the piping up to the roof, which is considered as an important factor for the huge solar heating market there.

As for district heating, the issues are treated below (Issue 10).

### 4.1.4 Barrier 3.4 - Tenancy and building ownership laws

In some frontrunner countries, mainly Germany and Austria, specific features of the tenancy law (user-investor dilemma) are being perceived as an increasingly important barrier for the further development of building integrated renewables. This barrier mainly refers to renewable heating technologies, but also to the possibility of installing PV systems on roofs owned by third parties.

As such, this kind of barrier presumably exists in several other countries, but it is not yet perceived as relevant, because the market for building integrated renewables typically starts to develop within the segment of self-owned detached houses.

Only when a critical mass of the renewable energy market has been reached, project developers start to look at selling in the more complex market of rented buildings. Therefore, it can be foreseen that this kind of barrier will be perceived in other countries as well in a few years. However, the relevance of tenancy law issues also depends on the number of rented residential buildings existing in a country. In Germany, this barrier is perceived as relevant also because Germany is one of the European countries with the highest share of population living in rented apartments or houses. In Italy, tenancy law has been identified as a barrier as such, but it is less relevant than others due to the particularly low share of rented buildings.

For all these reasons, the following barriers have been mentioned mainly in Germany, Austria and partly in the Netherlands, though they presumably exist in other countries as well:

- Landlords have little or no interest in renewables / energy efficiency measures, as the immediate beneficiary is only the tenant;
- Landlords willing to invest nevertheless may face difficulties in passing a part of the investment costs to the tenants. These boundaries are related to social laws defending the tenants, but could be adapted in certain cases;
- In public regulations or other market monitoring schemes with the purpose of monitoring and/or regulating the rent prices in a certain area, energy efficiency and/or the use of renewables are still not considered enough, or not considered at all. This makes it impossible for tenants to privilege energy efficient apartments, and reduces the incentive for landlords to invest;
- Activities of ESCOs are complicated by the fact that tenants may not be bound to tolerate energy saving measures carried out by ESCOs;
- It is legally difficult or impossible to distinguish between the ownership of a building and of energy equipment installed inside or on the top of the building. This legal insecurity makes it unattractive for an ESCO to operate for instance a micro CHP or a solar system on buildings owned by third parties.

### 4.1.5 Other barriers related to the renewables in buildings

Some of the other barriers related to the development of building integrated renewables that have been mentioned in the national reports are:

- The minimum energy performance required by the national laws implementing the European Performance of Buildings Directive is considered as too lax by many stakeholders;
- Lack of awareness and information among building owners, building users, architects, installers etc. are very frequently mentioned as a key barrier. See also Issue 5 on Information in the present study;
- The conservativeness of the construction industry, of architects and heating engineers, that tend to do what they always did, slowing down the penetration of technological innovations in the building sector;
- In a few countries, notably Poland, the lack of financial incentives for private owners in the residential sector;

- Public relations work of the heating oil industry has been explicitly mentioned in Austria as a barrier.

## 4.2 Benchmarking

On renewable obligations, the only possible benchmark (presence/non presence of a renewable obligation) has been discussed above. The quality of the implementation cannot be benchmarked because only Spain has implanted a RO for a period long enough to allow for an assessment.
On public buildings, the reasons why a quantitative benchmark within the limit of this project was clearly impossible are discussed above in detail.
On spatial planning, the analysis showed that two of the three points are treated in other chapters. As for the third, no Member State has implemented specific planning rules facilitating the future installation of renewables in buildings not served by district heating.

Finally on the issue of tenancy law, the analysis showed that it is perceived as a barrier only in Austria and in Germany, probably due to the higher level of development of building integrated renewables in these two countries. Because in all other countries, stakeholders have not indicated these issues as a relevant barrier, a further analysis was not performed. However, it can be assumed that the barriers identified in Austria and in Germany do exist also in all other countries.

## 4.3 Recommendations

*Renewable obligations insufficient*
In most EU Member States it is still allowed to plan new buildings without any input from renewable energy sources. The political will has to be stronger than the foreseeable resistance of specific stakeholders.

Difficulties in the implementation are usually teething problems due to insufficient attention and/or budget for the enforcement and for effective flanking measures (training, awareness raising). It is therefore necessary to take account of the past experiences while designing a renewable obligation (ESTIF 2007, ProSTO 2010), and to foresee clever enforcement mechanisms and sufficient flanking measures, such as information campaigns for the heating users, training and certification of installers and heating planners and random controls (see national study on Spain).

The enforcement may be complicated by fragmented political competences. In the cases where the obligation is adopted in principle by a higher political level (national, regional) than the administration (regional, local) that has to implement the regulation, it is recommendable to coordinate and agree on feasible and effective rules and enforcement mechanisms.

*Public buildings*

- Explicit public procurement policies in favour of renewables (and energy efficiency) should be adopted, empowering and possibly forcing the managers of public institutions to take full in consideration the energy costs during the lifetime of a building, based on realistic assumptions about the long term increase of non-renewable energy prices.
- The necessary financing opportunities (additional funds, soft loans) should be provided for the managers of public buildings willing to invest in renewables
- The managers of public buildings should be the target of dedicated awareness raising and training initiatives, to make them fully aware of the available renewable (and energy efficiency) technologies, and of the importance of the exemplary role of public buildings
- Wherever measures are taken, their visibility for the persons using the building (public and workforce) should be ensured, for instance by standard and visible displays showing the amounts of energy saved/produced, possibly with comparisons easily understandable for ordinary citizens, showing them for instance what is the equivalent of a MWh in terms of hot showers

*Spatial Planning*

It is recommendable to include in the NREAPs provisions aiming at creating favourable pre-conditions for the use of active and passive solar energy, biomass and geothermal energy in buildings not served by district heating systems. Some available tools are the positioning and the orientation of buildings taking into account solar and/or geothermal resources, the obligation to (or incentive for) preparing the buildings for a later use of renewables, for instance by install pipes to the roof, that could later be used for solar collectors, or by foreseeing the necessary space for biomass (boilers, storage), or for solar thermal use (solar tank).

*Tenancy and building ownership law*

Even though this barrier has so far been mentioned only in countries with relatively advanced markets for building integrated renewables, like Austria and Germany, it will become relevant in more and more Member States, as the markets develop there as well.

The legal framework is different in every country. In general, further goals should be considered in the NREAPS:

- Making it attractive for landlords to invest in renewables / energy efficiency measures, for instance by facilitating the passing of a part of the investment costs to the tenants and by ensuring that tenants may not easily oppose due to the disturbance caused by the works
- If there are public regulations or other market monitoring schemes with the purpose of monitoring and/or regulating the rent prices in a certain area, the overall energy efficiency of the building, including the use of renewables, should be considered as an increasingly important factor to determine the value of the rent
- The activities of Energy Service Companies (ESCOs) should be facilitated by creating a clear legal framework
- It should be made easy to distinguish between the ownership of a building and of energy equipment installed inside or on the top of the building. Legal certainty in

this areas facilitates ESCO willing to operate for instance a micro CHP or a solar system on buildings owned by third parties.

## 4.4 Literature and sources

ESTIF (2007). Best practice regulations for solar thermal. http://www.estif.org/fileadmin/estif/content/policies/STAP/Best_practice_solar_regulations.pdf (06.01.2010).

ProSTO (2010). Solar thermal ordinances. State of the art in Europe. http://www.solarordinances.eu/Portals/0/STO%20state%20of%20the%20art.pdf (06.01.2010).

# 5 Issue 4- Promotion of energy efficient renewable energy equipment (Ecorys)

## 5.1 Introduction

The issue *Lack of promotion of energy efficient renewable energy equipment* stems directly from the provisions of article 13 (6) of the RE Directive. In the case of biomass and heat pumps, the article sets precise obligations for the Member States. The rationale is that inefficient biomass or heat pump systems consume excessive amounts of scarce resources, and that this should be avoided.

For instance: even if the heat generated by very inefficient **biomass** burners is as such renewable, this kind of equipment should not be promoted within the renewable energy policies of the Member States, because such burners unnecessarily waste precious biomass resources.

In addition, several techniques could be applied to increase the biomass conversion efficiency such as:

- Using the produced heat (in case of CHP-mode);
- Application of add-on's (e.g. Organic Rankine Cycles - ORC, flue gas condenser etcetera) to increase electricity and/or heat production;
- Technological improvements of the combustion/digestion technology;
- Increase of the plant size (thermal capacity).

Also **heat pumps** require an energy input to work, usually electricity: inefficient heat pumps consume excessive amounts of electricity, which can even lead to a negative primary energy balance. Therefore, only heat pumps fulfilling the mentioned eco-labelling should be promoted by Member States. Broadly speaking, the overall efficiency could be mainly enhanced by a better **design, installation and operation** of the system with regard to its specific build environment application, and to a lesser extent by technological measures to decrease the electricity consumption.

For **solar thermal**, the article does not prescribe a specific efficiency level, because solar thermal systems use, but not "consume" solar radiation. In certain cases, a low-cost and low-efficiency solar thermal system may be a rational choice, from an economic and environmental point of view. In nearly all cases, for solar thermal, article 13 (6) prescribes only that Member States must promote certified equipment and systems (i.e. not promote uncertified equipment), and this certification should be based on standards, eco-labels and other technical reference systems established at European (i.e. not at national) level, where they exist.

This issue will primarily limit itself to the technologies biomass and heat pumps, since solar thermal is already discussed in Issue 2 *Technical Specifications*. What is more, the issue "lack of promotion of energy efficient renewable energy equipment" refers only to heating and cooling, in conformity with the Directive.

However, in principle the need for efficiency applies for all technologies and energy types. Therefore other technologies such as photovoltaics will be shortly described as well. There is an overlap with Issue 2, since the efficiency requirements is simply a specification for the technology in scope.

*Overview of (ranked) barriers*

The following barriers were identified for all the Member States:

- **Non-compliant promotion schemes**. The Member State actively supports biomass and/or heat pump or solar thermal systems that do not fulfil the requirements of Article 13(6), either through financial incentives or through the acceptance of such equipment for the purpose of fulfilling building regulations related to energy efficiency or renewable heating obligations. This barrier has been identified by the consortium as the strongest barrier for this issue;
- **Lack of substitution of existing inefficient systems**. In the Member State there is for historical reason a wide use of biomass or heat pumps that do not fulfil the requirements of Article 13(6), and the Member State has no policy to promote their substitution with more efficient renewable technologies. After the barrier non-compliant promotion schemes, this is the second strongest barrier;
- **Use of national procedures**. In assessing the conversion efficiency and input/output ratio of systems and equipment, the Member State does not use Community or, in their absence, international procedures although such procedures exist. This barrier plays a minor role for the current issue;
- **Insufficient information**. The Member State does not provide sufficient information to the relevant stakeholders about the availability of renewable energy equipment with different levels of efficiency or no information exists at all. This barrier plays a role together with all three abovementioned barriers, and has been recognised has a minor barrier.

Below follows a description of these four barriers in qualitative and quantitative terms. Moreover, some examples of best and worst practices per barrier have been identified.

## 5.2 Overview of main findings and barriers

### 5.2.1 Barrier 4.1 - Non-compliant promotion schemes

The Member States can comply or not comply, and therefore this barrier is strictly speaking not a barrier. For that reason, this paragraph will be described concisely. The table below lists an overview of all the Member States that may comply.

Table 5.1 Identified fully compliant and non-compliant Member States

| | EU 27 countries |
|---|---|
| Compliant | Denmark, Estonia and Finland |
| Non-compliant | Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, The Netherlands, Poland, Portugal, Romania, Spain and United Kingdom |
| Not available | Luxembourg, Malta, Slovakia and Slovenia |

From this table, it becomes clear that hitherto less than ca. 12% of the Member States fully comply with the Directive with regard to the promotion of energy efficient renewable energy equipment. In most cases, the underlying reason is that the Directive is rather new and Member States simply have not yet have found the time to implement it into national law. Moreover, for the Member States that are not on this list, no information regarding the efficiency was available.

However, when assessing this barrier in more detail, the conclusion is a bit more complex. Some Member States – for instance Austria – have a detailed and complex legal system regarding the efficiency requirements themselves. Within the biomass technology (a quite broad term for the numerous feedstock, pathways and end products), each step has its own conversion efficiency. Although some of the conversion steps are higher than the 85%, others can be below this target. In that case, does the end-product comply with the Directive or not is a question one can ask. In addition, the methodology to calculate the efficiency can be different or arbitrary, thereby creating differences between the standards applied by Member States and manufacturers.

In addition, various Member States (amongst others Austria, Germany, Ireland, Italy and Netherlands) comply with one of the two (either bioheat or heat pumps) requirements.

Finally, when assessing this barrier less strictly, and expanding the view beyond the Directive thereby including other technologies, we see that the case is less dramatic. Some Member States apply rather stringent efficiency standards in their support schemes – for example the United Kingdom for photovoltaic panels and the Netherlands for energy from waste incineration.

### 5.2.2 Barrier 4.2 - Lack of substitution of existing inefficient systems

There is a general lack of regulatory schemes that promote the substitution of older, inefficiency systems across Europe. In countries with a relatively long history of installing renewable systems, this barrier is particularly apparent, and out-dated systems are staying longer in place than should be from an efficiency perspective. Only there where there is an economic sensibility to replace older systems or when most of the systems are relatively young, this barrier not a major issue. However, since most systems – especially large-scale – have long return times on their investments and governments and investors have the tendency to have a short term view, this economic sensibility to substitute older systems does not occur regularly. Examples of systems that are substituted concern low-efficient hearths for more efficient stoves.

### 5.2.3 Barrier 4.3 - Use of national procedures

In a few cases, the conversion efficiency and input-output ratio of the different technologies and equipment are applied as specified in the Community and international context. Examples include photovoltaic panels and geothermal heat pumps in Belgium.

This result hints that this barrier is existent in most Member States. Most of the interviewees, however, responded that this barrier is not playing a large role. In other words, according to the industry the lack of the use of Community or international procedures is not preventing the development and deployment of RES in Europe.

In some Member States, Bulgaria for instance, almost all systems and equipment is imported. This hints that there is no need for national procedures compatible with the Community, because the manufacturers are complying with other, larger consuming countries already. The manufacturer is not making less efficient equipment for Bulgaria alone. The danger is, however, that this only works as long as not too many countries do not have synchronised national procedures.

### 5.2.4 Barrier 4.4 - Insufficient information

Insufficient information is a barrier that is always existent, at least to a certain degree. In this specific efficiency case, though, this barrier is not very large. Firstly because the whole issue of the lack of promotion of energy efficient renewable energy equipment is not very large itself. This implies that more information on this topic is not needed. And secondly, because in most Member States there is none or little legislation regarding the efficiency of the RES equipment, there is little information to be spread around in the first place.

When interpreting the barrier lack of information in a broader sense, this might play a role after all. The fact of non-compliance, lack of substitution schemes and incompatible national procedures in many Member States suggests the lack of awareness and understanding of policy makers and public officials for the need for energy efficient RES systems and equipment.

## 5.3 Quantitative analysis

The list of countries (Table 5.1) that presents the best practices regarding the efficiency of RES is rather unexpected, viz. Denmark, Estonia and Finland. It is unclear why exactly these countries may have ratified the Directive requirements. Possibly, there is a historical reason for this is simply that the best practice Member States mentioned above created or revised their legislation after the Directive, thereby immediately including the efficiency requirements.

### 5.3.1 Examples of best and worse practice

An example of a best practice element can be found in Slovakia. The efficiency of heat pumps and biomass boilers is strictly inspected by the Regulatory Office Industries every two years. What is more, the energy producers, such as district heat producers, often welcome the efficiency regulation as it is in their own (economic) interest.

Another best practice can be found in Germany, where for biomass, the Renewable Heating Law sets stricter efficiency requirements than those required by Art 13 (6) of the Renewables Directive: at least 86% efficiency for burners up to 50 kW, at least 88% for burners above 50kW.

Further, both Germany and the Netherlands include a bonus per produced kWh in their biomass conversion support scheme (SDE and EEG, respectively) if the heat is applied usefully.

There are ample examples of practices where this issue plays a role. For instance, in Lithuania there are no promotion schemes for efficient use of RES technologies or substitution of less efficient systems and equipment. What is more, the national procedures and legislation for energy efficiency do not include RES technologies. And therefore there is also no information to spread around. In addition, the policy makers have not recognised the need, obligation or benefits of increased efficiency of RES systems. The interviewees acknowledged the problem and identified this as a barrier to the overall deployment of RES technologies.

## 5.4 Recommendations

A recommendation is that Member States could be informed (for instance by dissemination of best practise) about the positive spin-offs of increasing the efficient use of RES in terms of reaching their targets. The interviewees responding that the issue impact is not significant for their country, suggests a general lack of awareness among public servants and policy makers.

Also more R&D could promote more efficient and economical systems and equipment. Europe could target research efficiency in renewable energy in the framework programme specifically. This could be further enhanced by implementing a rule/directive on the use of BAT (Best Available Techniques) including harmonized schemes on how to calculate the efficiency of various sub technologies most notably for:

- the valuation of heat as compared to electricity;
- the efficiency of the whole chain as compared to end-use efficiency.

Another recommendation is making use of the forthcoming Commission guidance regarding biofuels – both solid and liquid – sustainability requirements, heat pumps, new eco-labelling and eco-design standards.

Finally, the promotion of efficiency of renewable energy could be linked to the energy efficiency and monitoring programmes already existent in the Member States.

In conclusion, our survey suggests that the issue *Lack of promotion of energy efficient renewable energy equipment* is present in most Member States. However, this concern is generally not considered to be a large barrier that seriously prevents renewable energy development and deployment in the Union.

# 6 Issue 5- Information/awareness raising (eclareon)

This chapter summarises the main findings of the AEON project concerning information and awareness raising. It is based on the findings of the relative chapters of the national reports, which have been written taking into account the provisions of articles 14(1), 14(2), 14(5) and 14(6) of Directive 2009/28/EC.

This summary is structured along two potential barriers that may hinder the achievement of the goals of the RE Directive:

1. Insufficient availability of information on support measures (Barrier 5.1);
2. Insufficient funding and/or unsatisfactory conception of awareness raising and information campaigns (Barriers 5.2 and 5.3).

*Methodological issues*

The general conclusion that can be drawn from the AEON national reports is that, in most Member States, the public efforts to communicate on renewables are not satisfactory and require significant improvements.

There are substantial differences among the Member States, and in some cases even among different regions in the same country.

However, in this field it is very difficult to compare different countries on the basis of objective, and measurable indicators. In general, it is conceivable to measure the “supply side” of information tools or campaigns, or their impact.

