Non-cost barriers to renewables

– *AEON* study

Germany

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2 Introduction

Despite the fact that Germany is not best suited for the use of Renewable Energy Sources (RES), this sector has developed rapidly during the last decade.
According to latest figures from the German Federal Ministry of Environment, RES have reached in 2009 a share of 10.1 % of the total final energy consumption (biomass: 7.0 %, wind power 1.6 %, water power 0.8 %, other RES 0.7 %). With regard to the production of electricity from RES the figures are even more impressive. In 2009 the share of electricity from RES amounted to 16.1 %. This growth indicates that German RES policies have been in general very effective in the last years.
Nevertheless, Germany still needs to make signigicant efforts to reach its 2020 target set by the European RES Directive. The following report has identified barriers that may hinder the growth during the coming decade.

The study is structured along ten issues, which have been set at European level, to allow for a comparison of non-cost barriers in different European countries.

In a nutshell these are the main findings:

- **Issue 1 Administrative Procedures**: In general administrative procedures are considered as quite effective, and favourable to the development of renewables. Nevertheless, there are significant differences between different German Federal States, and different renewable technologies. In certain areas, improvements should be introduced.

- **Issue 2 Technical specifications:** Technical specifications of support schemes do not create barriers to trade or other impediments to the operation of the internal market. On the contrary, Germany is quick in adapting its technical requirements in order to recognise new certification schemes emerging at the European level;

- **Issue 3 Building integrated technologies:** This chapter covers a set of very differing issues:
    - The effectiveness of the German renewable obligation is difficult to evaluate because it has been just introduced;
    - Demonstrations projects of renewable energy in public buildings are frequent, but there is room for improvement
    - The German tenancy and ownership law brings about serious barriers especially for the development of heat generating systems;

- **Issue 4 Promotion of energy efficient renewable energy equipment:** In general, the German promotion schemes are designed to promnote the use of

efficient technologies, though the wording of the Directive is not yet implemented in all cases;

- **Issue 5 Information and awareness raising:** Information and awareness raising measures with regard to RES are in general widely available in Germany. On the whole, the general public shows a very positive attitude towards RES and insufficient information cannot be considered as a significant barrier anymore;

- **Issue 6 Certification of installers:** The education and certification of RES installers is in most cases implemented within the German standard vocational education. Problems, if any, derive from the fact that there are quality disparities and lack of practical knowledge;

- **Issue 7 Infrastructure Development:** The current situation of the German electricity grid is currently quite positive. However, in the medium and long term, lack of transmission and distribution capacities could become a major barrier for the further development of renewable energies. The main barrier for the grid expansion is local opposition of the public that delay or even impede the process and insufficient financial incentives;

- **Issue 8 Power Grid Issues:** 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 have solved most of the problematic points in this regard. Nevertheless, in particular concerning small building integrated systems there is still room for improvement;

- **Issue 9 Gas Network Issues:** Germany is one of the leading countries in the use of biogas, and at the same time a pioneer in terms of the injection of it into the natural gas grid. However, also in Germany this is still quite a new issue. Nevertheless, a rather efficient set of rules has been established throughout the past years in order to ensure good conditions for grid access for biogas. The main barriers seem not be lying in missing or prohibitive legal regulations but in the lack of cooperation on the side of the grid operators;

- **Issue 10 District Heating Issues:** In European comparison the share of DHC – with and without RES – in Germany is average. Due to high investment costs the main barriers are cost related but some of them can be resolved at the legal-administrative level.

3 Issue 1 Administrative Procedures

3.1 Introduction

In general, the following assessments could be made:

Positive evaluation: The stakeholders consider the administrative procedures in Germany as largely favourable to renewable energy sources (RES). In particular this is due to the following rules:

- **General administrative principles:** The German legal system has introduced tools to increase the efficiency of administrative procedures:
  - **the principle of expedition of proceedings:** The principles specifies that administrative proceedings should take place swift and without wilful delay, § 10 Administration Law ("*Verwaltungsverfahrensgesetz*[1]");
  - **the administrative inaction suit:** This legal remedy allows for legal actions at the administrative courts if the administrations does not react to complaints in due time, § 75 Administrative Court Procedures Code ("*Verwaltungsgerichtsordnung*[2]").The only downside is that the legal proceeding can take years. This fact weakens this instrument(Oppen 2010);
- **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 ("*Bundesimmissionsschutzgesetz*"[3]). This procedure is considered as rather complex, but it has a so-called "concentration effect" ("*Konzentrationswirkung*"), i.e. it includes also most other necessary authorizations (except from planning decisions, permissions according to the mining

[1] Verwaltungsverfahrensgesetz in der Fassung der Bekanntmachung vom 23. Januar 2003 (BGBl. I S. 102), das zuletzt durch Artikel 2 Absatz 1 des Gesetzes vom 14. August 2009 (BGBl. I S. 2827) geändert worden ist.

[2] Verwaltungsgerichtsordnung in der Fassung der Bekanntmachung vom 19. März 1991 (BGBl. I S. 686), die zuletzt durch Artikel 3 des Gesetzes vom 21. August 2009 (BGBl. I S. 2870) geändert worden ist.

[3] Bundes-Immissionsschutzgesetz in der Fassung der Bekanntmachung vom 26. September 2002 (BGBl. I S. 3830), das zuletzt durch Artikel 2 des Gesetzes vom 11. August 2009 (BGBl. I S. 2723) geändert worden ist.

law and water protection law requirements § 13 Federal Immission Control Act). 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 (Oppen 2010, Longo 2010 II, Law firm 2010 I, Law firm 2010 II);

- **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, § 10 Federal Immission Control Act. This so called preclusion effect increases legal certainty for the project developer in a considerable way.

Regional differences: Authorization procedures for all RES systems (except for offshore windpower plants) are executed on regional level. This separation has the advantage that authorization procedures are not slowed down by a federal bottleneck. However, it has the drawback that the application of administrative regulations is less uniform. As a consequence the severity of administrative impact on RES deployment varies strongly in the different Federal States. For example, most of wind power plants have so far been developed in the North and the East of Germany. In the other States, especially in Bavaria, Baden-Württemberg and Hessen very little capacity has been installed. For instance, small Rhineland-Palatinate has twice as much wind capacity in operation as the larger States of Hessen and Baden-Württemberg. North-Rhine Westphalia, has five times more wind capacity than Hessen, although it is only 50 % larger (AEE 2009).
These differences can be explained only to some extent by diverse resources, and the same feed-in tariff applies all over Germany. For this reason, it seems very likely that administrative barriers are one of the key barriers for the development of wind power in certain Federal States (Karpenstein 2010). It is for this reason not very surprising that a comparative study by the Renewable Energy Agency[4] ("*Agentur für Erneuerbare Energien*") ranked Hessen very low in comparison to the other Federal States, while Rhineland-Palatinate is one of top-runners (AEE 2008).

Technological differences: Apart from rather general considerations (long lead times, complicated procedures) the remarks of the stakeholders showed that most of the barriers are quite technology specific. RES technologies are facing varying administrative problems. This is for the following reasons:

- Some technologies are not growing in the German market because there is little potential (ocean energy, CSP), the cost barriers are too high (deep geothermal) or the technology is still under development (micro wind energy, algae). In these cases administrative barriers are not or only theoretically known;
- Some technologies still have the (partly unjustified) reputation of being emitters of noise (wind power plants), distracting movements (wind power) or smell and traffic (biogas installations). Promoters of these technologies report far more administrative barriers than those who promote more popular technologies like PV or solar thermal. It appears that in these cases administrative processes are used to impede the construction of unwanted technologies.

[4]The study compared the German Federal Countries on the base of composite indicators. The base for the indicators was a media research (professional journals, statements by associations, internet websites, energy programmes) and interviews with agents from the associations.

As a consequence of the technological differences, after a short introduction of general issues, the barriers are described by technology.

Influence of municipalities: The research of the administrative barriers has shown that regional differences exist and that these barriers are often expressions of discomfort of the local or regional policy makers towards the expansion of RES. Municipal administrations play a key role for the success of a RES project. Stakeholders consulted regarding this question confirmed that a positive attitude of the population and of the local government is crucial for the success of a project, otherwise administrative problems increase rapidly (Oppen 2010, Longo 2010 II, Law firm 2010 II, Karpenstein 2010). Sound policy to promote renewables should therefore offer benefits for municipalities and ensure the involvement of the local population. For this reason, the last of the following chapters describing the barriers is dedicated to attributes of the German political system, which decrease the incentive of municipalities to support RES in their region.