On the “supply side”, one can measure the resources invested (budget, number of flyers, mailings, events, staff involved etc). However, this kind of indicators does not say much about the impact of the campaign. Furthermore, within the framework of this study, in most countries it was not possible to obtain reliable and comparable data, for several reasons: such data are usually not published; the budgets are not always clearly separated from other activities of the public administration or of the energy agencies; campaigns, information portals and other tools often are operated and/or updated over a period of several years and therefore the budgets are not clearly identifiable; in many countries, there is an interaction between information tools at national, regional and local level, and/or between a number of different public relation activities and information sources, partly private and partly public funded. Therefore, it has not been possible to produce a quantitative comparison on the “supply side” of information within the boundaries of the present study.

An objective measuring of the overall impact of a communication activity on renewables would require a survey of a representative sample of the target group(s). In those countries where the main communication campaigns and/or promotion schemes are carried out at regional level, the survey should be repeated in each region. This kind of survey was impossible within the resources of the AEON study. Of course, the impact of a communication campaign cannot be judged on the basis of market development, because the market can be influenced by multiple external factors, like energy prices, economic situation, other marketing activities etc.

For these reasons, the assessments of this chapter are based on qualitative and unavoidably subjective evaluations. However, we are convinced that they are a fair reflection of reality.

One source is the information found in the national reports. However, in some cases the declaration of the stakeholders in the relative country may reflect more their level of expectation than the objective situation, which cannot easily be compared with other countries. Some German stakeholders argue that information should be improved, though any observer with a European overview experience in renewables would consider Germany as a best practice country.

Therefore, the judgement has been balanced with the own experience of eclareon. As the content provider for the databases “RES Legal” of the German Ministry for Environment and for the Subsidy Overviews of the German Energy Agency (dena), eclareon has been monitoring for several years the detailed conditions for power grid access, usage and expansion as well as the financial incentives for renewable heating and renewable electricity in all EU-27 countries (RES-Legal 2009, dena 2010). This experience enables us to compare the accessibility of information in all countries, and provides also a certain overview also on the ongoing awareness raising campaigns.

## 6.1 Overview of main findings and barriers

Overall best practice can be identified in Denmark, Germany, Luxembourg, Slovenia and Sweden. In these countries information is easily and widely available at national and regional level, both for professional target groups and for ordinary citizens without specific knowledge. Awareness raising campaigns were sufficiently funded, carefully designed to reach the target groups, and carried out professionally.

A good practice example for the proactive reassessment of the provision of information on renewables is Lithuania. Here the government has presented a draft law on renewables, which includes a separate section for a regulation on information and awareness raising. The envisaged provision would assign the responsibility for information dissemination and awareness raising not only to the national ministries, but also to municipalities and other public institutions. It remains to be seen what impact this will have in practice.

### 6.1.1 Barrier 5.1 - Availability of information on support measures

This section looks at the accessibility of the information on support measures, i.e. financial incentive schemes provided by public authorities. It may seem obvious that public authorities provide good information on the financial incentives they offer, but it is often not the case.

The availability of information on support measures is not only a key prerequisite for their success. Lack of transparency in this field may become a barrier for market development: in some cases, investments would be done even without subsidies. However, they can be postponed if the potential investor is aware that is possible, or might soon be possible to receive a subsidy, but is not able to obtain clear information on the subsidy.

The following table is based on the findings of the national reports and on the experience of eclareon (see above).

Table 6.1 Quality of information on public support measures

| | EU 27 countries |
|---|---|
| Positive | Austria, Denmark, Estonia, Germany, Ireland, Lithuania, Luxembourg, Malta, The Netherlands, Slovenia and Sweden |
| Average | Belgium, France, Hungary, Italy, Slovak Republic and Spain |
| Negative | Bulgaria, Cyprus, Czech Republic, Finland, Greece, Latvia, Poland, Portugal, Romania and the United Kingdom |

Source: AEON national reports, eclareon.

Only in 11 countries, several of them with a very small population, the availability of information has been evaluated positively: Austria, Denmark, Estonia, Germany, Ireland, Lithuania, Luxembourg, Malta, the Netherlands, Slovenia and Sweden.

In six countries the availability of information has been evaluated as “average”: Belgium, France, Hungary, Italy, Slovak Republic and Spain.
And in ten countries the availability of information has been evaluated as negative: Bulgaria, Cyprus, Czech Republic, Finland, Greece, Latvia, Poland, Portugal, Romania and the UK.

The most frequent remarks in this field are:

- **General lack of transparency**: information is unclear, difficult to be understood, not updated, different websites or sources contradict each other, only legal texts are made available without a clear guidance for the users;
- **Lack of support for the users**: In case questions arise, it is difficult or impossible to obtain explanations from the public authority (unsatisfactory or no answers per telephone or email). There is a lack of differentiation between ordinary citizens (final users) and professionals or multiplicators (craftsmen, architects, renewable system providers);
- **Inhomogeneous information in different regions**: where regional support schemes exist, the quality of the information provided by different regional authorities is

substantially different. This is the case among others in Germany, France, Italy and Spain. However, only in Germany a study has been found that compares the situation indifferent regions. Other national governments could finance such studies and all could exert pressure on the regional authorities lagging behind in this field.

### 6.1.2 Barrier 5.2 - Awareness raising campaigns

This section summarises the findings of the sections 5.2 (funding for campaigns) and 5.3. (design and conception) in the national reports.

Strong differences exist among Member States and can be easily detected. In certain countries, for instance Germany and Denmark, well funded and designed public awareness raising campaigns have been carried out for many years, with a clearly positive impact on public opinion and on the information and motivation of the most important professional groups concerned. Other countries that have received positive assessment are Austria, Ireland, Luxembourg, the Netherlands, Slovenia and Sweden.

In several Member States, among them large countries like Italy, Poland, Romania and the UK, there is a wide consensus among stakeholders that public awareness raising campaigns have been so far very limited and/or conceived and carried out at low quality levels.

However, for the reasons explained in the methodological section above, the empirical material is not sufficient to allow for a structured comparison as in the previous section.

The most frequent remarks in this field are:

The **lack of independent and comprehensive information:** particularly **for building integrated technologies**, the potential investors are often ordinary citizens. As they usually don't know renewable technologies yet, they need to be reassured and supported. The lack of reliable, independent information and of neutral support in the choice of products has been mentioned as a relevant barrier in several countries, among them Italy, the Netherlands, Spain and the UK. Particularly in the UK, there seems to be a problem of lack of trust on the marketing information provided by some private actors.

**Long-term actions need sufficient funding for longer time periods**: It is no surprise that most stakeholders, i.e. usually representatives of companies or associations active in the renewable energy markets, find that campaigns are underfunded. As explained above, it has not been possible to support or refute this point of view with reliable and comparable quantitative indicators.

However, it can be observed that in several countries, public information campaigns have been started, but did not last long enough to have a real impact. It is important to conceive such plans for the long term. Economies of scale can be achieved also on the time axis, as the target groups get used to search for information in certain ways.

Another important issue is **preparing public opinion to accept the impact on landscape of large scale RES projects**, such as wind power, or the related transmission grid. This has been mentioned in Ireland and other countries. In the Netherlands, the national report highlights that a lack of leadership from the responsible ministry is resulting in an uncoordinated information offer from various stakeholders.

In some cases, information campaigns and tools do not **address adequately the relevant target groups**. It is important to carefully define the most promising target group. Stakeholders from many countries criticised the **design of existing campaigns** as being **too unspecific**, i.e. not effectively focused on specific target groups. Contents, image and tools must be adapted to their relative cognitive and emotional needs. Stakeholders highlighted that information campaigns is often too **technical and complex** too address ordinary citizens (Austria, Czech Republic, Hungary and Portugal).

In this regard it was mentioned that existing myths about RES (such as prejudices about the cost/benefit ratio of renewables) should specifically be addressed to tackle consumers' uncertainty (Slovakia, Czech Republic, Germany). The German study outlines in this regard that the common prejudice still prevails that certain renewable technologies have a negative energy balance over their lifetime.

Another aspect was the need for **dedicated campaigns addressing specific target groups, such as the banking and financial sector** (Denmark) or the **public administration** (Ireland, Malta, and The Netherlands).

In Ireland, stakeholders assume that the lack of general understanding for the benefits, and necessity, of renewables significantly contributes to the local resistance against grid reinforcement measures.

## 6.2 Recommendations

The analysis of the national report has pointed out that effective awareness raising campaigns and the availability of information on support measures are crucial for the development of renewable energy markets in the building sector and for the social acceptance of infrastructure related to centralised renewable energy technologies such as wind power plants, biomass or biogas plants and CSP.

Based on the analysis above, following recommendations should be considered:

Regarding the availability of information, particularly on support schemes and on the regulatory framework, Member States should focus on the easy accessibility of constantly updated information. Additionally, it is advisable to conceive and implement ad-hoc information tols targeted at the specific target groups that are most relevant for the relative purpose: a one size fits all strategy is very unlikely to address the communication needs of households, installers, architects or financers with the same degree of effectiveness.

Well operated interactive support instruments, such as telephone hotlines or online helpdesks can further foster the success of the information brokerage instrument.

A strong emphasis should be put on the consistency of the presented information, also regarding other official websites, in particular when the regulatory framework or the structure of the support schemes make necessary an interaction between different political levels (national, regional, local) or between different administrations.

As for awareness raising campaigns, it is to highlight that the campaign design is of crucial importance. Only a careful analysis of the target groups and their specific needs, behaviour and communication patterns will allow for an adequate design and the success of the campaign.

Furthermore, the provision of comprehensive, independent information is a key aspect for the success of the campaign. If for instance a house owner has been convinced to consider investing in renewable energy equipment, s/he should be led to easily understandable and reliable (i.e. independent, non.-commercial) information allowing a comparison of the different technical options and of the quality and prices in the market place.

Finally, communication campaigns should be conceived as far as possible with the intent of triggering positive effects also in the medium and in the long term, which implies also funding over an adequate period of time,.

## 6.3 Literature and sources

DENA (2010): dena-Subsidy Overview EU-27 – REN Heat, http://www.dena.de/en/infos/publications/publikation/eu-27-renewable-heat and ,dena-Subsidy Overview EU-27 – Photovoltaic, http://www.dena.de/en/infos/publications/publikation/eu-27-photovoltaic

RES-Legal: Database on legislation on renewable energy generation, www.res-legal.eu

# 7 Issue 6- Certification of installers (Ecorys)

## 7.1 Introduction

The base of our study is the annex of the Renewable Energy Directive that includes a specific section describing the regulations necessary to abolish the barrier associated with the lack of (acknowledged) certification (see directive 2009/28/EC, Annex IV). In the annex the following is stated:

*"The certification schemes or equivalent qualification schemes referred to in Article 14(3) shall be based on the following criteria:*

1. *The certification or qualification process shall be transparent and clearly defined by the Member State or the administrative body they appoint. […]*

It is observed that there are many types of certificates and certifying bodies that are recognized locally. However, not for all RES technologies there currently is a single generally recognized certifying agency on a European level (like the CEN-institute[9]).

Broadly speaking, there may be various direct **benefits** of certification existing for both installers and consumers:

For the **installers:**

- Identifies installers as professionals, resulting in increased consumer confidence in their work;
- Validates extra resources spent on training and gaining experience;
- Allows for installer mobility as the market moves from state to state;
- Allows installers to distinguish their skills and experience in the field.

And for the **consumers**:

- Provides a means to identify qualified installers, promoting confidence and trust in the work performed;
- Preserves consumer choice, maintaining access to both certified and uncertified installers;
- Increases the quality level of installed equipment thus reducing the failure rate.

Furthermore, an indirect though interesting association with certification is its educational character: certifying bodies often contain training facilities where an installer (on personal or company level) can receive his, her or its certificate after a course, training or workshop.

This obstacle, as described in the tender specifications, includes the distribution of information about a general certification scheme. However, since there is not yet a certification scheme in place, information dispersal is not a barrier *per se*, and belongs to the recommendations.

[9] http://www.cen.eu/cenorm/homepage.htm

Finally, the lack of guidelines for architects, planners and other designers are part of this barrier as well. Guidelines are rather passive, and we would include training/certification of these target groups instead of mere guidelines.

In our opinion, this barrier is mainly institutional and social in nature. However, as mentioned above, there is a strong educational component in here as well. It is important to bear in mind that the barrier mentioned in the tender specifications is about the certification of installers (workforce) and not the equipment itself. Certification of installers must create trust and insurance for the consumers. Apparently, it is presently a barrier since no large certification schemes are in place. However, the impact of this barrier is difficult to estimate, since it is unknown what the need of the consumers is for certification and if consumers decide to choose for conventional energy technologies without a certification scheme in place. Our speculation would be that this barrier does not have such a big impact as compared with the other barriers. In addition, awareness of RES for planners, architects, etc. is currently lacking.

Without much literature to strengthen our hypothesis, we suppose there is more to gain in raising awareness and training of architects, planners and other designers. Nowadays, a building with PV panels or a stand-alone biomass plant is often a prestige project. However, the lion's share of newly constructed houses is of the conventional type, without much attention for local generation of energy and heat.

*Relevant renewable energy sources*

The relevant RES are in line with the technologies described in the directive 2009/28/EC, viz.:

- Biomass;
- Heat pumps / shallow geothermal;
- Solar PV and solar thermal.

In addition, this barrier is practically limited to small-scale systems. We anticipate that the construction of large power facilities *de facto* is contracted to verified and experienced contractors only, most often through tenders including both a strong focus on quality standards and a sound track record.

## 7.2 Overview of main findings and barriers

### 7.2.1 Barrier 6.1 - Lack of a Certification body

The first and strongest barrier reflects the absence of a national (or even European) appointed certification body. This barrier is considered to be the main problem regarding the issue of certification, and is therefore ranked the highest of all.

In some countries, a nationally recognised certification body or scheme is clearly missing. Examples concern Czech Republic, Greece and the Netherlands. Several Member States lacking such a body or scheme may experience problems regarding the quality of installations. From a supply side perspective, the companies that do invest in decent training for the installers are affected by companies that do not; both by avoided training

costs as well as a bad general reputation of the market. What is more, due to the lack of national benchmarks there is no standard, creating further problems with installation and maintenance. From a demand side perspective, consumers are reluctant to have RES systems installed due to uncertainty of good installation.

These problems have been recognised within most of these Member States. National bodies representing one or several technologies within the countries are currently developing certification, training and examination schemes to circumvent this barrier and improving installation of RES systems and equipment. Examples are the Holland Solar group in the Netherlands targeting the installation of photovoltaics and solar thermal systems or the manufacturer of the specific technology in Slovakia. It is also observed that companies are being certified by bodies that are not nationally recognised or appointed.

Subsequently, in some Member States this phase has been implemented already, where a certification body for one or several technologies is in place. The main technologies in scope are PV panels, biomass systems such as boilers and stoves, and heat pumps. Often these bodies provide training of a few days, including wiring and other electrics, piping and plumbing, and chimney fitting. After this training, there is an examination, after which the companies and installers receive their certificate if the pass successfully. These schemes are frequently integrated with certification schemes of central heating boiler installers, plumbers and electricians. Examples can be found in Austria, Belgium and Germany.

Finally, in some Member States there are certification bodies including all the relevant technologies. In addition, for consumers to be eligible for support, the systems and equipment must be installed by a certified company or installer. Denmark, France and the UK are example of such countries.

Overall, this barrier is present in about half of the Member States, which means lacking a certifying body for one or several technologies. However, the severity of the problem is not too large, for it is in the long-term benefit of the installers themselves to install the systems and equipment decently.

As mentioned above, this barrier is practically limited to small-scale systems. It is anticipated that the construction of large power facilities is *de facto* contracted to verified and experienced contractors only, most often through tenders including quality standards.

### 7.2.2 Barrier 6.2 - Lack of training and guidelines

This barrier focuses primarily on installing skills, but will not exclude the knowledge of public servants and policy makers, research, maintenance and operator personnel, etcetera. In addition, the lack of guidelines for planners, architects, etc. on optimising the use of renewable energy will be discussed. However, from the country reports it became clear that this barrier plays a minor role with regard to the issue of certification.

In general, there is a lack of sufficient training in the Member States. Possibly this is in direct connection with the lack of a certifying body and guidelines for designers. The training gap applies to a whole range of skilled people: from installers, to maintenance personnel, engineers and public servants. From a supply side of view, the lack of skilled personnel prevents or delays the installation of new systems, equipment or specific parts in the installation process. For already installed systems and plants maintenance is not done properly or not at all, ultimately hampering renewable energy in the long run. From a demand perspective, there is common fear that in case the equipment fails to work, repairing will be delayed. In the worst case, consumers do not choose to install renewable technologies due to the lack of trained and skilled installers and fear that in case the equipment fails to work repairing will be delayed.

Besides the need to create new skills, there is also a need for upgrading old skills for professional target groups such as electricians and plumbers.

In some countries, training of installers takes place via learning-on-the-job or from senior colleagues, which is quite common in the Netherlands for instance. Other initiatives include workshops, seminars and small courses which are provided by a wide variety of providers such as trade unions, manufacturers, RES associations and governmental institutions. However, these forms of training are not sufficient enough to remove the barrier of lack of training entirely. Interviewees suggested that RES technology installation, planning, maintenance, etc., should be an integral part of the corresponding vocational, higher or academic schooling.

Again, despite the general presence of this barrier throughout Europe, most interviewees did not recognise the lack of training as the most important barrier to the development and deployment of RES systems.

The lack of clear guidelines and directions for spatial planners, architects and other designers has an impact through missed opportunities and planning. It is assumable that designers – especially from older generations – do not have the training and background to include RES into their designs. Clear guidelines should counterbalance this problem, whereby spatial planners can reserve space for RES systems within the landscape, architects keeping room for RES systems in buildings and grid planners for extra capacity in likely RES sites. Currently, these guidelines are absent or insufficient throughout the Union. Exemptions include Estonia and Italy. Despite the general presence of this barrier, most interviewees did not recognise the lack of guidelines as a major hurdle.

## 7.3 Quantitative analysis

Table 7.1 suggests that the number of Member States including a certification scheme is roughly the same as countries lacking such a scheme. Nevertheless, it must be stressed that the term ‘scheme’ is applied rather loosely, without specifying the RES technologies or the magnitude of the scheme. Therefore, this figure presents the best case scenario.

Table 7.1 Table showing the Members States that have sufficient certification schemes for installers

| | EU 27 countries |
|---|---|
| Sufficient | Austria, Denmark, Finland, France, Ireland, Luxembourg and the United Kingdom |
| Insufficient | Bulgaria, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Romania and Slovenia |
| In between | Belgium, Germany, Portugal, Slovakia, Spain and Sweden |
| Not available | Malta |

Table 7.2 reveals that there is a general lack of training, indeed. Of all Member States, approximately 67% of the respondents indicate that the level of RES training in their country is insufficient.

Table 7.2 Table showing the Member States that have sufficient training on RES issued during the formal education of installers, planners and architects

| | EU 27 countries |
|---|---|
| Sufficient | Denmark, Finland, Germany, Slovenia and Sweden |
| Insufficient | Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Estonia, France, Greece, Hungary, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Spain and the United Kingdom |
| In between | Ireland and Italy |
| Not available | Luxembourg and Malta |

### 7.3.1 Examples of best and worse practices.

Our study reveals that the **United Kingdom** presents a best practice. There are several certification bodies appointed that certify RES installers. These bodies are present in several locations throughout the country. Further, information is readily available detailing which technology can be certified, the applicable conditions, etc. In general, the certification of installers is working properly as perceived by the (local) government by having insight into the market, as well as by the consumers by the protection it offers and by the installers themselves by preventing false competition and rogue installers damaging their reputation.

Moreover, another best practice can be found in **Germany**. The training in the field of RES technology and installation is officially a part of the education of concerned installers' professions. Although there is still some room for improvement, the RES training is a part of the vocational education of installers and is experienced as useful and with the time renewable energies have become more and more covered by vocational training. The general curricula for these professions demand schooling in the RES area. Apart from the point about the environment protection, which appears in curricula for every vocational education in Germany, also the specification about gaining the ability to install the RES-systems is mentioned.

A **worst practice** can be found in **Greece**, for example. In this Member State there is no certification body, no guidelines for planners or architects and a general lack of training. This is experienced as a significant barrier to RES system deployment.

## 7.4 Recommendations and conclusions

Obviously, the current issue of the lack of a certification body could be mitigated by mandating the Member States to appoint at least one such a body, where installers for all relevant technologies must be certified. Subsequently, all certified installers and/or companies could be mentioned on a publicly available list. An option of enforcing such a rule is that consumers are only eligible for support if the systems and equipment are installed by certified installers.

Guidelines are universally applicable for planners, architects, etc. Therefore, general guidelines could be made on a European level and taught by giving workshops and seminars. The barrier lack of training is in the first place a cost issue. However, RES systems, options and technologies could be a mandatory part of the appropriate vocational, higher and academic training.

What is more, the two barriers can be linked to each other. If a certified installer is required in order to be eligible for support, and a certificate will only be provided after a selective examination, then trainings and guidelines will develop organically.

In conclusion, the issue lack of certification, guidelines and training is generally present in most Member States. Despite this commonness, this issue does not rank amongst the strongest items hampering the development and deployment of RES systems and technologies in Europe.

## 7.5 Literature and sources

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# 8 Issue 7- Infrastructure Development (Golder)

This chapter summarises the main findings of the AEON project concerning the non-economical barriers that could impede the growth of renewable energy sources because of inadequate development of electricity network infrastructures.

The problems concerning the connection and grid access are developed in details in the subsequent Issue 8; this chapter will focus on the barriers that hinder the reinforcement of the national electricity network infrastructure and the development of a trans-European electricity network.

## 8.1 Introduction

### 8.1.1 General description of the issue and literature

This issue concerns the lack of development of electricity network infrastructures impeding the growth of renewable energy resources.

As stated in the preamble (n.57) of Directive 2009/28/EC "*There is a need to support the integration of energy from renewable sources into the transmission and distribution grid and the use of energy storage systems for integrated intermittent production of energy from renewable sources"*.

The importance of the grid infrastructure is remarked by the 3rd Legislative Package for the Internal Market in electricity which will come into force in early 2011. The 3rd Package provides for institutions and tools that promote the strong coordination of the operation and development of the national transmission networks, as well as the harmonization of the European regulatory frameworks. Regulation (EC) 714/2009 of the 3rd Package calls for the creation of the European Network of Transmission System Operators for Electricity (ENTSO-E) and according to Art. 8.3 (b) of the Regulation (EC) 714/2009, *ENTSO-E shall adopt a non-binding Community-wide ten-year network development plan* ("TYNDP") with the objective to ensure greater transparency regarding the entire electricity transmission network in the Community and to support the decision making process at regional and European level.

In general, the reasons for developing the grid have adapted over time, according to economic and social needs and aims. In this respect the EU, as well as individual Member States, sets specific standards with respect to the pillars of European energy policy, namely (i) Security of supply and (ii) Renewable integration.

The grid infrastructure was mainly built when the electricity sector was publicly owned and has been designed to allow large and centralized power plants being situated near mines and rivers, or near the main centres of consumption. Renewable electricity plants are normally not situated in the same type of locations as conventional electricity and have, in general, a different scale of generation (except for a few cases of biomass and wind plants) and territorial spread. In addition, RES plants face particular problems concerning grid issues as compared to conventional power plants due to the characteristics of some RES plants including for example the intermittency of power output (Wind, PV), smaller plant sizes or decentralized character.

The development of renewable energies in Europe, according to the targets set by the Renewable Directive 2009/28/EC, will require a comprehensive analysis and reinforcement of the entire existing European grid to encompass future developments.

*Relevant renewable energy sources*

This issue affects all plants for the production of electricity from renewable energy sources, but in particular large scale plants (e.g. biomass, wind power) and intermittent power plants (e.g. wind power, photovoltaic systems). Large scale RES plants are particularly interested by this issue since they often need to be connected directly to the transmission grid, which is less extended than the distribution grid. Intermittent power plants, on the other hand, imply an over-engineering of the grid: hence, the maximum capacity of the grid will be used only for a short period during the year. Consequently, without profound changes in the electricity system, the overall system costs will become much higher than the benefits expected from increasing penetration of RES in the electricity supply, resulting in a severe barrier to the development of RES plants.

*Relevant stakeholders*

- Policy makers and public authorities (Regulators);
- Transmission System Operators (TSOs) and Distribution System Operators (DSOs);
- National electricity system research centres;
- Energy agencies and European & national associations;
- Project developers, investors in RES technologies;
- Producers of RES technologies;
- Non Governmental Organizations (NGOs).

*Overview of (ranked) barriers*

Based on the literature consultation, the following barriers concerning the development of electricity network infrastructures and impeding renewable energy growth are identified:

*Barrier 7.1 - Problems concerning connection to existing electricity networks / Problems concerning development of electricity network infrastructures according to a long-term strategy*

For many renewable electricity generation projects connection to the electricity network represents a serious problem, especially when it is necessary to undertake technical adaptations and extensions of the existing grid. The main reasons for this are the following:

- Lack of smart networks - Insufficient grid capacity;
- Unpredictability of most RES plants – Lack of compensating power plants.

The extension of existing electricity networks and their development into smart networks is a key element for achieving a better integration of renewable electricity generation projects. Unless there's a strong awareness on this theme, there are still many barriers impeding the development of electricity networks according to a long-term strategy, taking account of the integration of renewable energy resources:

- RES insufficiently taken into account in grid development - lack of prevision of future demands and location of RES plants;
- Legislative instability - lack of regulation, weak coordination between authorities;
- Social opposition - EIA process.

*Barrier 7.2 - Problems concerning development of a Trans-European Electricity Network*

Despite many studies on the development of a Trans-European Energy Network (e.g. TEN_E programme) have been executed, cross-border trade in electricity between Member States is still underdeveloped as compared with other sectors because of the following reasons:

- Isolation and limited interconnection capacity of some Member States - Congestion and inefficient allocation of the existing interconnection capacity;
- Lack of discussion and coordination between national governments or cooperation between TSOs;
- Lack of accelerate authorization procedures for grid infrastructure of European interest.

The analysis of the stakeholders' answers and of the country reports showed a strong connection of problems concerning the connection to existing electricity networks and its development according to a long-term strategy: thus, network connection is developed in details in Barrier 8.1.

## 8.2 Overview of main findings and barriers

### 8.2.1 Barrier 7.1 - Problems concerning connection to existing electricity networks / Problems concerning development of electricity network infrastructures according to a long-term strategy

The European climate and energy policy sets ambitious targets concerning climate change threats that have an impact on the development of the electricity network. The RES growth depends largely on the national political, legal, and regulatory measures to encourage such investments in their areas. The current experience is that significant progress has been made in many countries, but in an uncoordinated manner resulting in disparities in investment planning and hence a reduced visibility for the TSOs to ensure that the network follows efficiently and on-time these investments, as well as to accommodate bulk power flows from areas with high RES penetration. This is aggravated by the fact that building transmission assets requires almost double the time as for building production assets, increasing substantially the risk of stranded costs for TSOs, or over/under investment (ENTSO-E).

Consequently, the lack of a long-term strategy concerning the development of electricity network infrastructures constitutes a barrier that can hinder the RES growth in Europe.

This barrier is perceived as present or partially present in most countries, as reported in Table 8.1 ("Presence of an efficient plan for the reinforcement of the connection capacity within the country").

Table 8.1 Presence of an efficient plan for the reinforcement of the connection capacity within the country

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Finland and Sweden |
| Negative (barrier is present) | Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, France, Greece, Latvia, Lithuania, Luxembourg, The Netherlands, Poland, Romania, Slovakia, Slovenia and Spain |
| Partially | Austria, Estonia, Germany, Hungary, Ireland, Italy, Portugal and the United Kingdom |
| Not available | Malta |

In general, the development of electricity network infrastructures is not perceived as a barrier to renewable energy growth in the following countries:

- In **Finland:** the grid operators were given clear rules: grid connection is granted to the operators at a reasonable price;
- In **Sweden:** according to the Electricity Act (1997:857), RES plants do not need to ask for a permit for grid connection. Moreover, according to the Government, currently the grid can support the renewable integration: just in a few areas characterized by a high concentration of wind farms, the grid could need an upgrade.

The main aspects of this barrier within the Member States are reported as follows:

*Lack of RES and spatial planning (RES insufficiently taken into account – Lack of prevision of future demands and location of RES plants)*

The current lack of a **national energy plan** and of a **clear energy strategy** for RE electricity generation in the overall energy balance of the country, makes it difficult to predict the new RES installation capacity and the investments required for the grid reinforcement.

**Spatial planning** represents another sub-barrier if it is inexistent or insufficient. The spatial planning is insufficient, for example, when RES are not taken into consideration by TSOs, DSOs, and national administrative bodies during planning electrical infrastructure development or when, in the administrative procedures, the responsibilities for spatial planning are not clearly defined and coordinated between the different responsible authorities and timetables for planning applications are not transparent.

It is also possible that the investment planning for the expansion of the grid has taken this into account but there is not a formal official characterization at the country level of the RES potential that could be used as a guide for this purpose. Our study suggests the problem dwells in the following countries: Bulgaria, Cyprus, Czech Republic, Denmark, France, Greece, Latvia, Poland, Slovakia, Spain, while some elements of this barrier are perceived in the following countries: Italy, Germany, Portugal.

- An example of lack of RES and spatial planning can be found in **Poland**: there are no forecasts to which extent the grid has to expand to cope with the expected rates of RES development. There is not an official concrete long-term strategy, in terms of an overall master plan that takes all priorities into account. A strategic plan for the transmission and distribution network development up to 2020 should be consistent with the national plan on use of RES;
- Another example can be found in **Greece**: in areas characterized by high wind energy potential, as the Evia Island, the electric grid is often congested. Moreover, there is no grid connection within many Aegean islands, characterized by high wind potential and by a low local demand: the congestion of the grid is consequently blocking many RES projects. For example, the grid reinforcement in Evia Island is scheduled in 2013, thus hindering the development of new wind farms. Another example is the 70 MW high temperature geothermal plants planned in Milos and Misiros Island: the power of the plants is higher than the local demand, consequently the lack of interconnectors is currently blocking this project.

### *Legislative issues (Legislative instability, lack of regulation, weak coordination between authorities)*

This barrier is due to the lack of an overall structured management system, of a national legislation on regulation and standardization covering grid issues and/or to a weak coordination between the competent authorities. The barrier is perceived in the following countries: Latvia, Lithuania, Poland, Romania, Spain:

- An example of a weak coordination between authorities can be found in **Spain**: the role of the Spanish energy regulator CNE in regulating the DSOs activity is still mainly of advisory and consultative nature. It could be useful to give CNE a more independent and decisive power, removing its need to receive the approval by the Ministry of Industry, Tourism and Commerce;
- An example of a lack of legal framework can be found in **Poland**, where there are no legal regulations that oblige the operators to modernise or expand the grids. TSOs and DSOs (e.g. TAURON Polska Energia, ENEA and ENERGA) plan to develop the transmission and distribution assets during the period 2009-2012, however the issue is left at the discretion of management boards of the respective operators.

### *Lack of political will*

According to the Czech and Slovak TSOs, the unpredictability of most RES plants is a structural barrier to their growth. Interviewed stakeholders consider the approach of the Czech and of the Slovak authorities as a lack of political will for the connection to the grid of the photovoltaic and wind plants rather than a technical problem.

### *Lack of clear, appropriate and predictable rules for the incentives*

The barrier is perceived in the following countries: **Lithuania, Poland and Romania.** Particularly in **Romania**, the lack in infrastructure development support, due to the fact that the new legislative act n. 220/2008 has not been yet applied, is seen a barrier. **Possible solution:** stability of the incentives and their coordination or harmonization within the Member States**.**

### *Social opposition – EIA process*

Social opposition to new infrastructure development is perceived as a barrier to renewable energy growth in **Denmark, France, Germany, Ireland, Italy, Lithuania, Romania, UK**. Social opposition to new infrastructure is present in many big countries located in the heart of Europe: consequently, this issue can constitute a strong barrier to the development of the entire European transmissions infrastructure.

In detail, per country the following observations can be made:

- **Ireland**: the opposition of local population to overland high voltage lines is the main obstacle for the extension of the transmission grid: several appeals at court are blocking a further extension of the transmission grid. A lack of awareness raising is identified as root cause for this situation: people generally in favour of RES often are lacking necessary information regarding the linkage between the expansion of the grid and a further development of RES technologies. Another barrier is the definition of legitimate complaints against planning or building permits: the undefined group of persons eligible for appeal is perceived as a barrier. Under the current legislation any third party, not even having the Irish citizenship could appeal at court against a planned project, thus lengthening the process. Possible solution: a limitation of this broad right to appeal regarding the group of eligible persons in conformity with European regulations could minimize this barrier and would still guarantee a democratic participation of local population;
- **Germany**: social opposition is mainly due to NIMBY attitude, environmental conservation issues, non-transparent planning process and lack of a participatory planning. Possible solution: increasing the participation of stakeholders in planning processes;
- **Italy**: in the last two decades, the development of the grid infrastructure has been almost blocked, mainly due to an increasing social opposition to new installations based on environmental reasons. Possible solution: in the past three years, the Italian TSO has significantly accelerated the grid development thanks to the adoption of the Strategic Environmental Assessment: the focus has been placed on the coordination with the Regions and authorities in order to guarantee high levels of environmental protection and promote participation in decisions by the Administrations and local communities. The public involvement in the decision-making processes and an improved communication and cooperation among interested parties can reduce the public opposition to the grid development works.
- The stretched duration of the EIA process is perceived as a barrier in **Austria**. According to the Austrian law, the maximum duration of an EIA process should be 1.5 years: this deadline is usually not met, mainly due to the large number of parties involved, the opportunity to make representations and objections throughout the whole duration of the EIA and the insufficient staff and resources in the responsible authorities. Possible solution: set a shorter period for the public representation.

### *No transparent planning processes*

This problem may be present in Latvia, Lithuania, Poland, Romania, and Slovenia:

- Each of the five **Slovenian** DSOs has different grid connection rules and requirements: consequently the process is not fully transparent;
- The sharing of grid extension and reinforcement costs is not transparent and is perceived as a significant barrier in **Poland**, since it is based on an individual arrangement between the investor and the DSOs. The Energy Law sets ambiguous guidance on grid connection cost: consequently, the costs imposed by the DSOs to similar RES plants can be very different;
- The lack of an overall structured management system on allocation of the existing grid capacity is seen a barrier in **Latvia** and **Lithuania**: the main consequence is a very expensive connection to the national grid. Possible solution: establishment of maximum costs for grid connection according to the plant size and to the grid extension construction costs.

### *Long and complex authorization process*

Long and complex authorization processes, which can lead to delays in grid optimisation and reinforcement, is perceived as a barrier in Belgium, France, Greece, Lithuania, the Netherlands, Poland, Romania, Slovakia, and Slovenia.

Particularly, in **Greece**, expropriation and land acquisition rules for new transmission connections can take years.

**Possible solution:** introduction of strict deadlines in the authorization process and of high fines for non-compliance.

### *Lack of suitable RES networks*

A massive renewable integration in Europe, as foreseen by the Renewable Directive 2009/28/EC, must cope with problems concerning the grid infrastructure. The two following main items could be distinguished:

**Lack of smart networks - Insufficient grid capacity**

In general, the Member States grid infrastructures were built to dispatch the electricity produced by large centralized power plants. A large-scale introduction of decentralized power generating units may lead to grid technical problems, as the instability of the voltage profile. Moreover, the bi-directional power flows and the complex reactive power management can be problematic and lead to voltage profile fluctuation.

Possible solution: the implementation of smart grids, which deliver electricity from suppliers to consumers using two-way digital technology, is widely seen as a possible solution to increase the reliability of the grid, thus leading to a larger renewable integration in Europe.

**Unpredictability of most RES plants – Lack of compensating power plants**

TSOs have the responsibility to ensure that load and generation are balanced at every moment. A massive development of intermittent renewable source, often located in isolated area far away from the load centres and with no integration with compensating power plants, as hydro pumping storage units, can lead to serious negative problems to the overall system power balancing. In general, this barrier is perceived as present in Bulgaria, Belgium, Czech Republic, France, Greece, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, while is perceived as partially present in Estonia, Germany, Hungary, Ireland, Italy, Portugal and the United Kingdom.

In detail per Member State:

- **Bulgaria**: the insufficient grid capacity is seen as a barrier to renewable growth. There are currently RES projects with a power higher than 12,500 MW waiting for the authorization: the power of these plants overcomes the current electric installed capacity of the country.
- **Czech Republic** and **Slovakia**: the Czech and Slovak electricity grid was built for large centralized power plants, which were the only electricity source until 1989. According to the countries TSOs, the unpredictability of most RES plants constitutes a technical problem for the grid.
- The **French** electricity grid shows major shortages regarding the capability to encompass further capacities from RES installations. Currently, grid reinforcement works are conducted in a punctual and selective way on the regional level, mainly to solve the most pressing problems concerning the grid and to satisfy urgent demand. The most pressing issue is the electricity dispatching from the offshore and onshore wind farms on the coasts, especially in the North-West of France, or from the Massif Central to high density population or industrial areas of France.
- **Latvia** and **Lithuania**: the electricity networks were built for large centralized power plants, consequently large investments and energy storage facilities are needed in order to connect to the grid new unpredictable RES plants.
- **Poland**: one of the most important barriers in Poland is the lack of grid access for the energy produced from renewable sources. The transmission and distribution infrastructure has not been properly modernized in the last two decades, hence is heavily overloaded and does not allow grid access for all RES applicants.
- **United Kingdom**: the lack of underground grid connection is perceived as a barrier to off-shore wind farm growth.