3.2 Description of barriers & options to mitigate barriers

3.2.1 Detailed description of the barriers and options

Barrier 1.1 – Inefficient general administrative procedures (including no/insufficient specific rules for building integrated/small scale RES installations)

Regarding **RES technologies in general** the following barriers were identified:

- **Lead times are perceived as too long** (AEE 2008). Some stakeholders evaluated lead times as too long.
  Possible option: The renewable energy associations request that the necessary consent of involved administrations (especially municipalities) should be considered as given after expiry of a certain deadline (BEE 2009). However, some legal experts argue that the general interest for a formally correct authorization procedure should prevail (Prall 2010 I I). It should be taken into account that, within a system that is in general delivering a strong growth of RES, a silence-consensus rule applied to all RES, and only to RES, might lead to problems of social acceptance and to defensive reactions of the public administration, like for instance restrictive interpretation of formal rules. Moreover it would be difficult to have on the one hand a building permission, which is based on a bound decision and which has preclusion effect; but on the other hand to weaken the permission process. Therefore, this solution should be considered, but limited to cases of real necessity.

Regarding **biomass systems** the following barriers were identified:

- **Inconsistent application of Authorization Law:** Due to the federal system in Germany, there are two different authorization procedures:
  - For large scale systems the federal procedure, according to the above mentioned Federal Immission Control Act
  - For small scale systems the regional permission process according to the respective building law of each German Federal State.

Most plants are large scale plants. One important difference between these processes is that the federal procedure has the above mentioned concentration effect, thus effectively allowing for one-stop shopping. The federal process applies if a biomass plant has a larger impact on the environment. The exact, very technical criteria are defined by the 4th decree to the Federal Immission Control Act[5] ("*4. Bundesimmissionschutzverordnung*"). If the plant does not reach this threshold, its permission is subject to the regional permission process, according to the law of the individual Federal States. These laws do not apply the concentration effect; the applicant needs many different licenses from numerous different authorities. These procedures vary in each of the *German* Federal States (BEE 2009) and are quite time-consuming (Siegmund 2010). As a consequence, paradoxically, the installation of a small system with a lower environmental impact can be more complicated than a large one. In most cases, however, biomass plants fall under the scope of the Federal Immission Control Act (Bredow 2010). Therefore, in case of biomass plants this problem is rather marginal.

- **Lack of knowledge and experience in the administrations**: Renewable energy associations have criticized that the clerks in the permission authorities still lack knowledge and experience about the permission procedure of biomass plants. This results in disproportionate requirements and inadequate decisions (BEE 2009). It remains to be seen if this problem will diminish, as the clerks gain more experience. In some Federal States, for example Lower-Saxony, the permission procedure for biomass plants that fall under the Federal Immision Control Act is conducted always by the same administrative body (Bredow 2010). Such concentration of competence can speed up the learning effect considerably.

Regarding **biogas systems** the following barriers were identified:

- **Inconsistent application of Authorization Law:** Biogas plants facee the same problem as biomass plants, regarding the question whether federal or regional permission law applies (see above). In Germany there are also a lot of smaller systems that do not fall into the scope of the Federal Immission Control Act. In case of biogas there are further reasons why a biogas system is subject to the Federal Immission Control Act. One of them is the amount of waste used by the installation. The administrations of the different Federal States interpret in an inconsistent way if liquid manure has to be regarded as waste. Some administrations consider manure as waste and thus apply the authorization process according to the Federal Immission Control Act. Some authorities do not follow this interpretation and apply the building laws of their Federal State. As a consequence, applicants face uncertainty, which permission regime is relevant (Klinski 2005; AEE 2008);
  Possible option: The Federal Immission Control Act could be applied to all biogas installations. This harmonization would allow for more legal certainty and would reduce the amount of administrative steps for the authorization of smaller installations (Klinski 2005). All applicants would benefit from the concentration

[5] Vierte Verordnung zur Durchführung des Bundes-Immissionsschutzgesetzes (Art. 1 d. V zur Neufassung und Änderung von Verordnungen zur Durchführung des Bundes-Immissionsschutzgesetzes)

effect and the authorisation bodies could more quickly gain experiences in a centralised process. On the other hand, the extension of the scope of the Federal Immission Code to all biogas systems no matter their impact as emitter contradicts the intention of the Federal Immission Code (Bredow 2010). An alternative would be to clarify the criteria, whether a biogas systems falls under the scope of Federal Immission Control Act, or not.

- **Complexity of process:** The applicant and operator of a biogas system have to deal with numerous different laws, which sometimes do not fit well together (among others: building law, waste law, fertilizer law, fertilizing law, water law and European laws). As a consequence, the applicant must read, understand and obey very difficult and different regulations. To add complexity, the administration in the single Federal States apply these laws in different ways (Klinski 2005, AEE 2008);
  Possible Option: One solution would be to reduce the complexity by simplification and harmonization on regional level. One federal decree could clarify all requirements for the installation and operation of a biogas system. Project developer would need to focus only on one text. It would be particularly useful to harmonize the requirements concerning the preservation of water and of the environment (Filser 2009 quoting Cedric Meyer)
  On the other hand it may be technically difficult to concentrate all relevant regulations in one central law. The acts of law that include regulations concerning biogas systems follow very distinct logics. It seems difficult to draft a single decree that respects all the different logics (Bredow 2010).
  Perhaps it is more promising to prepare sound and up-to-date guidelines in each Federal State, encompassing the different regulations and clarifying contradictions.

- **Categorization of gas generating plants:** In some Federal States (e.g. Bavaria), gas generating plants are regarded as energy systems, if the gas is transported over the borders of the premises. As such, they have to fulfil the requirements defined in § 49 Energy Industry Act ("*Energiewirtschaftsgesetz*[6]"). This leads to additional administrative efforts (Bredow 2010).

- **Disproportionate requirements for the storage of biogas:** On the basis of the EU Seveso II Directive, even smaller agricultural biogas plants in Germany are increasingly subject to the statutory order on hazardous incidents ("Störfallverordnung - 12. BImschV") if they can store 10,000 kg of biogas or more. In case of natural gas, which is about twice as volatile as biogas, this limit is at 50,000 kg.The bureaucratic and monitoring requirements that have to be fulfilled in this connection are impossible to be satisfied, especially in case of decentralized biogas plants that are integrated in agricultural processes. In addition these requirements are also disproportionate, especially when comparing them with the requirements for natural gas since natural gas is always stored pressurized, while biogas is generally stored without being pressurized (Grobrügge 2010).
  Possible Option: The industry association for biogas suggests that during a possible revision of the Seveso-II Directive, the exemption limit for biogas should be raised to

[6] Energiewirtschaftsgesetz vom 7. Juli 2005 (BGBl. I S. 1970 (3621)), das zuletzt durch Artikel 2 des Gesetzes vom 21. August 2009 (BGBl. I S. 2870) geändert worden ist.

100,000 kg, which corresponds to the limit of 50,000 kg natural gas. The German statutory order on hazardous incidents in Germany could then be adapted accordingly. In this way, its scope would be limited to a reasonable extent (Grobrügge 2010). An analysis of the technical risks resulting from the limitation of the scope of the Seveso-II Directive goes beyond the focus of this study. However, a revision of the Seveso-II Directive seems adequate if there are no reasons that justify the unequal treatment of biogas and natural gas.

Regarding **onshore wind power systems:**

The legal framework for onshore power systems is evaluated by stakeholders as generally positive. Most of the systems are subject to the Federal Immission Control Act, leading to the above mentioned advantages in terms of one-stop shopping.

Administrative barriers for onshore wind power installation often result from conflicts on regional and local level (Klinski 2005). In some Federal States, it also seems that there is lack of political will to support the use of onshore wind energy. In particular the following barriers were identified:

- **Wind power regulations** ("*Windkrafterlässe*") have been published in some German Federal States (mainly those whith very low wind power development: Hessen, Baden-Württemberg, Saarland). They are not legally binding, but they are taken as yardsticks for the administration. Therefore, they have a strong practical impact (BWE 2009). Some of the regulations prescribe particularly restrictive minimum distances and height restrictions. Such strict requirements are limiting the economic effectiveness of the wind systems and are not justified from the point of preventing hazards (Klinski 2005, AEE 2008). Moreover, the regulations stipulate absolute figures (such as maximum height or minimum distances), which makes it difficult to assess the individual case (Law firm 2010 II). Wind power regulations have been mentioned frequently and they seem to be one of the main barriers for the expansion of onshore wind power;
  Possible Solution: The introduction of a federal decree defining harmonized parameters in terms of emission levels and a technical state of the art could create more reliability and legal security (Klinski 2005). The decree should also contain flexible rules, concerning the minimum distance requirements based on the requirements defined by the natural protection law and the Federal Immission Control Act (BEE 2009). Of course such a harmonization should not be used to define requirements in such a strict way that it hinders the further installation. Moreover, the decree should offer some leeway for the permission authority, in order to respect the need for sound solutions for the individual case (Oppen 2010 Law firm 2010 I, Law firm 2010 II).