### 8.2.2 Barrier 7.2 - Problems concerning the development of a Trans-European Electricity Network

The EU Council of 2002 in Barcelona decided that each country should have an interconnection capacity with its neighbouring countries equal to 10% of its overall production capacity by 2010. Consequently, the development of a trans-European electricity network is a key point to meet the targets set by the European energy policy, namely the security of supply and the renewable integration.

In particular, according to the "Ten-year network development plan 2010-2020" submitted by European Network of Transmission System Operators for Electricity (ENTSOE), network development needs can be briefly identified as follows:

- **Massive renewable integration in the northern part of Europe**: The connection of renewable sources, mainly wind, is one of the most important triggers of this plan. Produced renewable energy has to be evacuated either within the North Sea and the Baltic Sea regions or to the East and to the South. Therefore, impacts are not limited to these two regions but also to the surrounding ones as investment needs are threefold;
- **Massive renewable integration in the southern part of Europe**: The connection and evacuation of renewable sources, mainly wind, hydro and solar in the Iberian Peninsula, is one of the most important projects needed in the South-Western and Centre-South region of Europe.
- **Important North-South and East -West flows in the Central South / South-East Region**: The block including Greece, Macedonia, Albania, and Italy is usually importing electricity. Strengthening of the Regional network in the predominant power flow directions, is a main driver that stimulates investment needs. North-South flow will even rise in importance as new generation in Bulgaria, Hungary and Croatia will have to be accommodated. The same increasing trend is valid for the East–West flows but for different reasons, namely the interconnections of new systems with continental synchronous system (Turkey's system in the short term and Moldova's and Ukraine's later on). A strong correlation with the wind power generation especially in North Germany is expected which will increase the need of transmission capacity between those two regions. A future increase of the wind generation in France and Italy will in a similar way lead to a need for investments to increase the exchange capacity between those regions;
- **Baltic States integration**: The EU Commission launched a Baltic Sea Energy strategy, which supports the results from the Multiregional plan, and an Energy Market Interconnection Plan (BEMIP) was launched at autumn 2008 by the EU commission. The goal is the full integration of the three Baltic States into the European energy market, through the strengthening of interconnections with their EU neighbouring countries (Finland, Sweden and Poland);
- **New conventional power plants**: Complementary to RES integration, connection of new conventional power plants totalling more than 100 GW is foreseen all over Europe in the next decade either to replace old, decommissioned plant or to cope with load growth and system balancing;
- **European cities and regions**: The power supply of some European cities and regions will be an issue in Europe (in Spain, France, Hungary, Slovakia, Poland, Czech Republic, etc.). The concern is of European relevance especially when interacting with other investments needs in the area, and limiting cross-border capacity.

Consequently, the lack of a mid or long-term strategy concerning the development of a Trans-European Electricity Network constitutes a barrier that can hinder the RES growth in Europe.

This barrier 7.2 is perceived as present in many countries, as reported in Table 8.2 ("Presence of an efficient (in terms of capability of achieving its stated objectives) plan for the reinforcement of the interconnection capacity with neighbouring countries").

Table 8.2 Presence of an efficient (in terms of capability of achieving its stated objectives) plan for the reinforcement of the interconnection capacity with neighbouring countries.

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Austria, Estonia, Hungary, Italy, The Netherlands, Romania, Slovak Republic, Slovenia and Sweden |
| Negative (barrier is present) | Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Lithuania, Latvia, Poland, Portugal and the United Kingdom |
| In between | Spain |
| Not available | Luxembourg and Malta |
| | |

In general, the development of a trans-European electricity network is not seen as a barrier to renewable energy growth in the following countries:

- Most of the **eastern countries**, since their priority is currently the operation and maintenance and the modernization of their old transmission infrastructure. With the further development of RES, probably the lack of a trans European electricity network will become a pressing issue for these countries too;
- **Italy,** mainly due its position at the southern border of Europe; moreover, the country has 18 interconnection lines with other Member States and there are plans for the increase of the interconnection capacity with France, Switzerland, Austria and Slovenia ad for a new interconnection line with the Balkan States and North Africa;
- **Austria**, since APG (the national TSO) is actively involved in the planning of a trans European electricity network;
- **Estonia**, since the good co-operation with Baltic States and Finland: in case of power plant transmission or transmission systems failures, Estonia has a contract with other States to import their electricity production within 15 minutes;
- **Hungary**, due its position in the centre of Europe, there are cross boarder connections with six countries through eight connection points. The only neighbour country without electricity connection is Slovenia.

The various barrier aspects for the Member States are reported below:

*Interconnection capacity issues (isolation and limited interconnection capacity of some Member States; congestion and inefficient allocation of the existing interconnection capacity)*

The congestion and the inefficient allocation of the existing interconnection capacity is perceived as a barrier to the development of a trans-European electricity network and consequently to RES growth in Europe. Moreover, the analysis of the cross-border congestion is a key point to identify the grid investment "of pan-European significance". This sub-barrier is perceived as present in **Belgium, Bulgaria, Czech Republic, Denmark, Finland, Greece, Poland** and **United Kingdom.**

The isolation and the limited interconnection capacity are connected to the previous aspect of this sub-barrier, but is at the same time stronger: it is perceived in Cyprus, Ireland, Latvia, Lithuania, Portugal, and Spain.

In detail:

- **Belgium**, **Denmark** and **United Kingdom**: the important contingents of offshore RES expected to be installed both in coastal areas of the region and in the middle of the North Sea will require solutions for their connection to grid and an increased interconnection capacity with the neighbouring countries in order to export and exchange the wind energy. In particular, a European electricity network is considered a priority in all the North Sea area: in the near future, the trans-European electricity network is expected to play a key role to manage to national grid congestion, by dispatching the electricity produced within the countries facing the North Sea;
- **Bulgaria**: the predominant power flows in the continental south-east part of Europe are in the north-south and east-west direction. For instance, Greece, Macedonia and Albania as well as Italy are usually importers. Imports of these countries from Bulgaria and Romania, that have a surplus of generation, and from countries on the north borders of the south east part of Europe are defining the above principal power flow directions. Strengthening of the Regional network in the predominant power flow directions, in order to assist market integration and to accommodate foreseen new generation arise in Bulgaria, is considered as a priority investment for Bulgaria;
- **Czech Republic**: new interconnections are required in order to export and exchange the new generation and to cope with the strong and variable renewable power flows: in the country, new lignite and CHP of more than 1500 MW of capacity, as well as several hundred MWs of renewable sources generation are expected before 2015, increasing the west to east power flow across the country;
- **Greece**: For the medium term, accommodation of RES generation appears as a driver for investment needs in Greece, which is characterized by a high wind potential. Moreover, investment needs will be required for the possible future interconnection of Turkey;
- **Ireland**, due to the absence of any interconnection to the European continent. Larger interconnection capacities would allow for the export of Irish RES energy to the European continent when output from Irish RES generations is high as well as for import of power when RES generation on the Irish island is low, thus internationalising the Irish energy market. All presented potential interconnections might face the existing problem of a very high base load of the French and Belgian electricity grid, thus not being able to accommodate larger amount of Irish RES energy, especially derived from wind. A transmission of Irish RES energy through these grids might thus only be possible if these networks are reinforced. Alternatively, there might also be the solution to connect Ireland or the British mainland with the Dutch network or even the Danish one;
- **Iberian Peninsula**, due to the not adequate connection capacity with France. Currently, Spain has interconnection with France only equal to 1,8% of its production capacity and an interconnection with Portugal equal to 2%. While the interconnection with Portugal may still be adequate, the one with France is insufficient. Simultaneous import capacity with France is expected be more than doubled within 2014 thanks to the new Spain-France interconnection;
- **Lithuania** and **Latvia**, since the countries are isolated in terms of energy supply from the European electricity grids and gas networks. The European interconnection capacity is a very pressing issue especially for Latvia, the only electricity importer among the three Baltic States, and it is considered very important for the development of the newly emerging solar energy industry in Lithuania.

### *Lack of discussion and coordination between national governments or cooperation between TSOs*

The lack of coordination between the competent authorities is perceived as one of the main barrier to the development of a Trans-European Electricity Network. This barrier is clearly perceived in **Germany** and **Belgium**, but it is supposed to be a pressing issue for all the Member States, especially in case of a large deployment of RES.

In detail:

- **Germany:** according to the stakeholders, an higher coordination is needed especially in the following areas:
    - **Institutional level**: lack of communication and coordination between governments and regulatory bodies hinders the development of a Trans-European Electricity Network [Ecofys 2009]. It is likely that the foundation of an agency for the cooperation of the Energy Regulators, which is foreseen by the 3rd Energy Package, will mitigate this barrier**;**
    - **Support schemes**: it seems necessary to coordinate (not harmonize) the support schemes in order to clarify which shares of RES by transnational projects are supported by which national support scheme (Ecofys 2009);
    - **Approval Procedure**: the development of a trans-European electricity network is further complicated by the different approval procedures (different time limits) in the particular Member states (on national or even regional level) (Ecofys 2009).

  Possible solution: The introduction of a European infrastructure approval procedure would be desirable. If this is not possible due to constitutional reasons, Member States administrations should cooperate in regional planning and establish common guidelines in order to mitigate this barrier efficiently;
- **Belgium:** according to the stakeholder, more discussion and higher coordination are needed among the countries involved in the TEN-E initiatives “North Seas Countries Offshore Grid Initiative”.

### *Lack of accelerate authorization procedures for grid infrastructure of European interest*

This barrier is mainly due to the long authorization processes needed for the development of high-voltage grid infrastructure. This barrier is clearly perceived in **France, Latvia, Lithuania, Poland** and **Spain**, but it is supposed to be a pressing issue for all the Member States, especially in case of a large deployment of RES.

In detail:

- **Latvia** and **Lithuania**: slow and insufficient development of a trans-European electricity network is perceived as a significant barrier. Possible solution: in 2009 a memorandum of understanding was signed by eight Baltic Sea Member States and the European Commission on Baltic Energy Market Interconnection Plan (BEMIP 2009). The three Baltic States have committed to further liberalization of their energy markets and removal of existing barriers for the creation of a regional Baltic energy market. Within the framework of this plan, three electricity connections are planned: Lithuania-Poland, Lithuania-Sweden and Estonia-Finland. The Estonia-Finland connection has already been built, while the construction of the Lithuania-Sweden connection is scheduled in 2014-2016. The European Union provides partial financial support for these projects as well as for electricity infrastructure modernization projects;
- **Poland**: discussions and plans for the trans-European electricity network in Poland are still at the initial stage of development and no concrete plans have been agreed on yet. According to the stakeholders, the trans-European electricity network along the Baltic Sea is considered as a key issue and should be prioritised in future plans and strategies;
- **Spain**: many environmental protection issues are being faced during the planning of high voltage interconnection with France, thus delaying the project. Possible solution: an underwater high voltage interconnection could reduce the environmental impact of the project.

### *High investment risk for new interconnector*

This issue is mainly perceived in **France.** Up to now, TSO and DSOs are reluctant to make new investment in grid expansion without reliable information regarding the future

demands and location of RES installations. This precautious position is further delaying the required grid reinforcement works, thus constituting a barrier to the development of a trans-European electricity network. Obviously, France is located in the heart of western Europe, consequently it will play a key role in the architecture of the future European grid: the existing situation of French transmission grid and the lack of comprehensive reinforcement plan constitute a barrier that can hinder all the European transmissions infrastructure.

## 8.3 Best Practice elements and recommendations

### 8.3.1 Examples of best and worse practice

Some examples of best practice include:

- In **Belgium**, the 380 kV grid extension, from *Zomergem* to *Zeebrugge*, built in 2009 by the Belgian TSO Elia in order to connect the offshore wind farms that should be built in the coming years, is perceived as a best practice;
- In the past three years, the **Italian** TSO has significantly accelerated the grid development thanks to the adoption of the Strategic Environmental Assessment: the focus has been placed on the coordination with the Regions and authorities in order to guarantee high levels of environmental protection and promote participation in decisions by the Administrations and local communities. The public involvement in the decision-making processes and an improved communication and cooperation among interested parties can reduce the public opposition to the grid development works;
- A capacity of 6,000 MW has been reserved in the **Dutch** high-voltage grid for the off-shore wind farms planned in the North Sea. The following access points to the on-shore national grid have been identified: **IJmuiden** wind farm can have access at the Corus steel plant high-voltage transmission system, whereas projects in the Province of Zeeland and the Rotterdam area can have access at Borsele. Another wind farm at the *Waddeneilanden* can get access at **Eemsmond** - this access point is currently being reinforced by the national TSO;
- **Spain**. The **Control Centre of Renewable Energies (Cecre)**, created by Red Electrica Española, is considered an excellent pioneering effort to increase the reliability and stability of the electricity system and, at the same time, to give priority to RES installations.

On the contrary, worst practices include:

- The grid reinforcement in Evia Island (**Greece**), characterized by high wind potential, is scheduled in 2013, thus hindering the development of new wind farms. Another example is the 70 MW high temperature geothermal plants planned in Milos and Misiros Island: the power of the plants is higher than the local demand; consequently the lack of interconnectors is currently blocking this project.

## 8.4 Recommendations

A strong coordination of the operation and development of the national transmission networks, as well as the harmonization of the European regulatory frameworks is needed, in order to meet the targets in term of climate and energy set by the European Union.

According to many stakeholders a national energy plan constitutes a key point for the development of a European electricity grid: the lack of a clear energy strategy, also at national level, makes it difficult to predict the new RES installation and the grid reinforcement needed: consequently, the planned investments might not be adequate in case of a large deployment of RES.

Moreover, the development of a trans-European electricity network is complicated by the various approval procedures within the Member States. The introduction of a European standard for the infrastructure approval procedure for important trans-national networks is perceived as a solution for this issue.

Another important barrier is the social opposition to grid development works. A lack of awareness raising is identified as root cause for this situation: people, generally in favour of RES, often are lacking necessary information regarding the linkage between the expansion of the grid and a further development of RES technologies. The public involvement in the decision-making processes and an improved communication and cooperation among interested parties is perceived as a key solution in order to reduce the public opposition to the grid development works.

According to the "TYNDP 2010-2020" submitted by ENTSO-E, should be take into account the European network development needs identified and the additional recommendations reported as follow:

About the challenges for grid development:

- TSOs have to manage the connection of large amounts of generation, especially RES, improve market integration and still ensure reliable supply while complying with increased legal and regulatory obligations;
- Though TSOs play a key role, coordinated efforts from all stakeholders are required to accelerate realisation processes.

About the investments needs on the European Power grid, the two main issues TSOs will have to face for the coming years are:

- Abolishing Internal Energy Market (IEM) barriers and
- Connection of new generation, especially RES.

About the foreseen investments on the European Power grid:

- In spite of increasing complexity in projects procedures, TSOs do foresee a large number of projects in the coming 10 years.42100 km of transmission projects of European significance either new routes or refurbishments, of which 20.000 km driven by RES:
- 23 to 28 billion € invested for transmission projects of European significance should be completed in the coming 5-year period;

- The main technology remains 400kV AC OHL but other technical solutions are being implemented in specific situations: DC links, underground cables, subsea cables, etc.

About the technical analysis and criteria:

- Systematically when planning, TSOs must perform complex network and engineering studies to ensure the infrastructure can still be operated reliably;
- The dynamics and possibly new interactions between system components in the future must be scrutinised so as to anticipate appropriate mitigation measures.

About prioritisation criteria:

- Cost-benefit analysis with respect to social welfare must be performed for every transmission project, but possibly using different metric from one country to another based on the regulatory regime and the national/regional requirements;
- Large scale market studies are required for a consistent assessment of investment needs and provide basic inputs to project evaluations;
- Common evaluation criteria for projects of European importance will be part of future grid codes and consulted with stakeholders.

About requirements for a widespread usage of new technologies:

- TSOs strive to make the best use of existing assets implementing technologies such as FACTS, PST, HTLS in order to achieve an efficient grid development, or as an interim measure where grid extension cannot be realised in a timely manner;
- When grid extension is needed, proven new technologies are widely resorted to fulfil transmission tasks;
- TSOs also do anticipate future challenges with live-testing of promising new technologies through pilot projects.

About system studies and longer run prospective:

- Building on several study projects, a qualitative long-run vision should be sketched, with an ever increased role of the transmission grid, especially to give EU consumers reliable access to RES;
- Coming investment projects support such a perspective.
- Efficient and swift development of offshore grids requires shared technical standards and a consistent harmonised regulatory framework for investors.

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# 9 Issue 8- Power Grid Issues (Golder)

## 9.1 Introduction

In general, our review suggests that this issue is considered to be one of the most **serious obstacles** to the growth of RES installations by the majority of the stakeholders. This is mainly caused by **long lead times for grid connection** and consequently significant delays in the operation of RES plants. This can be a source of discourage for developers to invest in RES plants. Furthermore, our interviews highlighted that there may still be frequent denials of grid connection, for many concurrent factors, such as: lack of connection capacity, discriminatory and absence of transparent rules on cost sharing and bearing of grid connection and TSOs and DSOs that tend to act in their own interests. Two possible policy solutions in order to eliminate or reduce the obstacles could be (i) the establishment of clear and strong regulations, and (ii) an efficient system of sanctions to Transmission System Operators (TSOs) and Distribution System Operators (DSOs).

### 9.1.1 General description of the issue and literature

The current issue concerns the problems of grid connection and grid access, that may impede renewable energy growth in EU Member States. The grid infrastructure was mainly built when the electricity sector was publicly owned and has been designed to allow large power plants being situated near mines and rivers, or near the main centres of consumption. Renewable electricity generation is normally not situated in the same places as conventional electricity production and has, in general, a different scale of generation (except for a few cases of biomass and wind power plants).

RES plants face particular problems concerning grid issues as compared to conventional power plants due to the characteristics of some RES plants including for example the intermittency of power output (Wind, PV), smaller plant sizes or decentralized character.

About these issues, the main European legislation is constituted by:

- Directive 2003/54/EC, that lays down the framework for the integration into the grid of electricity from renewable energy sources;
- Directive 2009/28/EC, concerning the promotion of the use of energy from renewable sources.

In the Directive 2009/28/EC specific requirements for these issues are explained in the Articles 16 (2 to 8).

*Relevant stakeholders*

Power grid barriers can have a negative impact on project developers, project financers and producers of RES technologies. Accountable are policy makers and authorities. The

TSOs and DSOs are accountable of power grid barriers and in a few cases they are also affected by these barriers.

*Overview of (ranked) barriers*

In Issue 7 “Infrastructure development” problems about grid expansions and grid planning are explained. Specific problems about grid connection and grid access are described in this issue. Regarding this issue, the following barriers have been detected:

*Barrier 8.1 – Problems concerning grid connection*

Regarding this barrier the two main identified problems are:

- Priority or guaranteed grid connection is not ensured by law;
- Long average lead times for grid connections (considering also approval).