Regarding **offshore wind power systems** the following barriers were identified:

- **Ambiguous permission law:** The law, which governs the authorization procedure for offshore wind power systems in the Exclusive Economic Zone, is the Marine Facilities Ordinance ("*Seeanlagenverordnung*[7]"). It contains ambiguities, which could be more specified (Klinski 2005) and it leaves a lot of issues open (Law firm 2010 II). However most of the problems were clarified due to the good handling by the responsible authority, the Federal Maritime and Hydrographic Agency of Germany (BSH) (Wustlich 2007, Prall 2010 I).
  The communication between administration of the BSH and the developers works very well, however there should be more employees at BSH to reduce the lead times (BEE 2009, Prall 2010 I).
- **One stop shopping:** So far, the whole authorization procedure has been executed by one administrative body – the BSH, including issues of the protection of species in compliance with the Habitat Directive and the Bird Protection Directive. Since March 2010, the competent body for this specific issue is no longer the Federal Maritime and Hydrographic Agency of Germany but the Federal Agency for Nature Conservation. This leads to the following procedural flaw: If the Federal Maritime and Hydrographic Agency rejects an application for an offshore wind park on grounds of the protection of the species, the applicant has to lodge two different appeals against that rejections, one against the decision of the Federal Maritime and Hydrographic Agency and one against the Federal Agency for Natural Conservation. This weakens the former one stop shopping principle (Prall 2010 II).
  Apart from that an additional process is needed for the grid connection. For the developers this is acceptable, because of its other advantages (better planning of grid structure) (Prall 2010 I).

Regarding **small/medium scale solar thermal installations and small/medium scale PV installations on buildings,** the requirements are very similar. The procedures are very efficient. Authorisation by default exists for most small systems, for other systems one-stop-shopping is possible. In general, no huge problems exist and only minor adaptations are necessary. According to a study written by the Agency for Renewable Energies ("*Agentur für Erneuerbare Energien*") which examines legal barriers and political commitment in each of the German states, the best conditions for solar thermal systems can be currently found in Baden-Württemberg and Hamburg. Worst case examples are Berlin, Brandenburg, Hessen and Mecklenburg-Western Pomerania. Nevertheless, the following barriers were identified:

- **Lack of harmonization:** The Regulations concerning the authorisation process differ from Federal State to Federal State. As a consequence project developers have to take 16 different building regulations into account.
  Possible option: Associations suggest that the Federal States should harmonise their building regulations. They should introduce standardised rules and deadlines for authorisation (BEE 2009). Such a harmonization may improve the administrative process to some extent. However, it should be pointed out that the building procedures in the different German Federal States are quite similar. In most of the PV

[7] Seeanlagenverordnung vom 23. Januar 1997 (BGBl. I S. 57), die zuletzt durch Artikel 26 des Gesetzes vom 29. Juli 2009 (BGBl. I S. 2542) geändert worden ist.

and ST systems do not require a building permission in the first place. If permission is required, the corresponding permission process consists of the same steps. The processes mainly differ in details, for example the exact conditions that allow for an installation without permission. Apart from that, it is politically almost impossible to harmonize the building regulations of the German Federal States on national (let alone European) level because these differences stem from the principle of the German federalism. For these reasons, this option does not seem advisable.

Moreover, **small/medium scale PV systems on buildings** are facing the following barriers:
Business activities: PV systems of a certain size are considered as business activity. In this regard, a number of problems can arise. For the time being those problems are nevertheless more of a theoretical than of a practical nature (Oppen 2010).

- **Registration:** It is not clearly defined by law, from which size PV systems have to be registered as business activity at the commercial regulatory authority ("*Gewerbeaufsichtsamt*"). Experience has shown that in most cases systems up to 3 kW are exempted from the duty of registration. Nevertheless, the requirements differ from authority to authority (PV LEGAL 2010).
  Possible solution: In order to gain legal security, this threshold should be clearly defined (Oppen 2010).

- According to the Land Use Ordinance ("*Baunutzungsverordnung*[8]"), it is not allowed to operate a business in residential-only areas. This leads to legal insecurities for PV system operators (PV LEGAL 2010).
  Possible option: It should be legally clarified, that the installation of PV systems is allowed in residential-only areas (Oppen 2010).

Regarding **geothermal heat pumps**, the following barriers have been identified:

- Authorisation procedures (application, technical specifications etc) differ in each of the German states. This brings with itself huge efforts for companies active in several German Federal States in order to collect all necessary information on authorisation procedures.
  Possible solutions: A standardisation of the procedures would help to overcome this obstacle (BEE 2009, BWP 2009, Rodehorst 2010). Here as well, the above raised concerns apply: It is politically almost impossible to harmonize the regulations of the German Federal States on national (let alone European) level because this difference stems from the principle of the German federalism. Therefore, this option does not seem advisable.

- **Complicated procedures:** Authorisation procedures are much too complicated and time-consuming for small systems. Reasons for this are for example the transfer of the applications from authority to authority, cross-checking of different authorities or time-consuming exploratory enquiries in advance.

[8] Baunutzungsverordnung in der Fassung der Bekanntmachung vom 23. Januar 1990 (BGBl. I S. 132), die durch Artikel 3 des Gesetzes vom 22. April 1993 (BGBl. I S. 466) geändert worden ist.

Possible options: As a solution, easier procedures for small systems for one-/two-family houses, probably in the form of a "one-stop-shop" for ground source heat pumps up to 20 kW are proposed (BEE 2009, BWP 2009, BWP 2010, Rodehorst 2010).

- **Strict requirements:** Authorisation procedures tend to be very expensive. This is due to irregular and high charges, unnecessary, exaggerated and expensive requirements as for example requirements for geological monitoring of drilling activities or requirements asking for specific materials and techniques for drilling or exaggerated regulations even in cases where drinking water protection is not an issue (BWP 2010).
  Possible solutions: The requirements should be verified regarding their relevance and loosened if considered exaggerated. However considering the impact on ground water and environment, this should be done with great caution.

- **Minimum heat limits:** More and more regulating authorities ("*Untere Wasserbehörden*") tend to issue regulations prohibiting the heat source temperature to drop below 0°C. This is due to the experience that the bentonite core, separating the different aquifers which should not get into contact, may crumble in case of strong frost. As a consequence of these regulations, much larger and thus more expensive heat pump systems have to be designed.
  Possible solutions: As an alternative, suitable frost-resistant material could be used. The assessment of the environmental impact of such materials should be carried out, to see if it is possible to avoid the prohibition of all heat pump applications that can lead the heat source temperature to drop below 0°C.

- **Requirements due to legionella protection:** The standard DIN 1998-20 (not yet in force) will introduce requirements for the protection of legionella that up till now have only been valid for large systems (more than 3 dwelling units) this time also for small systems for one and two family houses. This means that a continuous water temperature of 60 °C at the emersion point would be required. As a consequence, the heat pumps would need to be run at a significantly higher temperature level, leading to lower efficiency rates.
  Possible option: The heat pump sectors argue against introducing this new standard (Interview Rodehorst 2010). An analysis of pros and cons would go beyond the scope of this study.

- **Areal restrictions:** Regulations asking for a 5m distance to the neighbour's plot, often combined with limits in depth, hinder the installation of geothermal heat pumps (BWP 2010).

Regarding **deep geothermal systems** most of the barriers are rather theoretical because this technology is not very developed. There are merely three installations with a total installed capacity of 6.6 MW (Große 2009). It seems that mainly barriers related to costs, resources and technical limits are the main reasons for the low level of development. Nevertheless, the following administrative barriers could be identified:

- **Incomplete permission regime:** In general the permission regime for deep geothermal has not been developed very much. Moreover, it is regulated by laws (such as the Federal Mining Law ("*Bundesberggesetz*[9]") that are not tailored for deep geothermal systems.
  Possible Option: The introduction of a permission regime that specifically applies to deep geothermal systems should be considered (Law firm 2010 II).

- **Exclusion of applicants due to mining permission:** The mining permission according to the Federal Mining Law is a necessary step to get the claim to search for and exploit geothermal resources. The mining permission is always granted for a certain area and covers all resources below this area. Only the person who has obtained the permission can exploit the resources in this area exclusively, no matter for which depth the project is intended. Other applicants are blocked even if they want to exploit resources on a different level than the holder of the permission. This exclusion of other applicants hinders in this way an economically useful exploitation of geothermal resources (Große 2009).
  Possible Option: The number of operators exploiting at the same time geothermal resources at different depths could be increased by a modification of the Federal Mining Law (Große 2009). It should be possible that different project developers can exploit resources on different levels of depth. Such an extension might however cause conflicts between competing applicants. Nevertheless, if the regulation is sufficiently flexible and allows the authorization body to decide on the single case basis this risk should be limited;

Regarding **hydro installations** the following barriers were identified:

- **Lack of specific procedures applying to small systems:** There are no simplified procedures for smaller hydro installations (until 100 kW) in the authorization process (BEE 2009).
  Possible Solution: According to hydro power associations a possible solution would be to reduce the requirements for small hydro installations (BEE 2009). The evaluation of the impact on environment goes beyond the scope of the present study.