*Barrier 8.2 – Problems concerning grid access*

Regarding this barrier, the main identified problem is that priority or guaranteed grid access is not ensured by law for RES.

*Barrier 8.3 – Problems concerning TSOs and DSOs*

Regarding this barrier, the two main identified problems are:

- Lack of mechanisms that require TSOs and DSOs to provide (economically reasonable) solutions to the problems that led to the denial of grid connection;
- Lack of objective, transparent and non-discriminatory criteria of the rules on cost sharing and bearing of grid connection.

*Possible (historical) reasons for these barriers*

Some historical reasons for this issue are explained in the general description. A few other reasons that could be considered:

- Insufficient legal provisions and regulations not favouring RES;
- Resistance by TSOs and DSOs;
- Insufficient or not suitable grid infrastructure that can only be improved with huge (financial) efforts;
- Lack of harmonisation resulting in procedures.

## 9.2 Overview of main findings and barriers

The national studies within this project showed that there is a general obstruction that is connected to Issue 7 and to all barriers of this issue, i.e. the lack of connection capacity.

The grid frequently lacks adequate capacity to collect the electricity generated by RES. This is one of the main barriers concerning grid connection, leading particularly to long grid connection times. The majority of the national regulations set the obligation, in charge of the DSOs, to expand the grid to meet the applicants’ connection requests. According to the country reports, actually the grid is expanded only when the expansion is **economically reasonable**, thus hindering the development of RES plants (especially for small size plants).

Real examples of this barrier were identified in the region of *Bretagne,* in the regions of South-East of France, in the regions of Southern Italy, in *Bavaria* (Germany). Particularly, the lack of connection capacity is blocking the further development of wind projects in some regions of France: according to the stakeholders, urgent grid expansion works are required to overcome this situation. Still, stakeholders also highlighted that for the time being grid reinforcement is only done in a punctual and selective way; thus, not addressing the nationwide problem in this regard in a comprehensive way.

In Italy, priority power dispatch is granted to renewable energy according to the national electricity authorities (AEEG) decisions No. 168/03, 111/06 and 330/07. Despite the existing rules and regulations, in many cases priority power dispatch is not provided for, especially for large wind farms dispatching in high voltage. This generally happens when the production of intermittent green electricity (especially wind electricity) overcomes the capacity of the grid, thus hindering its security.

### 9.2.1 Barrier 8.1 - Problems concerning grid connection

In general, the RES industry evaluates the conditions for the connection to the grid as one of the main barriers to the growth of RES plants. The barrier[10] ("Problems concerning grid connection") is perceived as relevant in quite a few a countries, as reported in Table 9.1.

Table 9.1 Presence of problems concerning grid connection

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Austria, Bulgaria, Denmark, Estonia, Finland, Greece, Netherlands, Portugal, Sweden and the United Kingdom |
| Negative (barrier is present) | Belgium, Cyprus, Czech Republic, France, Germany, Hungary, Ireland, Latvia, Lithuania, Poland, Romania, Slovenia and Spain |
| Not available | Luxembourg , Malta and Slovakia |

One of the main problems perceived in EU Member States is the long average lead time for grid connection. Getting the approval and construction of grid connection lead time is very long. This happens also because construction time of new electric stations and new power lines is long and may be linked to the following aspects or problems:

The various barrier aspects are reported below:

*The administrative procedure for approval of grid connection is complicated and long*
The national or local authority or body, which is responsible of authorization of grid connection, imposes a complicated procedure that has to be followed in order to obtain the connection certificate. In addition, this procedure also must be approved by the grid operator. It takes a lot of time and money to acquire a connection approval. This barrier is

[10] Some barriers concerning grid connection which are particularly related to TSOs and DSOs are explained in the Barrier 8.3: "Problems concerning TSOs and DSOs".

perceived as relevant in some countries (Poland, Spain, Romania, Slovenia, Belgium, Latvia, Lithuania). Possible solution: the whole administrative procedure for grid connection needs to be simplified and streamlined, in particular for the connection of small RES plants to medium-low voltage power lines.

*There are too many technical requirements by TSOs and DSOs*

This is a barrier particularly for small installations. It's perceived as relevant in a few countries (Germany, Spain, Hungary, France and Italy).

*Delays by TSOs and DSOs*

There are several cases of unjustified delays when these projects need to be verified and approved by the TSOs and DSOs. This barrier is perceived as relevant in a few countries (France, Czech Republic, Italy, Poland and Spain). In Spain, the approval processes may become sensibly slower when the DSO is a small independent company.

*Insufficient transparency during the grid connection process*

In our opinion this is a serious barrier, especially for small projects. This barrier is perceived as relevant in few countries (Spain, Germany, Poland and Slovenia). Procedures and requirements are mainly internal and based on discretionary regulations, which are set up by the grid operators themselves. It is not clear how this problem could be resolved.

### 9.2.2 Barrier 8.2 - Problems concerning grid access

In general, grid access is considered as a strong barrier to renewable energy growth in many countries as reported in Table 9.2 ("*Problems concerning grid access?*"):

Table 9.2 Presence of problems concerning grid access

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Denmark, Germany, Greece, Hungary, Ireland, Poland |
| Negative (barrier is present) | Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Italy, Latvia, Lithuania, Netherlands, Portugal, Romania, Slovenia, Spain , Sweden and the United Kingdom |
| Not available and/or applicable | Cyprus, Luxembourg, Malta and Slovakia |

The various barrier aspects for the Member States are reported below:

*No priority grid access for electricity by RES*

Legislation might provide guaranteed and equitable grid access for all forms of electricity generation, being RES generated or conventionally produced electricity (coal, gas and/or nuclear). This satisfies only the minimum requirements of Article 16.2(b) of Directive 2009/28/EC, which demands for a guaranteed or priority access of RES to the grid. Stakeholders highlighted this situation as a limiting factor for the further development

and diffusion of RES. This barrier is perceived as relevant for half of the countries (**Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Latvia, The Netherlands, Portugal, Romania, Slovenia, Sweden, United Kingdom**).
Clear and strong regulations could be a solution to guarantee priority grid access. As can be seen in the paragraph "Best Practice", German regulations have solved most problems concerning grid access.

*Problems concerning curtailment of RES installations in case of grid overcharge*
Under this regime, for reasons of security, electricity generating installations are disconnected from the grid for a temporary period of time to relief the grid from the overcharge. This barrier is perceived as relevant in few countries (France, Italy, Belgium, Latvia, and Lithuania). In **France** stakeholders believe that RES installations are often disconnected before any other conventional installation.
In **Italy** tariffs of compensation attributable to the curtailment are unsatisfactory**.** With the incentive system called Green Certificates (*Certificati Verdi*) in Italy RES producers obtain two types of income: one related to the price of sale of electricity introduced into the grid and one related to the economic value of the certificates. When RES producers are obliged to turn off their plants, these two incomes are compensated in different ways. Related to electricity not introduced into the grid the tariffs of compensation have been updated in 2010 and are good according to the stakeholder's opinions. Related to the income of Green Certificates not earned, the system allows RES producers to obtain Green Certificates for 15 year plus the plant's time off. Again, clear and strong rules are a solution to reduce the danger of unjust curtailment of RES installations. As can be seen in the paragraph "Best Practice", German regulations have solved most problems concerning curtailment of RES installations. Apart from German regulations the following steps may be taken in order to reduce this barrier:

- Use of technical solutions: technical solutions such as temperature monitoring, and use of high temperature conductors would help to increase the capacity of the grid. They would mean that in cold days, for instance, considerably more electricity could be transported through the networks than on hot days. These measures have been tested in Germany on regional level so far. They should be expanded to cover the national German grid.
- Development of good forecast systems would also help preventing curtailment.
- Introduction of incentives: Another option would be the development of new subsidy schemes or the modification of the existing Feed-in-tariff. The new regulations could reward RES installations that guarantee a predetermined amount of electricity. Operators of RES plants would promise to deliver a certain range of electricity for a significantly higher tariff. However, if they fail to deliver this range, the tariff would be significantly reduced. Such a support scheme would create an incentive to invest more in energy storage technologies or in smart grid technologies.

Other than these barriers there is a characteristic barrier for **Spain** concerning grid access: The decision to include geothermal power systems in the group of technologies "non dispatchable". In Spain some stakeholders suggest that the law RD661/07 should be amended. This law in its Annex XI defines a number of RES technologies as "non dispatchable". In the text, RES technologies are generally said to be non dispatchable if:

- their primary energy source is not controllable or storable;
- the associated electricity generation systems do not allow for system operator managed production control without renouncing to the available primary energy source, i.e. wasting wind or solar resource.

As a matter of fact, geothermal energy is wrongly included within technologies "non dispatchable", and this constitutes both a mistake and a severe barrier against the development of this technology, as it creates in TSOs and DSOs a false perception of the possibility of geothermal electricity production.

### 9.2.3 Barrier 8.3 - Problems concerning TSOs and DSOs

RES producers suggest that are some problems concerning TSOs and DSOs and this could be one of the main barriers to the growth of RES installations. Our consultation reveals its presence in most countries (*"Problems concerning TSOs and DSOs")*, as reported in Table 9.3*:*

Table 9.3 Presence of problems concerning TSOs and DSOs

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Denmark, Finland, Germany, Ireland, and Sweden |
| Negative (barrier is present) | Austria, Belgium, Bulgaria, Czech Republic, Estonia, France, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the United Kingdom |
| Partly | Bulgaria, France and Spain |
| Not available and/or applicable | Cyprus and Luxembourg |
| | |

The various barrier aspects for the Member States are reported below:

*Denials of grid connection*

Our review revealed that there are cases of denials of grid connection, also in late stages of projects, stating the number of grid connection applications exceeded the maximum amount. In these situations, the grid operators are asked to fortify the grid, however in most cases the reaction is rather passive. In some countries there are also official regulations that state the grid operators have to confer grid connection to RES plants. In reality, it takes long until offers of grid connection are given and the transportation contracts (if given) are not commercially attractive. This sub-barrier is perceived as relevant in various countries, as reported in Table 9.4 (*"Is the denial of grid connection by TSOs and DSOs a common problem, constituting an important barrier for RES development?*").

Table 9.4 Is the denial of grid connection by TSOs and DSOs a common problem, constituting an important barrier for RES development?

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Austria, Cyprus, Denmark, Estonia, Finland, Germany, Hungary, Ireland , Italy, Latvia, Lithuania, Slovenia and Sweden |
| Negative (barrier is | Belgium, Czech Republic, Greece, Malta, Netherlands, Poland, Portugal, Romania, |

| | |
|---|---|
| present) | Slovakia and the UK |
| Partially | Bulgaria and France and Spain |
| Not available and/or applicable | Luxembourg |
| | |

In Poland connection terms are not issued for any new applications, and examination of applications filed in historical periods is often suspended or delayed. According to Polish legislation the investor applies for connection terms and conditions to the DSO operating in his area. The DSO issues its decision about determination of connection terms and conditions or refusal to determine them. Issuing the connection terms and conditions means that the capacity is reserved for the investor for the period of two years (i.e. for the term of validity of the grid connection terms). Up to now the connection terms are issued free of charge. The investor incurred the costs of drafting the respective application. The connection fee was only due after the actual connection takes place. During the recent years this situation resulted in an actual blockage of the connection potential by prospective investors whose total installed capacity for the declared investments exceeded 11 GW. On 8 January 2010 a new amendment of Energy Law came into force. As a consequence, a portion of the connection capacity should be freed up in the following year. However the new amendment can bring a new barrier as **introduction of advance fees** may constitute a significant barrier for smaller investors.

**Possible solution:** It could be useful to introduce an efficient system of sanctions to TSOs and DSOs to reduce this barrier. A rule that obliges DSOs to pay the damages has been implemented in Germany, for instance.

*Rules on cost sharing and bearing of grid connection are discriminatory and not transparent*

Costs imposed by the operator may vary on a case by case basis without clear and transparent rules. Some improvements are also noted as needed by stakeholders, aimed at a more equal and transparent treatment of all RES promoters. This barrier is perceived as relevant in some countries, as reported in Table 9.5 ( "*Are the rules on cost sharing and bearing of grid connection objective, transparent and non-discriminatory*?"):

Table 9.5 Are the rules on cost sharing and bearing of grid connection objective, transparent and non-discriminatory?

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Netherlands and Slovakia |
| Negative (barrier is present) | Belgium, Bulgaria, Latvia, Lithuania, Poland, Portugal, Romania, Slovenia and Spain |
| Partially | Austria, France, Germany , Sweden and the United Kingdom |
| Not available and/or applicable | Luxembourg , Malta |
| | |

In **Poland** the Energy Law (Article 7) gives ambiguous guidance on the cost of connecting to the grid. As a result the costs imposed to similar RES units of the same

technology can differ even up to twofold of the cost as per MW units. Several cases have been taken to court relating to this barrier. Further, in **Spain** RES operators wishing to connect to the distribution network in Spain have to pay for all the connection costs, including the eventual upstream network reinforcements ("deep" connection charges). On the other hand, network charges are not applied to them for the later utilization of the distribution infrastructure. This means that RES operators have initially to pay a large amount of money but that later they are not incentivized to make an efficient utilization of the resource.

**Possible solutions:** Clear rules on cost sharing and bearing should be established, with only the costs directly linked to the connection of the renewable energy system to be paid by the plant operator. All works on the electricity infrastructure should be taken over by the grid operator, that may then in a further step pass the costs on to all grid users. The establishment of law that defines maximum costs of grid connection on the basis of plant size is generally perceived as a way forward.

*Monopolistic regime*

Some argue that the energy system **is still highly centralized and monopolized.** This barrier is perceived as relevant in few countries (Latvia, Lithuania and Romania). The renewable energy developers have to face a **monopolistic regime** whilst the energy market is slowly ongoing a liberalization program. The grid operators' interest in grid development for RES plants is perceived by the interviewees as limited**.**

*DSOs tend to make own interests and to favour few companies.*

DSOs could prefer their own interests in investing in the infrastructure. Furthermore it was reported that some DSOs tend to favour the connection of RES systems operated by companies that belong to the same industrial group. This sub-barrier is perceived as relevant in few countries (Estonia, Czech Republic, Spain, Romania, Hungary, Latvia, and Lithuania).

In Spain it must be noted that "small" DSOs with less than 100.000 customers are allowed to directly own RES generation capacity, and that there have been reports of difficulties in accessing the networks of some of these small operators.

Given the large number of small DSOs (for example in Spain over 300), it could be useful to proceed to **full ownership unbundling** for both large and small DSOs, following the example of the Netherlands that will implement this kind of regulation in early 2011. Other countries such as Denmark and United Kingdom are supportive of this solution.

*Conditions and requirements for connection can be quite different between DSOs*

One of the problems is that there is no uniformity between DSOs. This sub-barrier is perceived as relevant in few countries (Austria, Belgium, and Slovenia). In **Austria** grid operators ask for different requirements for the connection of photovoltaic systems and for the installation of metering points.

*Inflexibility of the existing grid connection procedure of grid operators*

This sub-barrier is perceived as relevant barrier in **France**. Stakeholders outlined that the current system was predetermined by the grid operators without taking into account that the **various RES technologies have different prerequisites** and problems regarding the

connection. In consequence, the procedure does not provide for any flexibility, but is to be applied in the same way on all RES technologies.

*Other barriers*

Finally, the RES producers think that are other problems concerning "Power grid issue", particularly the speculation and no transparency of the choice (by TSO or DSOs) of the exact location of connection point. This barrier is perceived as relevant in some countries, as reported in Table 9.6:

Table 9.6 Presence of other barriers concerning "power grid issue"

| | EU 27 countries |
|---|---|
| Positive (barrier not present) | Austria, Belgium, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland , Netherlands, Romania, Slovenia, Spain, Sweden and the UK |
| Negative (barrier is present) | Bulgaria, Czech Republic, Germany, Italy, Latvia, Lithuania, Poland and Portugal |
| Not available and/or applicable | Cyprus, Luxembourg and Malta |
| | |

*Speculation*

A high number of connection requests of RES plants are submitted for the mere purpose of selling the connection's authorization after it has been issued. The projects with an approved authorization of connection are sold at a price significantly higher than the project's original value. This barrier is perceived as relevant in a few countries (Latvia**,** Lithuania, Italy, Portugal, Czech Republic and Bulgaria).

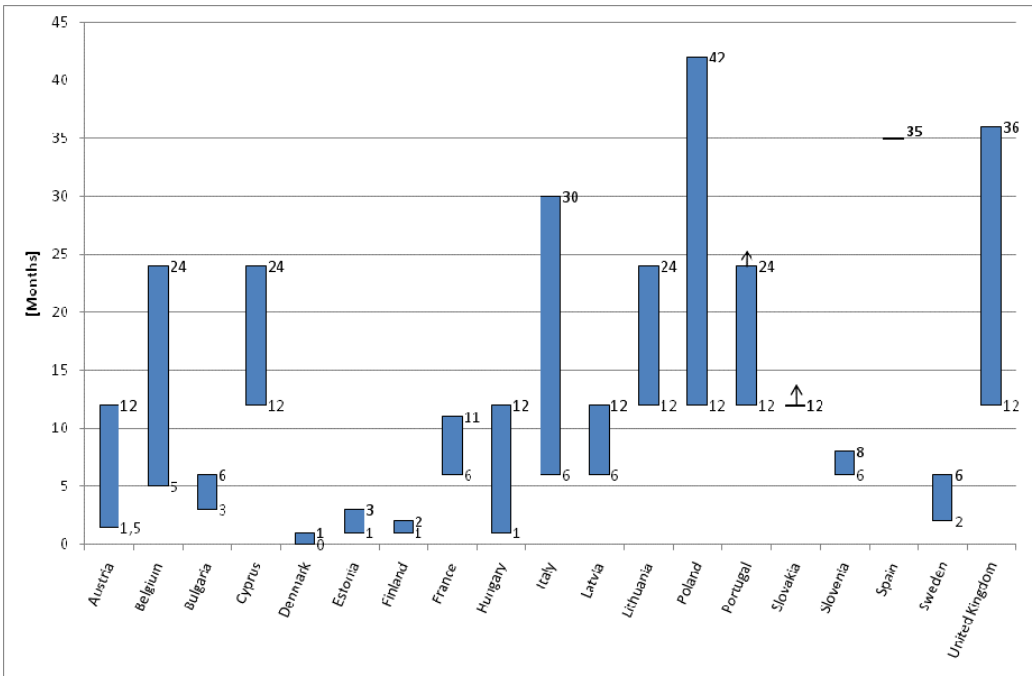
*The choice (by TSO or DSOs) of the exact location of connection point to which a RES producer must connect is not transparent*

The exact location of the connection point influences the sharing of costs of power lines. Often the plant operator bears the costs of connecting the plant to the most nearby located point of the grid (connection point). The grid operator often bears the costs for the development of the grid. So the exact location of connection point has been object of controversy between plant operator and grid operator. In fact often the term "connection point" is defined in ambiguous way. The grid operator is not obliged to justify the choice of the exact location of connection point. This barrier is perceived as relevant in a few countries (Germany, Italy and Poland).