- **Blocking water permissions by permission owners:** According to the Federal Water Act ("*Wasserhaushaltsgesetz*[10]") the operator of a hydro power plant has to have a special permission ("*Wasserrechtliche Erlaubnis*"). This permission is granted exclusively. In some Federal States the owners of that permission do not use the hydro power potential. Thus, they are blocking the utilization of the resources (Longo 2010 II).
  Possible options: The permission can be revoked if the owner does not use it. The authorities of the Federal States should make consistently use of this right (Longo 2010 II).

[9] Bundesberggesetz vom 13. August 1980 (BGBl. I S. 1310), das zuletzt durch Artikel 15a des Gesetzes vom 31. Juli 2009 (BGBl. I S. 2585) geändert worden ist

[10] Wasserhaushaltsgesetz vom 31. Juli 2009 (BGBl. I S. 2585)

Barrier 1.2 – Inexistent or insufficient spatial planning

The German spatial planning process, regulated in the Federal Building Code ("*Baugesetzbuch*[11]") and the Spatial Planning Law ("*Raumordnungsgesetz*[12]") restricts any construction activity in the so-called "outer zone" ("*Außenbereich*"), i.e. the area not covered by buildings and not subject to special plans. In these outer zones, RES systems can generally be constructed only if they are regarded as privileged ("*privilegiert*") according to § 35 Federal Building Code. "Privileged" means in this context that a building can be installed without the need of a spatial planning process. This accounts for wind power, hydro power and under certain conditions for biomass systems. However, the planning administration on regional level, which sets up regional plans ("*Regionalplan*") can define certain areas of the outer zone as so-called "priority areas". In these priority areas, a specific kind of activity, such as for instance the construction of a wind park or of a biomass plant, is foreseen. However, by legal default or by decision of the regional authorities (depending on the Federal State), the definition of priority areas has so-called "preclusive effect" ("*Ausschlusswirkung*"). This means that the RES systems are restricted to the priority areas, while no development is allowed in the rest of the outer zone (§ 35 Federal Building Code). Also the municipalities have a strong impact on the planning process. They are consulted during the planning process of the regional plans and they can set up own plans on local level. These local plans ("*Bebauungsplan*") have to be in line with the regional plans. Nevertheless, they can have strong impact on the RES development process because the municipalities can define in the local plans further restrictions. In general the implementation of the planning regulations has proven to support the development of RES technologies. Nevertheless in some German Federal States they can also lead to specific barriers as explained in the following.

Regarding **biogas systems** the following barriers were identified:

- **Unclear definition which installations are privileged:** According to the Federal Building Code ("*Baugesetzbuch"*) biogas plants can be installed in the outer zone as privileged buildings. "Privileged" in the sense of § 35 para 1 Federal Building Code means it is not necessary to conduct a spatial planning procedure before constructing or renovating the biogas plant. This is very important for project developers, as the conduction of a spatial planning procedure cannot be enforced in court (Bredow 2010). If the biogas plant is not privileged according to § 35 para 1 Federal Building Code, permission is only granted if the spatial plan foresees no priority areas for the utilization of biogas and if the biogas plant fulfils certain requirements. The Federal Building Code enlists these requirements in a quite unspecific way. In some German Federal States (e.g. Saarland) there is no administrative regulation that specifies these requirements. One of the requirements for the privilege of § 35 para 1 Federal Building Code is that the biogas plant has a total electric capacity of less than 0,5 MW. As a consequence, the decision whether or not the plant is privileged depends on the degree of efficiency of the plant (Bredow 2010). This can lead to the following problems:

[11] Baugesetzbuch in der Fassung der Bekanntmachung vom 23. September 2004 (BGBl. I S. 2414), das zuletzt durch Artikel 4 des Gesetzes vom 31. Juli 2009 (BGBl. I S. 2585) geändert worden ist.

[12] Raumordnungsgesetz vom 22. Dezember 2008 (BGBl. I S. 2986), das zuletzt durch Artikel 9 des Gesetzes vom 31. Juli 2009 (BGBl. I S. 2585) geändert worden ist

- If the total capacity is increased due to technical solutions, the plant is not privileged anymore although its size has not been changed. The Federal Building Code is applied in a quite inconsistent way so that the applicant does not know whether the it is possible to renovate the biogas plant without a spatial planning procedure, or not (AEE 2008);
- In case of a gas generating plant, which generates no electricity in the outer zone, it is necessary to calculate the gas yield into electric capacity without any legal definitions for that (Bredow 2010);

Possible Option: The administration should specify conditions, under which a biogas plant can be regarded as privileged in an ordinance. Among others the criteria for the definition of capacity should be adapted, for example the amount of substrata (BEE 2009, Manten 2008, Bredow 2010). Such an adaption would increase legal clarity and security and should respect the goals of the Federal Building Code. However it must be ensured that the specifications do not worsen the situation because they are too strict;

- **Too strict requirements for biogas generating plants:** Biogas generating plants that feed the gas into the natural gas grid are explicitly supported by the German government. Theses plants have to be large in order to be efficient. The current limits according § 35 Federal Building Code make it impossible to install a biogas generating plant in the outer zone. They always require a spatial procedure, for which the criteria by the municipalities are not transparent and sometimes inappropriate (Bredow 2010).
  Possible Option: It should be considered that biogas generating plants are always privileged in the sense of § 35 Federal Building Code. Before that, the environmental impact should be considered carefully.

- **Prevention of utilization of heat:** In some German Federal States (e.g. Lower-Saxony) biogas plants can be installed only in priority areas. These areas are distant from settlements. This hinders the utilization of the generated heat (AEE 2008).
  Possible Option: When allocating priority areas the governments of the German Federal States should ensure that the plants are located near to settlements or other places which can make use of the generated heat.

- **Disadvantages of concentration of biogas plants:** The concentration of biogas plants in priority areas is economically and environmental inefficient because biogas plants need a lot of space which can be used to produce the resources for the use of the biogas plant. If biogas plants are concentrated in one area the neighbouring area cannot deliver sufficient resources and it is necessary to rely on transport. This increases the costs and reduces the energetic efficiency of the biogas plant (Bredow 2010).

Regarding **onshore wind power systems** the following barriers were identified:

- **Lack of suitable priority areas:** Many German Federal States have introduced priority areas in order to prevent the scattered installation and uncontrolled growth of wind power plants. In some Federal States however (notably Hessen, Saarland, Baden-Württemberg, Bayern and Thüringen) the choice of priority areas has a serious

impact on the development of new wind power plants. The areas are too small or not windy enough (AEE 2008, BEE 2009). In the Federal State of Hessen, the size of the priority has been remarably reduced in the last years (Karpenstein 2010).
A similar problem exists on the local level. When setting up the above mentioned local plans some municipalities apply severe restrictions to those areas which are reserved for the priority use of wind power utilization. They prescribe minimal distances or height limitations for wind power systems impeding an efficient and economic use (Klinski 2005, AEE 2008, BEE 2009, Karpenstein 2010). In some cases it seems that the announcement of priority areas is used only to prevent the development of wind power. There are no legal remedies to impede such prevention planning effectively (Klinski 2005, Oppen 2010). However, such preventive planning happens rarely (Oppen 2010).
Moreover, minimal distances from residential areas push the plants deeper into the nature. This may increase conflicts between wind power installations and environmental protections (Wustlich 2007). The problems concerning priority areas have been mentioned repeatedly and seem to constitute one of the main barriers for the development of wind power systems;
Solution: The best solution seems to be the announcement of more priority areas by the German Federal States. The problem regarding severe restrictions in the priority areas could be resolved by the introduction of a federal decree that harmonizes minimal distances and height limitation on a level that is suitable for the development of new wind power plants. However, also such restrictions can be regarded as an expression of discomfort for the installation of wind parks. Therefore, it seems more sustainable to convince the municipality by involving it politically and economically into the development process (Karpenstein 2010);

- **Prevention of repowering:** The announcement of priority areas constitutes a particular problem for the repowering of old wind power plants. They are often located outside of priority areas and at the same time the announced priority areas are already blocked. In this case repowering is not possible (Klinski 2005, BWE 2009). Moreover, height restrictions and minimum distances are too strict to make repowering of old systems attractive (Wustlich 2007).
  Solution: To overcome this barrier the following approach seems adequate:
  - municipalities should allocate certain special areas which are reserved for repowering;
  - if a municipality does not allocate special areas for wind power plants, which replace old installations, the repowering systems are privileged even if they are installed outside of priority areas (Klinski 2005, BWE 2009);
  - minimal distances and height restrictions should be adjusted also for repowering plants (Wustlich 2007);

- **Unclear solution for conflicting public interests during spatial planning:** Associations have criticized that the law does not sufficiently specify how the conflict between "public interests" and the interest to develop more wind power plants should be resolved during the spatial planning process. This reduces planning security. (BEE 2009). However, it does not seem feasible to solve this problem by introducing more regulations that solve this conflict in the interest of the wind power plants. The

individual conflict depends too much on the concrete situation so that no public interest should automatically prevail ;

Regarding **ground mounted PV installations** the following barriers were identified:

- **Identification of suitable areas:** It is sometimes difficult to assess the eligibility for feed-in tariffs of the systems according to the German Renewable Energy Act ("*Gesetz für den Vorrang Erneuerbarer Energien* [13]"). The act sets very rigid and distinct requirements that ground mounted PV plants are eligible for the German Feed-In-Tariff. Ground-mounted systems are only eligible for feed-in tariff payments if they are erected in the scope of an urban development plan or on an area for which complex planning procedures were conducted. For systems which are erected in the scope of an urban development plan which was created or altered after 1.9.2003 there is an additional series of requirements for the quality of the area. Due to unclear term definitions, it is often difficult to establish whether the area requirements establishing the eligibility for feed-in tariff payments are met. The actual usage of an area can be difficult to prove. Legal uncertainty arises when systems are erected on areas which are not eligible for feed-in tariff payments, but are granted compensation. The decision upon the eligibility lies upon the grid operator who has to reimburse the owner of the plant. He has to take this decision once the project is realized. The eligibility of a ground mounted PV plant requires that the plant is installed on an area for which a legally binding land use plan is announced. Moreover, the electricity from the plant is only eligible if that area fulfills other criteria. These criteria are difficult to assess and to prove. This leads to legal uncertainty for all stakeholders: The system owner is facing the risk that his system is not eligible and therefore his investment is lost (PV Legal 2010).
  Solution: That risk could be mitigated if the conditions for eligibility are defined more clearly. Moreover, the grid operator could introduce a pre-check of the eligibility of the project in an early and separate procedure (Law firm 2010 II). However, the complete abolishment of planning procedures does not seem adequate, because this would lead to the loss of public acceptance of PV.

  Long planning procedures: The amendment of urban and land use plans is a very long process. Without preliminary planning permission of the municipal council, there is no involvement of the public. This may result in an individual member of the municipal council blocking the entire process of amending the urban development plan (PV Legal 2010).

Regarding **offshore wind power systems** the following barriers were identified:

No planning procedure: There is no planning procedure for installations outside of reserved areas for offshore wind power plants (BEE 2009).

Regarding **deep geothermal installations** the following barriers were identified:

[13] Erneuerbare-Energien-Gesetz vom 25. Oktober 2008 (BGBl. I S. 2074), das zuletzt durch Artikel 12 des Gesetzes vom 22. Dezember 2009 (BGBl. I S. 3950) geändert worden ist.

No privilege of geothermal plants: Geothermal plants are not privileged according to § 35 Federal Building Code. "Privileged" in the sense of § 35 Federal Building Code means it is not necessary to conduct a spatial planning procedure before constructing or renovating the geothermal plant. Their installation in the outer zone is for this reason not possible and requires always complex planning procedures.
Solution: This problem could be easily solved by amending § 35 Federal Building Code. The paragraph should also enlist geothermal plants as privileged projects (Große 2009). Biomass and wind power systems are already privileged and it is not clear, why geothermal technology should be treated differently. Moreover, the status "privileged" does not mean that no approval procedure is necessary. The geothermal project still has to get permissions according to the Federal Mining Law, the Federal Water Act and the building laws of the German Federal States. Therefore, it seems reasonable to make such an amendment.

Regarding **hydro power systems** the following barriers were identified:

- In some Federal States, the expansion of hydro power systems is neglected during the planning process. Regional planning authorities set up regional water management plans that do not exploit the existing potential in an appropriate way (Longo 2010 II). This is explained with the requirement of European Directive 2000/60/EG)[14] that animals can move freely in the water. However, this requirement can be met also by other means.
  Possible solution: The planning authorities could introduce a systematic water cadastre to assess the potential of hydro power. The results should be taken into account when setting up regional water management plans.

[14] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Barrier 1.3 – Competing public interests

Regarding **biomass systems** the following barriers were identified:

Long duration of Environmental Impact Assessments: Associations have criticized that Environmental Impact Assessments can lead to application procedures which take up to 2 years (BEE 2009). However, in comparison to other countries these lead times are still relatively short (Ecofys 2008) and it is not clear how the Environmental Impact Assessments could be shortened without reducing the high requirements, which are necessary to guarantee the protection of the environment.

Regarding **onshore wind power systems** the following barriers were identified:

Environment: In general the balancing between the installation of wind power systems and the protection of birds or bats respectively seems adequate. The procedural requirements of the Environmental Assessment Act ("*Gesetz über die Umweltverträglichkeitsprüfung*") and the substantive legal specifications of the Federal Nature Conservation Act ("*Bundes Naturschutzgesetz*") provide a practical strategy to adequately approach the impacts of wind turbines on protected nature (BWE 2009). If problems come up they are usually isolated ones and no fundamental issues which can be usually solved in cooperation with the competent administrations (Oppen 2010).

Landscape protection: In some Federal States (for example Hessen) the protection of the landscape forbids the installation of wind power plants in a distance of 5 km to cultural monuments, if the plants are visible (Longo 2010 II).

Regarding **small and medium PV and solar thermal systems** the following barriers were identified:

- **Monumental protection:** The rules for monumental protection can seriously impede the installations of PV / ST systems on protected houses (Longo 2010 I). On the other hand, the buildings which are actually protected and suitable for the utilization of PV and/or ST technology amount to only 1,5 % of all German buildings (Zieske 2010). Therefore, regulations limiting the installation of RES systems on the roof of protected houses may be a serious barrier in the concrete case. However, they have only a very small effect on the development of the overall PV sector.

Regarding **hydro power systems** the following barriers were identified:

- **Ecologic requirements:** A study by ESHA also identified as main barrier long lasting permission procedures and ecological requirements especially for the protection of the aquatic life in river beds (ESHA 2007). According to ESHA the requirements stem from an inappropriate implementation of the Water Framework Directive 2000/60/EG)[15].

[15] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Possible solution: The assessment whether that directive has been implemented in an appropriate way goes beyond the scope of this study. However, it could be considered to monitor that implementation.

Barrier 1.4 – Lack of incentives for municipalities

As discussed above, municipalities are a decisive factor during the permission process. Therefore it is necessary to set incentives for municipalities to support the development of RES in their respective area. In this context it seems adequate to shortly point out the barriers for such incentives.

Regarding **tax law** the following barriers were identified:

- **Inadequate distribution of local business taxes:** The present distribution of local business does not increase the motivation for municipalities to support the development of RES technologies in their area. The revenue of local business taxes for the RES installations goes to the municipality which is the seat of the owner of the installations and not to the municipality in which the installations are located. As a consequence the location municipality does not really benefit from the installation of RES systems on its territory (BEE 2009). In case of wind power installations the regulations of the tax law have been adapted so that both municipalities receive a share of money. However, since it takes some years before operating companies are realizing profits, it takes some year before municipalities actually benefit from the wind park construction (Oppen 2010);
  Solution: The tax law should be modified to ensure that also the location municipality benefits from the RES project. This rule should be applied to all RES technologies. At the moment, there is a proposal for a law in the legislative process which embodies this idea (Longo 2010 II).

Regarding **municipal law** the following barriers were identified:

- **Restriction of economic activities:** In some Federal States the laws, which regulate the activities of municipalities ("*Gemeindeordnung"),* limit the economic activities of the municipalities. Municipalities are not allowed to conduct a certain economic activity if the economic goal could be also reached by a private actor. This restriction hinders municipalities to become participators in RES projects. Therefore they cannot directly benefit from the project (Karpenstein 2010).
  Possible option: One option to overcome this barrier is to modify the municipal law and to abandon the restriction at least to cases when it comes to investment in RES projects. Due to the complexity of municipal economic law, it would be necessary to examine this option more carefully.

3.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Is one stop-shopping possible?	Yes
2	Do authorisation procedures take into account the specificities of those renewable energy	Yes

	technologies?	
3	Are timetables and deadlines usually communicated and respected?	Yes
4	Time to be spent for administrative process (duration to get the main permits) (in weeks)	26
5	Number of administrations that must be contacted	8

3.3 Literature

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4 Issue 2 Technical Specifications

4.1 Main findings

The support schemes in Germany do not create barriers to trade or other impediments to the operation of the internal market. On the contrary, 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.

This approach is understandable, since Germany is a strong exporter of renewables technology and thus has a clear interest in reducing barriers to trade within and beyond the EU.

4.2 Introduction

This chapter analyses if the provisions of the renewables Directive 28/2009/EC concerning technical requirements are fulfilled in Germany.

Notably, following preamble:

> "National technical specifications and other requirements [...] in the field of technical standards and regulations [...] relating for example to levels of quality, testing methods or conditions of use, should not create barriers for trade in renewable energy equipment and systems. Therefore, support schemes for energy from renewable sources should not prescribe national technical specifications which deviate from existing Community standards or require the supported equipment or systems to be certified or tested in a specified location or by a specified entity."

and mainly Article 13 (2):

> "Member States shall clearly define any technical specifications which must be met by renewable energy equipment and systems in order to benefit from support schemes. Where European standards exist, including eco-labels, energy labels and other technical reference systems established by the European standardisation bodies, such technical specifications shall be expressed in terms of those standards. Such technical specifications shall not prescribe where the equipment and systems are to be certified and should not impede the operation of the internal market."