## 9.3 Benchmarking and quantitative aspects

The results of the interviews concerning the lead time for getting grid connection (including also grid connection approval) are exposed in Figure 9.1. This figure does not consider the different RES technologies but it's useful to give an overall order of magnitude.

Figure 9.1 Number of months for getting grid connection (considering also approval of grid connection)




These data are not a result of statistical work, but they are actual lead times for grid connection collected from the stakeholders. Notably, in some countries the (average) actual lead times may exceed 12 months.

## 9.4 Best practice elements and recommendations

### 9.4.1 Examples of best and worse practice.

Consulting national reports and stakeholders the conditions for the access to the grid in **Germany** is perceived as **best practice**. In Germany, the access of electricity from RES into the grid has been constantly developed and improved during the last years. As a result, the current regulations, mainly the Renewable Energy Sources Act (*Erneuerbare Energien Gesetz*) have solved most of the problematic points with regard to the access of RES into the grid.

Priority grid access is guaranteed through clear and strong regulations: favourable rules for the access to the grid are one of the main reasons for the strong and fast expansion of RES. They provide for clear conditions and transparent costs for market players. The priority access also reduces the influence of the existing grid companies' monopoly. At the beginning of 2009 Germany overhauled the respective rules concerning also curtailment of RES installations in the Renewable Energy Sources Act.

Since these rules are still relatively new, systematic barriers in this regard have not been reported yet. The new provision:

- Regulates under which conditions the grid operator can curtail RES & CHP installations (Section 11 Renewable Energy Sources Act);

- Ensures the priority of RES and CHP installations. That means that curtailment is possible only if there is solely electricity from RES or CHP installations in the grid (Sections 2, 11 Renewable Energy Sources Act), and
- Compensates operators of RES & CHP installations in case of feed-in management (Sections 11, 12 Renewable Energy Sources Act).

Regarding examples of **worst practice**:
In **France**, stakeholders believe that RES installations are often disconnected before any other conventional installation. So, there is a serious problem concerning grid access in case of grid overcharge. In addition, in Italy a serious barrier is the speculation. A high number of connection requests of RES plants are submitted for the mere purpose of selling the connection's authorization after it has been issued. The projects with an approved authorization of connection are sold at a price significantly higher than the project's original value.

## 9.5 Recommendations

Our general recommendation is that all EU-27 countries make clear and strong regulations for the connection and the access to the grid. For example:

- The establishment of a law that defines maximum costs for grid connection on the basis of plant capacity is generally perceived as a way forward;
- The whole administrative procedure for grid connection needs to be simplified and streamlined, in particular for the connection of small RES plants to medium-low voltage power lines.

Furthermore, we suggest that it's useful to explore to introduce also an efficient system of sanctions to TSOs and DSOs in order to reduce related barriers. The solutions for specific barriers are described previously.

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# 10 Issue 9- Gas Network Issues (ECORYS)

## 10.1 Introduction

Renewable gas network issues are a matter of primary importance in the development of renewable energy sources in Europe. Upgrading raw biogas to green gas for grid injection has a large potential for carbon emissions reductions and fossil savings. With regard to this issue, a few mainly cost-related barriers can be identified:

- National support schemes frequently are discriminating in the sense that while feed-in tariffs are in place for green electricity, they are not existing for biogas or green gas (as end-products);
- In contrast to the electricity grid, the natural gas network in various EU Member States has not sufficiently been developed to provide a close connection; i.e. the distance becomes too large and too expensive for the producer to connect. Analogously to electricity, the natural gas grid capacity may be insufficient to absorb the renewable gas, in particular in summer (and/or in rural areas);
- Finally, a barrier remains in the sense that the biogas should be upgraded and compressed to meet specific natural gas standards. However, in case of gas production instead of electricity generation, the investment in a gas engine can be avoided leaving some financial flexibility with respect to the business case.

Albeit these cost-linked and technical barriers are not the objective of our study, they may conceal the appearance of non-cost obstacles.

With respect to the relationship between biogas and gas networks, the Directive 2009/28/EC states[11] that "*the costs of connecting new producers of […] gas from renewable energy sources to the […] gas grids should be objective, transparent and non-discriminatory and due account should be taken of the benefit that […] producers of gas from renewable sources bring to the […] gas grid*".

Article 16 of the same directive lists provisions with regard to the access to and operation of the grids. Furthermore, the importance of the relationships between gas networks and biogas is underlined in the Commission decision 2009/548/EC, [12] which recalls Articles 16(7), (9) and 10 of Directive 2009/28/EC for providing reporting obligations also for the template of the National Renewable Energy Action Plans.

[11] Directive 2009/28/EC preamble, point 62.

[12] Commission Decision of 30 June 2009 establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC of the European Parliament and of the Council.

## 10.2 Overview of main findings and barriers

*Biogas production and upgrading*

Biogas may be produced starting from different materials (e.g. organic waste, biomass, energy crops, etc.) and the process may yield products with different technical characteristics. These products, in order to be come compatible with natural gas and hence to be injected in the network, need to undergo an upgrading and pressurisation process, which will make their characteristics aligned. Jensen (Jensen 2000/Polman), for instance, provides an average indication of natural gas characteristics and compares them with a sample biogas (the assumed composition is $CH_4$=65% and $CO_2$=35%).

The upgrading process, and the subsequent transport and insertion of the gas in the natural gas network may be costly. Furthermore, often support schemes are directed toward renewable electricity production rather than to green gas production (as an end-product). A transparent system of transferable certificates for green gas does not always exist.

Given this, biogas producers may be encouraged to make use of their biogas in a different way, i.e. local and private use (e.g. in engines with a relatively low efficiency and no heat usage), rather than processing it and injecting it in the network. Various biogas projects producing electricity make a loss, even though feed-in tariffs for renewable electricity are provided. [13]

*Lack of information and bureaucracy*

Further, the quality of information on the procedure to follow for injecting processed biogas into the network may pose a barrier, as also becomes evident in Issues 1 and 5. Such would be the situation in case information is not easily accessible, in the most evident hypothesis, but also in situations in which available information is partial, outdated or contradictive between sources.

Effects, in any case, again would be that biogas producers would not receive an incentive in undergoing the bureaucratic process, as they would be challenged with possible uncertainty of information in the first place.

This situation may be due to a number of factors, primarily the efficiency of the competent public institution and gas- or renewables- related associations. Furthermore, an underlying lack of clarity or the absence of stringent rules in regional or national legislation may be causing this situation. The barrier is revealed by among others lack of publications on technical rules on network connection and connection tariffs.

In addition to the potential transparency lack of legislation, authorisation procedures can be largely time-consuming. This situation is additional to the one assessed in the previous paragraph and concurs in posing a disincentive to producers to upgrade and inject their biogas in the network. The potentially large amount of time required by such procedures may, in fact, pose a threat to producers as regards seeing quick returns on their investment

[13] http://www.agriholland.nl/ , for instance.

to connect to the network. Bureaucracy is linked to several factors: inefficient procedures, inefficient internal organisation, and lack of knowledge on the subject by public servants, etc. Moreover, legal lack of clarity or missing legal coverage of the issue may result being other underlying causes.

*Infrastructure and access*

Finally, given the different characteristics of biogas with respect to natural gas, and notwithstanding the upgrading process undergone, network operators may still deny access on a technical basis. Access can only be granted by the operators and, perhaps also thanks to a loose legislative framework that allows it, without their consensus biogas producers cannot enter the transmission or the distribution network.

Technical reasons are quoted as being the main issue from which this barrier stems; however, it should be considered that the amount of biogas injected in the network would be very little and therefore it would be impossible that its impact would be in any way noticeable. Deeper reasons may be found in the lack of a direct return for network owners when opening to biogas, and also their potential willingness to limit the amount of actors on their network.

This may be expressed by e.g. lack of governmental assessment of extended gas network infrastructure needs to integrate biogas and/or discriminating tariffs for transmission and distribution.

*Technology status*

Biogas technology is a rather new and yet uncommon technology in Europe. Information on this technology has been collected for several countries and it appears that the application of biogas varies largely between different countries in terms of implementation and advancement. It is believed that this large variability is due to the relative novelty represented by this technology and in particular by the possibility of injecting biogas in the network. For this reason, most countries that are in the beginning of the implementation phase, are still trying to deal with a new issue and it appears that a harmonised approach to the matter is absent.

In general, biogas technology *per se* is present in all countries for which information is available, with the exception of Cyprus, Malta and Greece. As for the countries that apply this technology, some of them present a solid presence of biogas, whereas other ones are still in the beginning of the implementation phase with a small number of running projects. The former group of countries consists of Austria, Belgium, Czech Republic, Denmark, Spain, Germany, Italy and the Netherlands. Countries in the latter group include Bulgaria, Finland, Latvia, Lithuania, Poland, Portugal, Romania, Slovenia and the United Kingdom.

It is worth underlining how only some of the countries in which biogas technology is well established are undertaking biogas injection in the natural gas grid. These are, namely: Austria, Denmark, Germany and the Netherlands. In particular, only in Denmark biogas injection in the natural gas grid is taking place at a larger level. In all other countries, biogas is not injected into the grid.

Before outlining the different barriers identified for this issue, a consideration is to be made. The meaning of the results presented below varies largely depending on the technology status in a specific country. For example, lack of information is not felt as a barrier in Poland and in Denmark. This should be interpreted as a given factor for the former, as biogas injection is not taking place and thus no such barrier can exist yet. For the latter, this is a quite positive remark, as biogas injection is taking place and is not hampered by the lack of information.

The table below provides an overview of the different status of biogas technology and of biogas injection in the analysed countries.

Table 10.1 Status of the technology

| | None or Negligible | Emerging | Developing |
|---|---|---|---|
| Biogas production | CY, MT, GR | BG, LT, PL, PT, RO, SL, UK, FI, LA | AT, BE, DK, ET, DE, IT, NL |
| Biogas injection | BE, BG, FI, FR, IT, LT, PL, PT, RO, SL, UK, HU, LA, PT, ES | AT, DE, NL | DK |

### 10.2.1 Barrier 9.1 - No encouragement for upgrading

Two groups of countries can be distinguished on the grounds of this barrier, depending on their advancement in implementing RES.

Countries more advanced in RES implementation

Countries in this group are more advanced in biogas and some also operate biogas upgrading and injection in the network. It is interesting to underline how all countries in this group face very strict requirements by grid operators for injecting biogas into the network. This may be considered as an indication of how grid operators intend to limit grid access to biogas producers. This could be happening mainly for two reasons: safety concerns, meaning that upgraded biogas may still damage infrastructure or willingness to limit the number of operators on their infrastructure, possibly in order to favour certain companies. The contacted stakeholders in certain countries outlined that often access is easier for companies controlled by the grid operator or in which the grid operator itself is a shareholder. Stakeholders that shared this point of view were nationals of Austria, Denmark, Estonia, France and Germany. In France and Denmark, among others, grid operators demand very high standards of the injected gas. In the former, the injected biogas should have an oxygen content lower than 0,01% instead of 0,5%, which is the accepted standard in Europe. In the latter, natural gas extracted from the North Sea is of superior quality, thus automatically increasing the requirements for the injected biogas.

Countries less advanced in RES implementation

Biogas is perceived as a relatively new technology by a number of stakeholders in a set of countries that are not yet developing biogas injection in the natural gas network, thus, a barrier related to gas upgrading is not yet present as it may possibly take place only after

injection starts to be considered. This is the case for Hungary, Latvia, Poland, Portugal, Romania, and Slovenia.

As aforementioned, it is also worth underlining how a cost barrier appears to be able to create an ex-ante block for the evaluation of barriers related to gas upgrading. This is the case for the Netherlands and for Italy. For the latter, in particular it appears that there are no incentives for biogas injection but only for electricity generation through biogas.

### 10.2.2 Barrier 9.2 - Lack of information and bureaucracy

According to the collected information, several contacted stakeholders in Austria, Bulgaria and Lithuania believe that the lack of relevant information is quite a strong barrier. In Bulgaria, for example, information on biogas is available, however not on biogas injection. This lack of information is particularly surprising and relevant for Austria, which is one of the few countries where biogas injection is taking place. To a lower level, stakeholders in Belgium, Germany and the United Kingdom share the same opinion, either actually, for Germany, where little or no information on grid conditions is available, or prospectively for Belgium and the United Kingdom.

Conversely, there is also a number of countries for which stakeholders do not believe that the situation creates particular obstacles, such as Czech Republic, Denmark, Estonia, France, Italy, Poland and Hungary.

Given this distribution of the barrier in the different countries, and considering their different state of advancement in the technology, it is not possible to identify a pattern or an underlying reason for this situation. The difference in the status of advancement for this technology should also be taken into consideration as the lack of information in a country where biogas injection is not taking place bears a largely different meaning than in a country that already implements this technology.

Results show that authorisation procedures are perceived as a barrier mainly for two reasons. Firstly because they provide for cost sharing regulations between grid and plant owners that make connection unattractive and secondly as the procedures are quite lengthy and time-consuming. Both aspects are valid for contacted stakeholders in Germany and the United Kingdom, where an authorisation procedure can take up to 18 months. In Austria, stakeholders see authorisation procedures as a barrier only in terms of cost sharing.

On the other hand, authorisation procedures are not considered to hamper the development of biogas connection to the network by a large number of countries, that is: Czech Republic, Denmark, Estonia, Italy, the Netherlands and Hungary. Results for Belgium and Poland also show that this barrier is not considered relevant, however only because the technology is not yet sufficiently develop for this barrier to take place.

### 10.2.3 Barrier 9.3 - Lack of incentives for infrastructure owners to open to biogas

Grid operators are seen as cooperative only in the Netherlands, where stakeholders agree that this does not constitute an issue. In all other countries for which information is available, the perceptions of the contacted stakeholders show that grid operators appear to oppose grid access in different ways. Specifically, difficulties may arise if the grid operators are not involved in the project requesting access (Austria), if the project is not operated by the natural gas suppliers (Denmark, Germany) or because incentives are insufficient (Italy, United Kingdom). In Belgium, Estonia and France the underlying reason for non-cooperation is not indicated and there is no information available for Bulgaria, Lithuania and the remaining countries. For Poland, it is explicitly stated that this is not considered a barrier yet as this technology is still considered new.
From this overview, it appears that the general opinion arising form our interviews and research is that grid operators are not keen on allowing access to biogas producers. Reasons may be different and it is likely that underlying, unstated reasons exist, however the general outcome remains, in the sense that this is an important barrier for the development of biogas and biogas technology.

*Other barriers*

Given the relative novelty of this application of biogas technology, the legislative base of several countries still does not cover this issue, resulting in a lack of legislation or just in partial coverage. Interviewed stakeholders from Austria, Bulgaria, Lithuania, Poland and the United Kingdom perceive this barrier as particularly relevant. An example includes the **absence of legislation** for infrastructural networks specifically dedicated to biogas and/or green gas. Another example is the **subsidy eligibility** in case of various biogas producers on one hand, and a central collection and pressurization unit on the other hand.

Denmark, Germany and Italy also suffer from this phenomenon, however this barrier is considered somewhat weaker than for the aforementioned countries. Stakeholders in the remaining countries have made no mention of this issue.

## 10.3 Benchmarking and quantitative aspects

The status of the collected information and specifically the different advancement in the analysed countries with respect to this technology does not allow for a valuable quantitative analysis of the issue. This, or course, by itself is an indicator telling that the injection of green gas is an emerging technology.

*Best practice elements*

The Netherlands appear to be exceptionally well placed among all considered countries. Gas injection is still in development and as of now only some small-scale projects (mostly landfill, but also some co-digestion facilities are under construction) are in place, however the technology is rapidly developing to reach a larger scale. Of the four assessed barriers, none seems to pose a major threat to the development of biogas in the Netherlands. Financial barriers are present as regards gas upgrading and grid operators appear to seek marketing advantages in cooperating with biogas producers, however none of these is to be considered a major barrier.

It is worth mentioning how the Netherlands has established a green certificate system for the gas grid, which works in similar terms to the one in place for electricity. In addition, this system allows localising and identifying from what plant the biogas originates.

*Novelties*

In addition, several projects are being developed connecting various spatially separated biogas producers (farmers, food residue companies, digestion of household waste, sewage facilities, etc.) to a 20-30 km long central **biogas ring**. The aim is to first collect the biogas, then upgrade and inject it at a single spot thus benefiting from economies of scale with regard to (relatively expensive) equipment for upgrading biogas to natural gas quality. Currently the Dutch SDE subsidy regulation for green gas is being adapted to have these kinds of projects being eligible.

## 10.4 Recommendations

In summary, prior to mitigating non-cost barriers, for most countries the preferential subsidy tariff for green electricity as compared to green gas should be removed, either by the introduction of direct and equivalent subsidies for green gas as end-product, or by the implementation of a system of transferable green certificates.

Legislation with regard to access, grid codes, shared infrastructure etcetera for dedicated biogas networks is missing and should be developed for almost every Member State.

A further development could be encouraged by the dissemination of various best practise projects as observed in Austria, Germany, Denmark and the Netherlands.

## 10.5 Literature and sources

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Overview of centralized biogas plants projects in France - Will the new economic incentives overcome the non technical barriers? Christian Couturier (2007).

Biogas and natural gas fuel mixture for the future, Jan K. Jensen, Anker B. Jensen (Sevilla, 2000).

Adding gas from biomass to the gas grid (E. Polman et al, Contract No: XVII/4.1030/Z/99-412).

# 11 Issue 10- District Heating (eclareon)

District heating is defined as in article 1(g) of the "Renewables Directive" 28/2009/EC. The policies for renewables in district heating have been analysed keeping into account in particular the articles 13(3), 13(4), 13(5) and 16(11) of the same Directive.

Related to DHC, there are in principle two strategies of supporting the goals of the Renewables Directive:

1. Increasing the share of renewables in existing DHC systems (Barrier 10.1 below)
2. Facilitating the initiation and expansion of DH systems (Barrier 10.2)

The findings of the research are structured along these two strategies. Their relative importance varies strongly according to the specific conditions in each country, as discussed in the introduction.

## 11.1 Introduction

From the point of view of the Renewables Directive, district heating and cooling (DHC) is not a goal as such, but a mean to increase the share of renewables in the heating and cooling market.
However, the importance of DHC is substantially increased by the fact that DHC is an ideal channel for the use of heat from combined heat and power (CHP). The promotion of CHP is a goal of the EU, covered by an own Directive. Therefore, initiating and expanding DHC systems is an action that can promote several energy policy goals at once, particularly if the DHC systems are largely based on renewables.