Renewable electricity in Germany is mainly supported through the feed-in tariff, which is based on the amounts of electricity generated. The renewable electricity act (EEG) does not define detailed technical specifications for the systems to be supported.

Art 13 (2) of the Directive is mainly relevant for renewable heating applications. Since this kind of renewables is often supported by investment grants, the legislator frequently defines the technical specifications, in order to avoid subsidising systems that are not state of the art and do not produce appropriate amounts of energy.

In Germany, the key support scheme is the federal "Marktanreizprogramm" (MAP, Market Stimulation Programme).

All details related to the technical, financial and other specifications of the MAP are published in the specific official guidelines ("Richtlinien zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien im Wärmemarkt"). This information can be found on the website of a Federal agency - BAFA at: http://www.bafa.de/bafa/de/energie/erneuerbare_energien/index.html.

The last version of the MAP guidelines has been published on 22 February 2010. The adjustments adopted in 2010 can be found here: http://www.bafa.de/bafa/de/energie/erneuerbare_energien/vorschriften/energie_ee_aenderung_richtlinien_vom_17022010.pdf.

However, most of the passages relevant for this chapter have not changed since the version of 2009: http://www.bafa.de/bafa/de/energie/erneuerbare_energien/vorschriften/energie_ee_richtlinie.pdf.

The MAP has been active for over a decade. During this time, it was constantly adapted to the evolving market situation. The continuity of its operation is remarkable, and has allowed the creation of a large market. However, due to budget constraints, the MAP has been stopped at the beginning of May 2010 (BMU 2010).

When local or regional authorities provide additional incentives, the technical specifications usually are based on those of the MAP, or in any case do not create any additional certification requirement (see for instance: L-Bank 2009, Hamburg 2009 I, Hamburg 2009 II). This is favourable to market development, as the RES-H system providers do not need to spend resources to comply with different requirements.

4.3 Description of possible barriers & solutions

Barrier 2.1 – Weak definitions
No barrier.

After 10 years of experience with the MAP, the definitions are very clear. In the past, when some ambiguities occasionally arose, the administration was very collaborative and efficient in tackling the issues rapidly.

Barrier 2.2 –Non-EU standards. or specified locations for testing and/or certification requirements

Solar thermal

In short: in practice, no relevant barrier exists

The main criterium for compliance with the technical specifications of the MAP is the European standard EN 12975. The minimal efficiency criteria (525 kWh / m² collector) can be certified based on the ordinary test procedure used to demonstrate compliance with EN 12975. Since 2010, the MAP requires the European certification of compliance with EN 12975, the "Solar Keymark" (BAFA 2010).

Additionally, there is a reference to a national label ("Blue Angel" eco-label for solar collectors). The MAP guidelines require compliance with the national standard RAL-UZ 73. RAL-UZ 73 is the implementation for solar collectors of the "Blauer Engel" eco-label.
This seems acceptable from the point of view of Art 13(2) of the Directive 28/2009/EC, because there is no comparable label at European or international level, and in practice it does not constitute any barrier.

The Blue Angel describes itself as "the first and oldest environment-related label for products and services in the world. It was created in 1978 on the initiative of the Federal Minister of the Interior and approved by the Ministers of the Environment of the federal government and the federal states. It considers itself as a market-conform instrument of environmental policy designed to distinguish the positive environmental features of products and services on a voluntary basis." (RAL 2010).
In the case of collectors, it examines the materials used in the collector, the fluids for the primary loop, the environmental impact of the production process, the efficiency and some other criteria.
See: http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=168.

Most of the criteria required to comply with RAL-UZ 73 can be fulfilled by a simple declaration of the producer. All information is available in English. Representatives of the industry confirm that this procedure does not represent any barrier (Nielsen 2010, Welling 2010). In the past, to prove compliance with RAL-UZ 73 it was necessary to own a certificate provided by the German certification body. Now certifications from any certification body accredited according to EN ISO/IEC 17025 would be accepted.

Biomass

According to the MAP guidelines mentioned above, a number of technical specifications apply to biomass systems. They are mainly related to the emissions and to the combustion process. All these specifications are expressed in terms of objective values. No reference is done to any specific non-EU standards.

Compliance can be demonstrated with a test certificate for the sample (Baumuster-prüfung) or through an individual expert option from an "appropriate body".

Heat pumps

According to the MAP guidelines mentioned above, most technical specifications for heat pumps are expressed in terms of objective values and of European standards.

The MAP supports only efficient heat pumps, defined as those with relatively high seasonal performance factors (SPF -Jahresarbeitszahl). In order to calculate the SPF, the MAP guidelines prescribe the use of the VDI guideline 4650 of 2009 (VDI 2009). This seems compatible with the Renewables Directive 28/2009/EC, since there is no equivalent standard at the European level (Nowak 2010).

To calculate the SPF, it is necessary to determine the COP of the heat pump. The latest amendment of the MAP guideline (February 2010) prescribes that, from 1 July 2010 onwards, the COP must be certified by an independent test institute. The MAP guideline of 2010 explicitly recognises the EHPA European Quality Label for Heat Pumps, which does not require any additional testing in a specific country.

4.3.1 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Are specifications expressed in terms of European standards (including eco-labels, energy labels and other technical reference systems), though such European references exist?	Yes

4.4 Literature

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RAL gGmbH (2009): Vergabegrundlage für Umweltzeichen RAL-UZ 7, March 2009 (http://www.blauer-engel.de/_downloads/vergabegrundlagen_en/e-UZ-073_2009.zip http://www.blauer-engel.de/_downloads/vergabegrundlagen_de/UZ-073_2009.zip)

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5 Issue 3 Building integrated technologies

The barriers related to small/medium scale RES technologies installed in or on buildings are very multifaceted. An assessment will thus be made on each group of barriers separately. Administrative barriers (permitting etc.) are covered under Issue 1, also when they relate to building integrates systems.

The second group of barriers relates to the neglect of the exemplary role of public buildings. In this regard, it is possible to notice certain efforts by the German public authorities to include RES into their buildings. Nevertheless, authorities could be even more ambitious by using all cases of energetic renovation for changing their energy supply completely to RES. A different problem is linked to the question, whether the RES systems on public buildings are noticed by the general public. This is often not the case. Further measures to ensure a better visibility of the usage of renewable energies in public buildings should thus be carried through.

The third group of barriers, barriers concerning tenancy and ownership law, have been so far mainly analysed with regard to the installation of solar thermal systems in multi-family houses (3 to 12 dwelling units) in Germany. The problems discovered will nevertheless also occur in the case of heat pumps and biomass boilers, as they are linked to the change of a conventional heating system to a heating system based on RES in general, independently of the RES technology. The main problems discovered can be assigned to three different areas: problems concerning the installation of the system, problems concerning the refinancing of the system and problems related to energy contracting. Even though certain weaknesses in legal regulations have been identified, the main solution seems to lie in awareness raising measures for tenants, thus preventing them of making use of the legal possibilities to hinder the installation of a renewable energy system on their building.

5.1 Description of barriers & solutions

5.1.1 Detailed description of the Barriers and solutions

The first group of barriers concerns problems connected with RES obligations. Since the beginning of 2009, the Renewable Energies Heating Law introduced a RES obligation on the federal level ("*Erneuerbare Energien Wärmegesetz*"[16]). It is thus still too early for

[16] Erneuerbare-Energien-Wärmegesetz vom 7. August 2008 (BGBl. I S. 1658), das durch Artikel 3 des Gesetzes vom 15. Juli 2009 (BGBl. I S. 1804) geändert worden ist[17] Bürgerliches Gesetzbuch in der Fassung der Bekanntmachung vom 2. Januar 2002 (BGBl. I S. 42, 2909; 2003 I S. 738), das zuletzt durch das Gesetz vom 28. September 2009 (BGBl. I S. 3161) geändert worden ist.[18] Bürgerliches Gesetzbuch in der Fassung der Bekanntmachung vom 2. Januar 2002 (BGBl. I S. 42,

thorough evaluations about its efficiency or possible problems. First rough assessments suggest a very positive picture of the obligation. The only major point of criticism mentioned is the fact that the obligation applies only to new buildings, and therefore does not cover the broad majority of the building stock. On the other hand, it is legally and politically problematic to oblige owners of existing buildings to make important investments, except they are making a major renovation anyway.

On local level, the municipality Marburg introduced in 2008 a so called "solar charter" ("*Solarsatzung*") (Longo 2010), which defined RES obligations on local level. The higher authority annulled the solar charter, the case is currently pending.

Barrier 3.1 – Renewables obligations insufficient

- **Only new buildings covered:** The German renewables obligation according to the federal Renewable Energies Heating Law applies only to new buildings. The federal law allows the different federal states ("*Bundesländer*") to introduce additional regional building obligations also for buildings undergoing refurbishment. However, only one state - Baden-Württemberg, has made use of this possibility so far. It adopted an own obligation that covers also existing building, in which the heating installation has been replaced. Some other federal states, among others Berlin, Bremen and Saarland, are considering the implementation of their own regional building obligation (Mayer 2010).
  Possible options*:* The different states could be encouraged by the German federal government to take Baden-Württemberg as an example and introduce regional building obligations, as well as assign authorities responsible for the execution of these obligations (BEE 2009).

  Another possibility welcomed by a number of stakeholders is the inclusion of existing buildings into the federal Renewable Energies Heating Law, at least in the case of major refurbishments or for all exchanges of heat systems. They prefer a clear and uniform regulation than several differing regional rules (BEE 2009, BWP 2009). This approach has originally been considered by the federal government, but was finally discarded due to the opposition of the traditional heating industry and of the building owners. They feared that building owners that are subject to such an obligation would delay their planned investments in a new heating system, thereby sharpening the existing backlog in this area. This would fire back in terms of the energy savings in general (Wustlich 2008). The example of the Baden-Württemberg should be monitored in order to see whether or not this concern will come true. If this widening of the obligation does not lead to delayed investments, an extension on federal level should be considered.

- There are several substituting measures defined in the EEWärmeG, which make it possible to avoid the use of renewable energy sources: an owner can take special and defined efforts for energy efficiency, make use of heat from CHP installations or from a district heating network. The first two exceptions are criticised by some renewable energy stakeholders (GtV-BV 2008);

- Information provision on the EEWärmeG can still be improved. In a survey, 82 percent of the respondents expressed the desire for more and better information on the law (Agentur für Erneuerbare Energien 2010).

Barrier 3.2 – Exemplary role of public buildings neglected

Where the use of photovoltaic and solar thermal systems on regional public buildings is concerned, huge differences can be noticed in the different German states. Baden-Württemberg, Bavaria, North Rhine-Westphalia and Hamburg have the highest number of installations, while Saxony-Anhalt is the least developed state in this regard (AEE 2008).

A very useful project idea, aiming at increasing the number of photovoltaic and solar thermal systems on public buildings, is the so-called "Solardachbörse" (solar roof exchange). This tool, introduced by the city of Berlin (see www.berlin.de/sen/umwelt/klimaschutz/solardachboerse/) as well as some other German cities, lists public roofs that are made available for private investors in the framework of energy contracting (AEE Berlin 2008).

- Renewable energy sources have been installed in quite a number of public buildings, particularly in certain areas of Germany. The differences among the Federal States are remarkable. However, it is not yet a widely used standard. For new constructions, and for the renovation of existing public buildings, the use of RES is neither required nor implemented to an appropriate degree. Individual cases of a successful integration of RES are promoted as flagship projects but can rather be considered as an exception, than really demonstrating a high engagement for RES (BWP 2009).
  Possible options*:* The renewable energy associations call for a complete switch to RES whenever public buildings are energetically refurbished (BEE 2009). Nevertheless the question arises, how these measures should be funded. A general law at federal level could not oblige all public authorities to do so, without providing the funds.

Barrier 3.3 – Tenancy law and ownership law impede development of building integrated RES technologies

- **Problems concerning the installation of the system:** According to § 554 of the German Civil Code ("*Bürgerliches Gesetzbuch*"[17]) tenants are in principle obliged to tolerate energy saving measures. This obligation only applies if the measures do not constitute a hardship for them. Whether a case of hardship occurs or not is determined through a weighing of interests between tenants and the landlord. These regulations lead to a number of barriers: It is legally unclear, whether the installation of a RES system is considered as an energy saving measure because RES replace the source of energy but it does not save energy. The law defines the legitimate interests of the tenants that must be taken into consideration, but not those of the landlord. Courts may thus take the interests of the tenants more into consideration than the interests of the landlords (Oppen 2009).
  Possible options*:* A clear definition of "energy saving measures" as "measures leading to savings in final and primary energy" should be introduced in the § 554 of the German Civil Code. This proposal is supported by the association of the building owners IVD, Haus & Grund, GdW, and by the solar association BSW-Solar).

In addition, the weighting of interests could be reformulated so that the interests of energy savings/ installation of RES systems usually prevail over the interests of the tenants (Oppen 2009).

- **Problems concerning the refinancing of the system:** According to § 559 of the German Civil Code the landlord has the legal possibility to refinance his investments into a RES system through increasing the rent. Nevertheless, the form of these rules does not encourage the landlord to make use of them and thus constitutes an investment barrier. One option for the landlord is to increase the rent to the typical rent for the area according to § 558 of the German Civil Code ("*ortsübliche Vergleichsmiete*"). This typical rent is determined through legally defined characteristics constituting the dwelling value. None of these characteristics take the thermotechnical characteristics of the buildings into account (Oppen 2009).
  Possible options: The thermotechnical characteristics should be legally defined as one of the aspects constituting the dwelling value. In addition, the usage of this aspect in the establishment of the rent index according to § 558c of the German Civil Code should be encouraged (Oppen 2009).

- **Problems related to energy contracting:** There is no clear legal regulation on whether tenants are obliged to tolerate energy saving measures carried out by energy service companies (ESCOs). In addition, arrangements on operating costs in rental agreements may pose problems. In case that there is no arrangement allowing for the allocation of costs of a commercial heat supply, tenants have to formally agree with the allocation of costs. Another problem is that according to § 93 of the German Civil Code the RES system may be legally considered as belonging to the estate, even if a third party installs it. These legal problems are joined by economic problems such as a small number of ESCOs operating on the market and psychological problems such as missing confidence due to the complexity of the service, "black sheep" and information deficits. All these barriers may hinder the assignment of ESCOs (Oppen 2009).
  Possible options: The barrier could be overcome with the help of a package of measures addressing its different aspects. From a legal point of view, tenants should have the obligation to tolerate building measures aiming at energy savings carried out by ESCOs. The controversial question on the possibility of cost allocation in case of commercial heat supply should be solved through legal provisions favourable to energy contracting. The issue of property could be solved by defining a renewable energy system as non-integral part ("*Scheinbestandteil*") of the building. As accompanying measures, targeted information in the form of model contracts and helpdesks would be advisable (Oppen 2009, BEE 2009).

5.1.2 Best practice elements and indicators

No.	Benchmark	Result
1	Is this installation type in normal cases exempted from an authorization procedure (building permit)?	Yes
2	Are legal-administrative requirements inadequate for this installation type?	No

No.	Benchmark	Result
3	Is there a Renewables Obligation that operates sufficiently?	Yes
4	Number of administrations that must be contacted	0

5.2 Literature

AEE (2008): Agentur für Erneuerbare Energien e.V./ DIW/ ZSW Stuttgart. Vergleich der Bundesländer: Best Practice für den Ausbau Erneuerbarer Energien Indikatoren und Ranking, Berlin 2008

AEE (2010): Agentur für Erneuerbare Energien. Bilanz nach einem Jahr Erneuerbare-Energien-Wärmegesetz: Häuslebauer nehmen Vorgaben gut an. Hintergrundinformation zur tns emnid-Umfrage unter 500 Bauunternehmen, Planungs- und Architekturbüros (www.unendlich-viel-energie.de)

BEE (2009): Bundesverband Erneuerbare Energien e.V. REPAP 2020. Ausbauprognose der Erneuerbare-Energien-Branche für Deutschland, Stand: 30. November 2009, Berlin

BWP (2009): Bundesverband Wärmepumpe e.V. 2009. BWP-Branchenstudie 2009, Szenarien und politische Handlungsempfehlungen

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Mayer (2010): Jörg Mayer, Agentur für Erneuerbare Energien e.V. Interview on 08.02.2010

PV LEGAL (2009): Reduction of bureaucratic barriers for successful PV deployment in the EU. Research findings for Germany, not published.