The **share of the total demand for heating currently covered by DHC** networks varies strongly in the EU, from more than 50% in Denmark and Poland, to low shares around or below 5% in countries like the UK, France and Italy, and (close to) zero in countries like Spain, Ireland and Greece (Ecoheatcool 2006, Lutsch 2009).
Also the **share of renewables on the total heat delivered to DHC systems** varies strongly from country to country. In Sweden, it is 53%, in Denmark 33%., in Austria almost 29%, but it is only 7% in Germany and less than 5% in countries like the UK, Poland, Hungary and others.

In 2003, the share of energy supply for district heat in Europe was as following (Ecoheatcool 2006):

| | | |
|---|---|---|
| Natural gas | 40,3% | |
| Coal and coal products | 35,9% | |
| Petroleum products | 7% | Total fossil fuels: 83,1% |
| “Combustible renewables” | 7,1% | |
| Geothermal | 1,1% | |
| Solar thermal | 0,002% | Total renewables: 8,2% |
| Waste | 5,9% | |
| Nuclear | 0,3% | |
| Others | 2,4% | |

DHC networks offer exceptionally favourable conditions for the integration of RES sources. It is in general easier and cheaper to switch the energy sources used in a few large scale plants to feed a centralized DHC system, than to substitute large numbers of heating units in individual buildings or residential units. DHC networks make it possible to substantially increase the RES-H production with a relative small number of larger projects. Therefore, increasing the share of renewables in DH systems can be a very effective way to reach the targets of the Directive.

However, the data above show that the total share of renewables in the European DH networks was 8,2% in 2003, i.e. at a comparable level with the share of renewables in the heating market in general, that was circa 10% in 2005 according to PROGRESS (2008), a bit less according to other sources.

This suggests that the potential for increasing the use of renewables in existing DHC networks is substantial. However, it must be considered that, even though more than 90% of the heat delivered by European DHC networks is not strictly from renewable sources, a large part of the “non-renewable” heat in DHC networks is of high value in terms of climate protection, and of security of energy supply: mainly waste heat and/or heat from CHP.

The share of CHP in the heat supplied to DHC networks in Europe is 68,3%, varying from 100% in Poland, Netherlands, Luxembourg and the United Kingdom (the latter however with very small absolute amounts), to only 32% in France (Ecoheatcool 2006). Moreover, in some countries there is a significant share of waste process heat in DH networks, e.g. heat from industrial processes.

CHP can be fuel by fossil fuels, or by renewables (biomass and, where the resource is available, geothermal). Switching a CHP plant from fossil to combustible renewables would always be an advantage in terms of reaching the RES targets.

However, substituting fossil-based CHP with heat only renewable sources may not produce a reduction of fossil fuels consumption. In certain cases it can even be counterproductive – for instance if the fossil fuels continue to be used for electricity generation only. On the other hand, the existence of the DH network can in certain cases

determine the economic rationale for continuing the operation of high carbon-intensive processes, which might be substituted by more sustainable energy sources. Thus, a policy designed to increase the share of RES in DH systems should encourage an assessment case by case, in each DH network.

These differences show that, from the point of view of the Renewables Directive, **the priority of action concerning DH systems is very different, according to the country**:

1. In the countries with low or non existing DHC penetration, the priority will be the creation of new networks, based on renewables and/or on high efficiency CHP and waste heat;
2. In countries that already have an important DHC infrastructure, but a low share of renewables and CHP in the DH networks, the priority should be to increase these shares;
3. In countries with a very high share of CHP in DHC networks, the only way of further improving the situation is to switch from fossil-based CHP to renewables based CHP. If the biomass resource is available, this is certainly positive. However, in these countries there may be in general more promising ways to increase the penetration of renewables in the heating sector, for instance focusing on the promotion of renewable heating and cooling in those buildings that are not and cannot reasonably be connectable to DHC systems, and of course on energy efficiency measures.

*Relevant renewable energy sources*

Following renewable sources can be used to feed heat into DH systems:

- Biomass in the various forms considered by the Renewables Directive[14] ;
- Geothermal;
- Biogas;
- Solar thermal;
- Ambient heat (for district cooling).

The lion's share consists of biomass, which makes up circa 85% of the renewable energies sources fed into district heating systems in Europe (Ecoheatcool 2006). Biogas plays a minor, but increasing role, especially in Germany. If available, deep geothermal sources often play a decisive role. Solar thermal plays for the moment a very small role; though in some countries and particularly Denmark, Sweden and Germany there is a growing number of small and medium sized DH systems that cover a substantial share of their demand with solar.

[14] 'biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste;

## 11.2 Overview of main findings and barriers

### 11.2.1 Barrier 10.1 - Lack of positive conditions for the increase of the share of renewables in existing DHC systems

*Overview*

The national studies within this project showed that the large majority of the EU Member States are currently not implementing substantial proactive policies to increase the share of renewable energy in existing DHC systems.

Significant policies in this direction have been identified in the following countries: Austria, Denmark, Finland, Lithuania, Slovakia and partly in France and Germany.
In following countries this issue is considered as not relevant, due to the very limited size of DHC networks: Belgium, Greece, Ireland, Portugal and Spain. In Cyprus and Malta, there are no DHC networks.

In the other EU Member States district heating plays a more or less significant, or even dominant role in the heating market, but there currently are not policies aimed at increasing the renewable energy share in their DHC networks.

However, as discussed above, having policies in this area can be more or less important, depending on the starting point, i.e. the shares of renewables and of CHP already integrated in the DHC networks of the relative country. These shares vary very strongly, as shown by the table below (Ecoheat cool 2006).

Table 11.1 Shares of renewables and CHP share in DHC networks.

| Country | Renewable share in DHC networks | CHP share in DHC networks | Total renewable & recycled share |
|---|---|---|---|
| Austria | 29% | 65% | 87% |
| Belgium | 8% | 99% | 100% |
| Bulgaria | 0% | 78% | 78% |
| Czech Republic | 4% | 76% | 77% |
| Denmark | 33% | 81% | 96% |
| Estonia | 12% | 40% | 52% |
| Finland | 23% | 76% | 83% |
| France | 22% | 32% | 56% |
| Germany | 7% | 81% | 85% |
| Hungary | 1% | 69% | 69% |
| Italy | 16% | 64% | 77% |
| Latvia | 14% | 45% | 59% |
| Lithuania | 9% | 52% | 59% |
| Luxembourg | 4% | 100% | 100% |
| Netherlands | 7%% | 100% | 100% |
| Portugal | 0% | 100% | 100% |
| Poland | 1% | 61% | 61% |
| Romania | 0% | 74% | 74% |
| Slovak Republic | 2% | 54% | 56% |
| Slovenia | 4% | 69% | 72% |

| Country | Renewable share in DHC networks | CHP share in DHC networks | Total renewable & recycled share |
|---|---|---|---|
| Sweden | 53% | 33% | 87% |
| UK | 3% | 100% | 100% |

Source: Ecoheatcool (2006). Note: Cyprus, Greece, Ireland, Malta, Spain are not included because they have no district heating systems (CY, MT), or their share is negligible (IRL; GR, ES).

The data in this table have been published in 2006, but are originally from 2003. More recent, equally comprehensive data have not been found. In some countries, these shares may have changed during the last years, usually for the better. In some cases, the new figures are reported in the national reports.

The last column requires an explanation. According to this statistic, produced by the European association of the district heating sector (Euroheat & Power), the "total renewable & recycled" includes renewables, all kinds of CHP and of waste heat from industrial processes, also if originated from fossil fuels. Therefore, even in the countries with 100%, there is a potential for increasing the renewable share, by substituting fossil-based CHP with renewable-based CHP. However, this is not always reasonable (see above).

Several countries (Estonia, France, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) have very large shares, between 26% and 48%, of district heat generated in fossil fuel heat-only plants. In these countries, the potential for improvement is particularly high.

The main barriers to the increase of the RES share in district heating networks are the following:

Lack of motivation of district heating operators: There is absolutely no experience with unbundling in the DHC sector. Typically, DH operators own and operate the generation, transmission and distribution facilities. They have captive customers, who have no exit option and cannot exert pressure by choosing a "green heat" provider, like in the electricity sector. Under these conditions, DHC operators are not very motivated to change their energy supply structure. In Germany, one large utility is voluntarily introducing elements of third-party access with the aim of increasing the share of solar and biomass heat in the Hamburg network, under the political pressure of the local authority threatening to take obligatory measures (e.on Hanse Wärme 2009).

According to the national report, in the Czech Republic, DHC operators are in theory obligated to accept renewable heat into the network. However, the conditions are set so strictly that this provision is not applied in practice.

While there is not yet any practical experience with unbundling or liberalization in DH networks, this development shows that unbundling and thus a kind of a feed-in regime in DHC networks might be thinkable in the future. However, the European district heating associations warns that for technical and economical reasons, unbundling would

jeopardize the economic feasibility of district heating systems, thus leading to a net loss in terms of energy efficiency (Euroheat 2010).

Distortion caused by support schemes for RES electricity and/or CHP: Biomass electricity production benefits of strong financial incentives in many EU countries, whereas biomass heat supplied to DH networks does not. This unintended distortion is increased by the fact that CHP support schemes usually provide an incentive for the amounts of electricity generated by the CHP plants. This creates a distortion because CHP plants are often operated to maximise the electricity production, instead of aiming at maximising energy efficiency and/or the environmental benefit. However, the Danish experience shows that strong support schemes for CHP can be designed in a way compatible with a good share of renewables in the DH sector.

Lack of obligation for operators: In Denmark, utilities including DHC operators are obliged to gradually increase the efficiency of their energy supply structure (Nielsen 2010). This has been one of the main drivers for the exceptional development of solar and biomass district heating in Denmark. Similar obligations are being introduced in some other countries, like France, but are not yet a standard policy instrument.

Lack of specific financial incentives: dedicated to renewable heat in district heating networks. On one hand, DHC operators usually do not face strong increases in demand and already dispose of enough capacity to meet peak demand. On the other hand, they often are not offered any incentive for this purpose. In most Member States the financial support schemes for renewable heating and cooling are limited to investments outside DHC networks.

Price regulations: in some countries, like Lithuania and the Netherlands, price regulations conceived to protect the captive customers from the monopolist prevent the DH operator to apply prices higher than the alternative, i.e. natural gas. Because the price of natural gas may fluctuate, investing in RES entail for the DH operator the risk of being forced to sell the renewable heat at a lower price than its generation costs, in case the gas costs go down.

Lack of reliable biomass supply: has been mentioned as an important barrier in many countries, among them Bulgaria, France, Czech Republic, Germany, Ireland, Latvia, Portugal and Spain. In some countries, measures are being taken in this area.

Lack of demonstration projects and of technical know-how on the integration of solar energy into DHC networks are mentioned as a key barrier for nearly all European countries (Pauschinger 2010), except for Denmark, Austria and Sweden which have already some experience in this field. Lack of information on the available resources and on the integration is a barrier also for the use of geothermal within DHC system, at least in some countries.

### 11.2.2 Barrier 10.2 - Lack of positive conditions for the initiation and expansion of DH systems largely based on renewables

The bulk of district heating systems in Europe was created after the first oil crisis, or earlier.

In the last 10-15 years, most Western European countries experienced a slight increase of heat deliveries from district hearing and a first (small) wave of district cooling systems. In some countries like Austria and Italy there has even been an important increase, mainly through new small networks, often based on biomass. In no western European countries there has been a decline in the recent past. However, most of the DHC infrastructure was created decades ago.

In most countries of the former Soviet bloc, however, there has been a significant decline of DHC, often starting from a very high share of DH in the heat market. The reasons were various, including a strong cultural trend towards individualism, the negative image of DH, often associated with energy inefficient management and low levels of comfort (impossibility for the user to control the heat input), as well as in some cases the shrinking population in areas served by district heating.

However, the wave of shrinking of the networks seems concluded. Therefore, the barriers faced in this area are becoming more homogenous all over Europe.

The creation of new DH infrastructure implies high investment costs. DH systems require a minimum connection density and heat loads to be profitable. Historically, local authorities have played a key role providing the city planning and regulatory framework, as well as the equity. In many cases DHC networks have been created and are operated by municipally owned companies.

The main barriers identified by the study that can be influenced by policy making are:

Urban planning: When new areas are planned and authorized, the preconditions for the introduction of DHC networks are not fulfilled, for one or more of the following reasons:

- The option of creating / expanding a DHC network is not considered by routine, leading to missed opportunities;
- The trend to scattered, low density settlements is endorsed, making DHC financially unsustainable;
- Failure of coordination in planning: too many decision points would need to be involved;
- Lack of long-term planning: if a large area is developed in several subsequent planning steps, only the heat demand of the first stage is considered, thus excluding the option of a DHC networks which would be reasonable in the long term

Private vs public interests: In some countries, like Denmark and Germany, local authorities have the powers to impose the connection to DHC network for all (new) buildings in certain areas.

But this is not the case in many countries. In these cases, the strong interest of individual building owners to be free to choose their heating supply prevails against a weak and diffuse interest of society to progress towards a more sustainable energy supply, which may include making good use of the DHC infrastructure, often created with public investments;

Privatisation of municipal utilities: The trend towards privatization often leads to a short term orientation focused on capital reward, which is detrimental to the development of long-term, community based investments in infrastructure such as DH networks;
Mixed effect of the EU $CO_2$ Emission Trading Scheme: the ETS system distorts competition in favour of individual heating devices that are not subject to the emission cap, while DHC heat generators with plants above 20MW are subject to the cap. On the other hand, the ETS scheme puts pressure on these very operators to reduce their emissions, encouraging them to consider, among others, investing in a higher share of renewables in their network.

Discrimination in the calculation of the Energy Performance of Buildings: It has been mentioned in some countries, like France, that the current methodology for the EPBD discriminates against buildings connected to district heating based on renewable energy sources.

Popularity of District heating: A negative image of DH systems has been signalled as a barrier both in the former socialist countries and also in Western European countries, for instance Ireland and France. This is linked to a perceived association between DHC and social housing with low comfort, but also to real-life experiences of DHC heating systems associated to bad insulation and lack of control devices in the individual residential units. Parts of the population believe to be more “independent” with an individual gas burner, though the security of energy supply from a DH system may actually be higher (redundant capacities based on different sources). Scandinavian countries demonstrate that DH can be known and popular at the same time.

A number of other barriers have been mentioned, which are not policy made, among them:

- Unsecure development of demand: In most of the EU member states long-term planning is restrained by social and technological development which may result in the reduction of the demand for DH:
  - The decline in population may lead to a generally reduced demand for heat. However, in many countries there has been a growth of single households while population decreased;
  - Also the foreseen thermotechnical refurbishment may reduce the demand for DH. This point is quite controversial because the time corridor for refurbishment is not clear yet;

## 11.3 Literature and sources

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e.on Hanse Wärme (2009): Karl-Friedrich Henke, Managing Director e.on Hanse Wärme, Abbau von Hemmnissen: Herausforderungen der Integration von Solarenergie aus der Perspektive eines Fernwärmebetreibers, presentation at the Forum Solarpraxis, Berlin 20 November 2009

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# Annex I ENTSO investments

The mid term investments needed in order to address these targets are reported in following Figure 11, Figure 12 and Figure 13 [Source: ENTSO-E].


Figure 11: Map of mid-term investment needs in the regional group Continental South West (left) and Central-South (right)

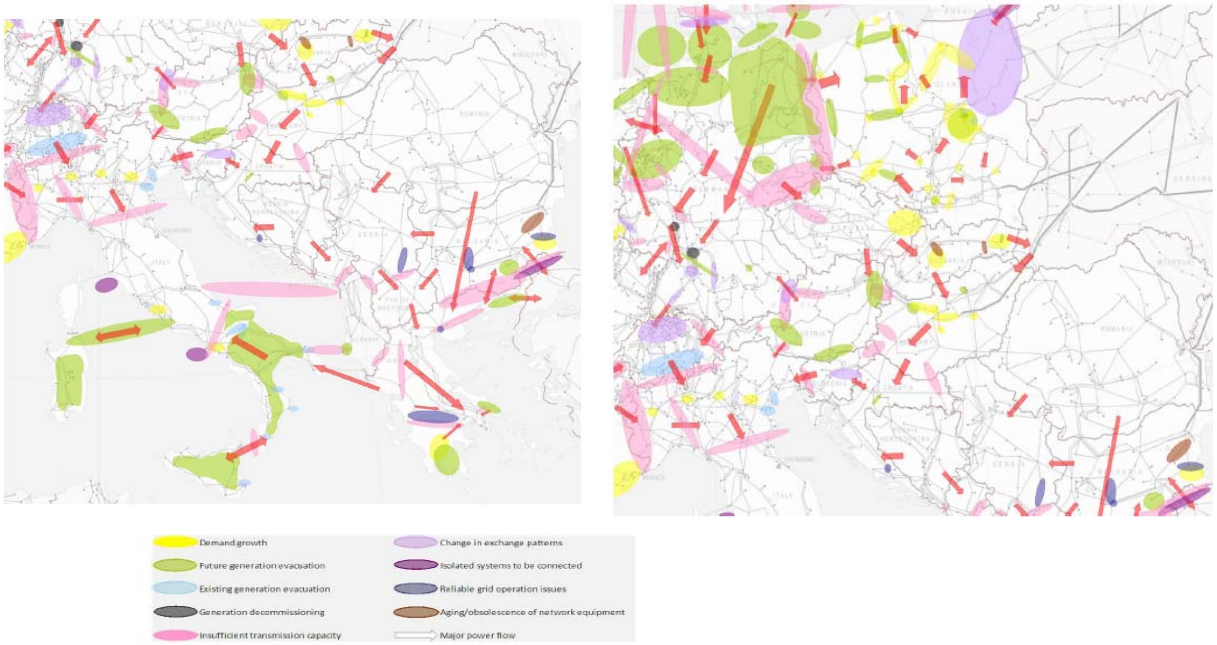



Figure 12: Map of mid-term investment needs in the regional group Continental South East (left) and Central-East (right)

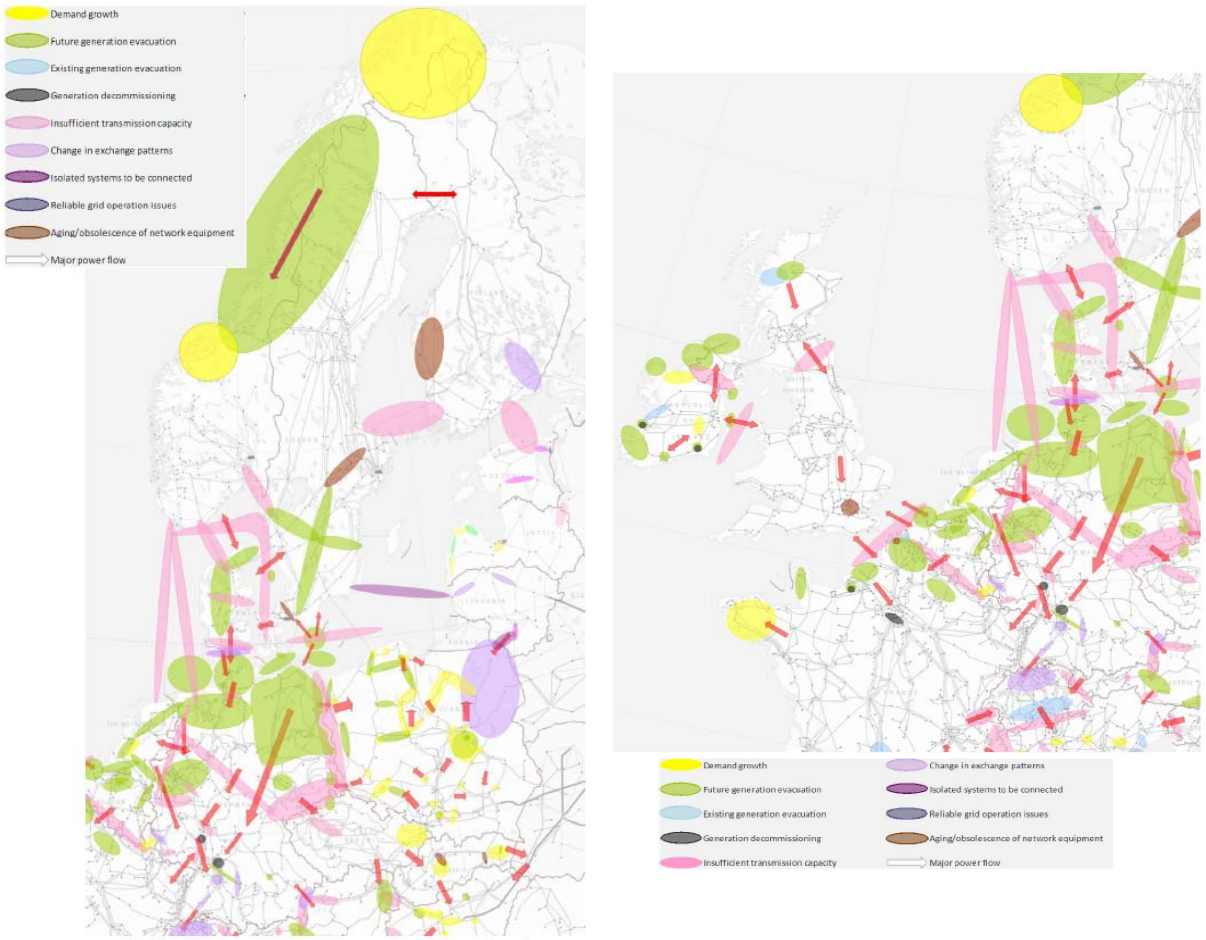



Figure 13: Map of mid-term investment needs in the regional group Baltic Sea (left) and North Sea (right)

# Annex II Member State benchmarking

The first part of this Appendix summarizes the quantitative and qualitative indicators that have been discussed in detail in the chapters above. The second part provides a tentative overall benchmarking of the countries, taking into consideration all barriers treated in this study.

**List of the indicators**

As discussed more in detail above (in general in chapter 1.2., and for each indicator in the relative chapters), this benchmarking must be taken with a pinch of salt. The main purpose of this study was to produce a list of specific barriers present in the different EU Member States, with the aim of facilitating their removal when designing and implementing the NREAPs. The research design has deliberately privileged the gathering of a wide number of real-existing problems, rather than trying to force a complex and heterogeneous reality into a rigid matrix established at European level for the purpose of benchmarking. Therefore, research and interviews were usually carried out with an open approach, i.e. first asking for the barriers perceived by the stakeholder, then asking specific questions on these barriers, and at the end asking whether some of the potential barriers identified at European level, but not yet mentioned by the interviewee, were relevant as well.
One consequence of this approach is that a large portion of the information gathered in the national reports refers to peculiar issues that cannot be compared at European level, at least not quantitatively. Moreover, it was obviously not possible to interview a statistically relevant number of stakeholders for each sector, technology, project size and country. Therefore, all the judgements based on the opinion of stakeholders may entail subjective distortions due to their personal perception. For instance, stakeholders from the most advanced (in terms of renewables) countries sometimes tend to perceive more barriers than their colleagues in less advanced countries, probably because their level of expectation and/or awareness is higher (see for instance chapter 4.1.4. or chapter 6 above).
Finally, the level of detail achieved of the national reports in the time available for this study varies strongly from country to country. The comparability of the assessment is therefore in certain cases limited.

Despite of these methodological reservations, it is useful to summarize all indicators that have been used in the study, shown as overview in the table below:

- One-stop-shopping: data stem from our AEON study. Often the procedures wary according to technology, size or region. The consortium has summarized this

information into a single judgement. Only four countries are considered to have a one-stop shopping, i.e. the possibility of submit one single application and obtain at once all necessary permissions. In reality, the border between yes and no may be blurred. Italy, for instance, is considered as a "no", since a one-stop-shop exists only in theory. Some countries, offering a one-stop-shop for a limited amount of technologies (like 100 MW or beyond for some wind energy projects in the Netherlands) or regions (like Walloon in Belgium), are also marked with a "no";

- Share of administrative costs compared to overall project development costs: this indicator refers only to small (usually <5kWp) PV systems installed in residential buildings. The data originate from the IEE project PV Legal and are therefore available only for only 10 countries (see paragraph 2.2.3 for details).
- Share of time spent waiting for permission compared to overall project development time: this indicator also stems from the PV Legal project (see indicator above) and refers to the same sample as the previous indicator (see paragraph 2.2.1 for details);
- Lead-time for permits: as discussed in detail in the introduction of Chapter 2 (Administrative procedures) above, it is not possible to quantitatively compare different countries on this subject. Nevertheless, valuable information was gathered in the present study. It was chosen to establish a qualitative ranking with three categories (low/medium/high length of permitting procedures). This indicator refers to large scale systems (small-scale systems are evaluated by the next indicator). The data stem from the analysis of the national reports, but also following studies were considered: the ESHA barrier study for small-scale water projects[15], the Ecofys / Golder biomass benchmarking study[16], the Admire Rebus wind onshore study[17] and the Admire Rebus small hydropower study. The meta evaluation of all these sources has been performed with a similar methodology as described below for the benchmarking among countries;
- Estimated amount of permit requirements: like above, this indicator refers to large scale projects. Because there may be important differences between regions, technologies and individual projects. Therefore, it has been chosen to establish a qualitative ranking with three categories (low/medium/high number of permitting procedures), taking also into account the difficulty as expressed by the stakeholders interviewed.
- Exemption from an authorization procedure: this indicator shows whether the installation of building integrated renewables requires a permission or not. Two categories were distinguished: small-scale solar (PV < 3kWp, ST <9m²), and geothermal heat pumps <10kW;
- Promotion of efficient bioheat and heat pumps: this indicator shows if the requirements of Art. 13 (6) of the Directive are implemented (see also Table 5.1);
- Quality of information on public support measures: this indicator reflects the quality of the information provided by public authorities on the financial incentives they provide to support renewables. The evaluation is based on the findings of the national reports and on the experience and judgment of the consortium (see introduction Chapter 6 and Table 6.1);

[15] Administrative barriers for small hydropower development in Europe (ESHA, 2007).
[16] Benchmarking of permitting procedures for bio-energy installations in the EU-27 (Ecofys/Golder 2009).
[17] Renewable electricity market developments in the European Union - ADMIRE REBUS (ECN, 2003).

- Availability of certification schemes or equivalent qualification schemes for installers – see also Table 7.1 for further information;
- Indicator on the presence of an efficient (efficient in terms of capability of achieving its stated objectives) plan for the reinforcement of the power grid interconnection capacity with neighbouring countries – evaluation based on AEON expert judgements with regard to the country reports (Table 8.2);
- Indicator on the presence of an efficient plan for the reinforcement of the power grids within the country able to support the growth of renewable electricity - evaluation based on AEON expert judgements (Table 8.1);
- Rules on cost sharing and bearing of grid connection: this indicator asks if these rules are objective, transparent and non-discriminatory – values based on AEON expert judgements;
- Indicator on the possible denial of grid connection by TSOs and DSOs being a common problem thus constituting an important barrier for RES development – values based on AEON expert judgments and country reports (see Table 9.4);
- Indicator reflecting the average lead time for getting grid connection (considering also approval of grid connection in months). These data are derived in this study; see also Chart 9.1 for an elaborate description;
- Policies to proactively promote the increase of the RES share in existing District Heating (DH) networks. This indicator asks whether such policies exist. For the countries left blank, this indicator is not relevant due to the non existence, or very limited size of DH networks. The values are based on AEON expert judgements and country reports (see also paragraph 11.2.1).

**Overall benchmarking of the countries**

The analysis of all qualitative and quantitative indicators mentioned above has been summarized in the geographical chart below, to provide an in indicative ranking of the EU Member States

The procedure used is the following:

- All individual scores are marked with one of these colours: red, green or black
- For qualitative indicators: "green" means that no or little barriers are present, "red" that relevant barriers are present, "black" an average judgement
- For quantitative indicators, the upper third (in positive sense) is marked in green, the intermediate in "black" and the lower third part in "red".
- The total value for each country is determined by adding the number of green tags while subtracting the number of red tags, while black is considered to be neutral.

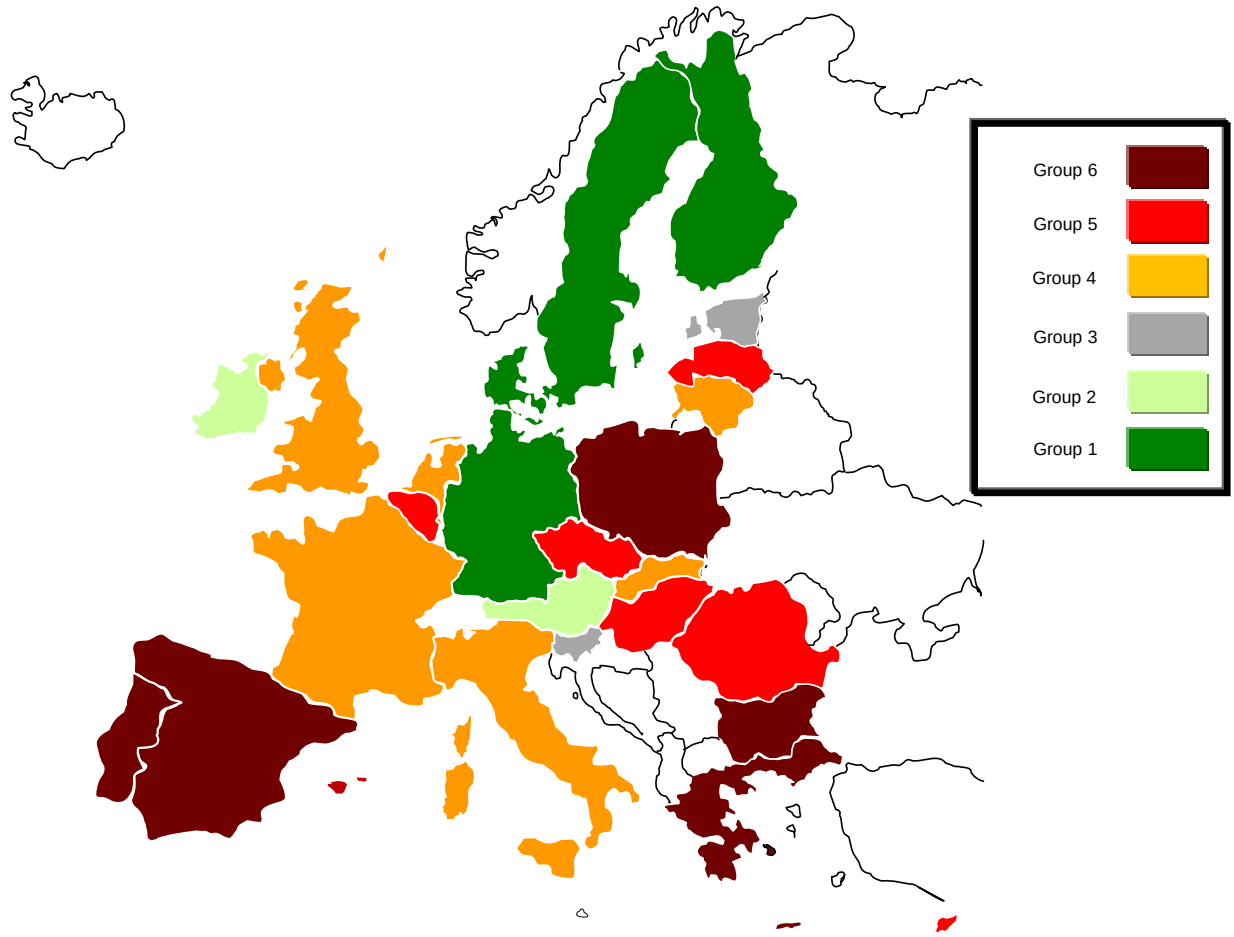
It must be stressed that this ranking is highly subjective, for several reasons; not only because of the character of the individual indicators discussed above, but also because it assigns the same "value" to each of the indicators, though it is obvious that some of the indicators are significantly more important than others. However, any quantification of the "value" of the different indicators would have added further subjective elements to this ranking, while reducing the transparency of the procedure.

Therefore, it has been chosen to use this procedure, though it is clear that this ranking is a mere summary of the results of the specific questions researched in this study. While the ranking can be used as a first, broad indication of the barriers for renewables deriving from the national administrative frameworks, it should not be seen as an objective measurement.

Based on this procedure, six groups of countries (visualised below) could be established. The degree of barriers identified in the study is lowest for group 1, and highest for group 6.

- Group 1: Denmark, Germany, Finland and Sweden;
- Group 2: Austria and Ireland;
- Group 3: Estonia and Slovenia;
- Group 4: France, Italy, the Netherlands, Lithuania, Slovakia and the United Kingdom;
- Group 5: Belgium, Czech Republic, Cyprus Hungary, Latvia, and Romania;
- Group 6: Bulgaria, Greece, Poland, Portugal and Spain.

Luxembourg and Malta have not been included due to the limited and/or non-applicable data.



## Benchmarking of EU-27 countries

| EU 27 Member State | 1 Is one stop-shopping possible? | 2 Share of administrative costs in comparison to overall small-scale PV project costs (%) | 3 Share of waiting time in comparison to overall small-scale PV project lead-time (%) | 4 Lead-time for projects | 5 Amount of permits required (excluding small-scale systems) | 6 Exemption from an authorization procedure (building permit) PV/Solar Thermal | 7 Exemption from an authorization procedure (building permit) Heat Pump < 10 kW | 8 Fulfilment of both the requirements of Art 13 (6) of the Directive concerning the promotion of efficient bioheat and heat pumps | 9 Quality of information on public support measures | 10 Availability of certification schemes or equivalent qualification schemes for installers | 11 Presence of sufficient training on RES issues during the education of installers, planners, architects | 12 Presence of an efficient (in terms of capability of achieving its stated objectives) plan for the reinforcement of the interconnection capacity with neighbouring countries | 13 Presence of an efficient plan for the reinforcement of the power grid capacity within the country | 14 Are the rules on cost sharing and bearing of grid connection objective, transparent and non-discriminatory ? | 15 Is the denial of grid connection by TSOs and DSOs a common problem, constituting an important barrier for RES development | 16 Average lead time for getting grid connection (considering also approval of grid connection) | 17 Are there policies to promote the increase of the RES share in existing DH networks? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Austria | no | | | low | low | yes | no | no | positive | yes | no | yes | average | partly | no | medium | yes |
| Belgium | no | | | medium | medium | yes | | | average | partly | no | no | no | no | yes | high | |
| Bulgaria | no | 65 | 64 | medium | high | no | no | no | negative | no | no | no | no | no | partly | low | no |
| Cyprus | no | | | medium | high | | | no | negative | no | no | no | no | yes | no | high | |
| Czech Republic | no | 28 | 61 | medium | high | yes | no | no | negative | no | no | no | no | yes | yes | high | no |
| Denmark | yes | | | medium | low | no | no | yes | positive | yes | yes | no | no | yes | no | low | yes |
| Estonia | no | | | medium | medium | no | no | yes | positive | no | no | yes | average | yes | no | low | no |
| Finland | no | | | medium | medium | | | yes | negative | yes | yes | no | yes | yes | no | low | yes |
| France | no | 19 | 62 | high | medium | no | yes | no | average | yes | no | no | no | partly | partly | medium | yes |
| Germany | yes | 8 | 33 | low | low | yes | no | no | positive | partly | yes | no | average | partly | no | | yes |
| Greece | no | 23 | 86 | high | high | yes | | no | negative | no | no | no | no | yes | yes | high | |
| Hungary | no | | | medium | high | no | no | no | average | no | no | yes | average | yes | no | medium | no |
| Ireland | no | | | low | medium | yes | yes | no | positive | yes | average | no | average | yes | no | | |
| Italy | no | 45 | 77 | high | low | yes | yes | no | average | no | average | yes | average | yes | no | high | no |
| Latvia | no | | | low | high | yes | yes | no | negative | no | no | no | no | no | no | medium | no |
| Luxembourg | no | | | | medium | | | | positive | yes | | | no | | | | |
| Lithuania | no | | | medium | high | yes | yes | no | positive | no | no | no | no | no | no | high | yes |
| Malta | no | | | | | | | | positive | | | | | | yes | | |
| Netherlands | no | 21 | 59 | high | medium | yes | no | no | positive | no | no | yes | no | yes | yes | medium | no |
| Poland | no | | | medium | high | yes | yes | no | negative | no | no | no | no | no | yes | high | no |
| Portugal | no | 36 | 73 | high | high | yes | yes | no | negative | partly | no | no | average | no | yes | high | |
| Romania | no | | | low | high | no | no | | negative | no | no | yes | no | no | yes | low | no |
| Slovakia | no | | | medium | high | no | no | | average | partly | no | yes | no | yes | yes | medium | yes |
| Slovenia | no | 26 | 80 | medium | high | yes | no | | positive | no | yes | yes | no | no | no | low | no |
| Spain | no | 39 | 82 | high | high | no | no | no | average | partly | no | average | no | no | partly | high | |
| Sweden | yes | | | medium | medium | no | no | | positive | partly | yes | yes | yes | partly | no | low | yes |
| UK | yes | | | medium | low | yes | no | no | negative | yes | no | no | average | partly | yes | high | no |