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Siegmund (2010): Thomas Siegmund,. Bundesverband BioEnergie e.V. Telephone interview on 18.01.2010

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Oppen (2010): Margarete von Oppen, Geiser & von Oppen Rechtsanwälte. Telephone interview on 29.01.2010

Wustlich (2008): Guido Wustlich. "Erneuerbare Wärme" im Klimaschutzrecht, ZUR (Zeitschrift für Umweltrecht) 3/2008, p. 113-168

6 Issue 4 – Promotion of energy efficient renewable energy equipment

6.1 Introduction

Purpose of this chapter is to verify if following provisions of article 13 (6) of the Directive are fulfilled in Germany:

Three main sources have been analysed for this chapter:

- The **Federal Renewable Heating Act** (Gesetz zur Förderung Erneuerbarer Energien im Wärmebereich) that creates an obligation to use renewable heating in new buildings. Technical parameters are defined, determining which renewable energy equipment can be considered as fulfilling the obligation. These are analysed below;
- The Federal **Energy Savings in Buildings Law** (Verordnung über energiesparenden Wärmeschutz und energiesparende Anlagentechnik bei Gebäuden), which is the main instrument of implementation of the Energy Performance of Buildings Directive in Germany. However, this law does not prescribe technical parameters for renewable heating equipment, since it focuses on the overall energy performance of buildings. Therefore, it does not contain provisions relevant for this chapter;
- **The market stimulation program (MAP) for renewable heating.** The provisions of Art 13 (6) of directive 28/2009/EC are limited to "building regulations and codes" and thus do not necessarily apply to support schemes, like the MAP. However, also financial support schemes applied only to efficient systems, or positively discriminating in their favour, can be an important instrument for the purpose of Art 13 (6). Therefore, in the following we also look at the relevant provisions of the main support scheme for renewable heating and cooling, the MAP (Marktanreizprogramm, see also above the chapter on Issue 2 for more details on the MAP). In general, the MAP contains a number of measures designed to promote the use of particularly efficient and/or productive renewable heating systems. A special bonus is designed for systems that are particularly efficient and/or produce particularly high amounts of renewable heating. The technical criteria are very detailed and cannot be summed up here (see chapters 11 and 12 of BAFA 2010).

Biomass

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.

For biomass, Art 9 of the MAP (BAFA 2010) sets following eligibility requirements for the basic support scheme:

- Burners with a nominal capacity up to 1000kW: burner efficiency ≥ 89% is required; moreover, a bonus is provided for condensing boilers and other items like the automatic alimentation of pellet boilers.
- Burners with a nominal capacity above 1000kW: they only need to comply with the general rules of Federal Immission Control Act (BMU 2002). These do not contain any requirement on the conversion efficiency of the combustion process. In this respect, Germany does not yet comply with the requirement of Art 13(6).

Heat pumps

For heat pumps, both the Renewable Heating Act and the MAP set clear minimum energy efficiency requirements. These are expressed in form of the Seasonal Performance Factor (SPF - Jahresarbeitszahl).

There is no formal reference to Commission Decision 2007/742/EC of 9 November 2007. However, it is argued by the German and by the European heat pump associations, that the current provisions of the MAP are adequate to promote the use of efficient heat pumps, as the calculation of the SPF is a better indicator for the efficiency of the heat pump system than the COP, as foreseen in the Decision 2007/742/EC (Nowak 2010).

The Renewable Heating Act also distinguishes between different kinds of heat pumps, and provides a bonus for heat pumps used in highly energy efficient buildings.

The MAP (BAFA 2010) prescribes a number of efficiency criteria as a condition for eligibility of heat pumps, among them:

- From January 2011 onwards, the circulation pumps must be particularly efficient (class A);
- Devices metering electricity/gas consumption and heat production must be installed;
- Evidence of a Seasonal Performance Factor of at least 4.0 for brine/water and water/water heat pumps in new construction.

As the EC renewables Directive has not yet been implemented, there is no reference to 2007/742/EC. However, all in all, the German policy framework clearly intends to promote particularly efficient heat pumps.

Solar Thermal

Both the Renewable Heating Act and the MAP (see also Issue 2) fully implement the provisions of Art. 13(6) of the Renewables Directive. The latter makes an explicit reference to the relevant European standards (EN 12975 and 12976) and to the relative European certification scheme (Solar Keymark).

No.	Benchmark	Result
1	Are the requirements of Art 13 (6) of the Directive concerning the promotion of efficient bioheat and heat pumps fulfilled?	Yes

6.2 Literature

BAFA (2010): Bundesamt für Wirtschaft und Ausfuhrkontrolle. Richtlinien zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien im Wärmemarkt, February 2010 and February 2009 (http://www.bafa.de/bafa/de/energie/erneuerbare_energien/index.html)

BMU (2002): Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Erste Allgemeine Verwaltungsvorschrift zum Bundes–Immissionsschutzgesetz (Technische Anleitung zur Reinhaltung der Luft – TA Luft) vom 24. Juli 2002

Nowak (2010): Thomas Nowak, Secretary General o fthe European Heat Pump Association (EHPA), telephone and email interview, March 2010.

7 Issue 5 Information/awareness raising

7.1 Introduction

Information and awareness raising measures with regard to renewables (RES) are in general widely available in Germany. On the whole, the general public shows a very positive attitude towards RES and insufficient information cannot be considered as a significant barrier anymore, at last if compared with other European countries.

Of course, there is still some potential for improvement, particularly with the purpose of motivating different kind of building owners, above all public and private investors, who own large numbers of rental houses, to invest in RES.

Information on support measures is in most cases made available online in a structured and comprehensible form by the public authorities and by the relevant industry associations. This is a non-exhaustive list.

www.foerderdatenbank.de
www.foerder-data.de
www.waerme-plus.de
www.energiefoerderung.info
www.solarfoerderung.de
www.unendlich-viel-energie.dewww.waermewechsel.de
www.res-legal.de (also covering the European level).

All together, there is a broad information offer on support measures on a national, regional and local level. Search functions allow different target groups for a structured investigation of the suitable programmes.

Significant differences can still be observed among different regions, concerning the delivery of online information on renewables. As best practice example, the state of North Rhine-Westphalia can be mentioned. A variety of regional websites and comprehensive, significant and up-to-date information on different aspects of the use of renewables and on support measures is available for various target groups. A good example is the website of the North Rhine-Westphalian Energy Agency: www.ea-nrw.de . According to a study of 2008, the least active federal states in this field were Saxony-Anhalt, Berlin and Mecklenburg-Western Pomerania, where information was insufficient, outdated, or not easy to be found (AEE 2008).

7.2 Description of barriers & solutions

7.2.1 Detailed description of the Barriers and solutions

Barrier 5.1 – Insufficient availability of information on support measures & of guidance for planners and architects

Generally the availability of information on support measures in Germany can be evaluated as sufficient. The information is normally available online. Numerous campaigns have taken and are taking place. Their target groups are both specialists (e.g. technicians, installers, architects) and the general public.

Nevertheless improvements would be possible and desirable. In general the information on renewable heating is less convincing than it is the case for renewable electricity (Mayer 2010 II). Most specialists within the building sector express the wish for better information, although their knowledge on this subject has been evaluated as good in the same survey (AEE 2010).

Barrier 5.2 – Insufficient public funding for campaigns/programmes

Public institutions in Germany have been very active in initiating and funding campaigns for RES, if compared with other European countries. At federal level, the main public, semi-public and publicly supported institutions active in the field of campaigning for RES in Germany are the Federal Ministry for the Environment, the German Energy Agency dena and the Renewable Energy Agency (Mayer 2010). In addition, many regional and local authorities started their own campaigns. The industry associations collaborate with these bodies and also initiate campaigns on their own.

Some examples of campaigns are:

"Germany has endless energy" (Deutschland hat unendlich viel Energie) - www.unendlich-viel-energie.de

The campaign is organised by the Renewable Energy Agency with support from the Federal Ministry of the Environment, the Federal Ministry of Food, Agriculture and Consumer Protection, as well as from companies and associations in the renewable energy industry. Total budget of the campaign accounts for one million Euro. Half of the funding comes from public sources, the other half from the industry sector. The campaign started in 2005 and aims at communicating the most important advantages of an energy supply system based on the different RES. The instruments chosen are manifold: information and news service, campaigns and events, advertising measures, an electronic newsletter as well as a website with comprehensive information (www.unendlich-viel-energie.de).

"Week of the sun" (Woche der Sonne) - www.woche-der-sonne.de

The annual campaign is organised by the Solar Industry Association (BSW-Solar) with support of the Federal Ministry of the Environment and numerous companies since 2007. Since 2010 the campaign is entirely financed by the solar energy industry. Each year, a huge range of actions is organised throughout the whole country during one week. With more than 5,000 actions, media coverage of over 1,100 articles and contributions and around 400,000 visitors, the campaign is the largest solar campaign in Germany (www.solarwirtschaft.de, www.woche-der-sonne.de).

"Heat pump action weeks" (Wärmepumpen-Aktionswochen) – www.waermepumpe.de
With a concept similar to the "Week of the sun", the German Heat Pump Association (BWP) together with the Federal Industry Association for Building, Energy and Environmental Technology (BDH) started an annual action week in 2008. In the first year, about 2,400 actions have been organised throughout the country (www.waermepumpe.de).

"Solar heat now!" (Solarwärme jetzt!) - www.solarwaerme-jetzt.de
„Solar heat now!" is a campaign of the German Solar Industry Association (BSW-Solar) and its members. Since 2007 it informs on the advantages of solar thermal heating (www.solarwaerme-jetzt.de, www.solarwirtschaft.de).

Barrier 5.3 – Insufficient campaign-/programme-design

- Successful examples for campaigns are so-called "action weeks" for different technologies, such as the "Week of the sun" (Woche der Sonne) or the "Heat pump action weeks". These weeks consist of a large variety of locally organised actions under a national umbrella campaign.
  Despite their success, certain possibilities for improvement still exist. It would be useful to further develop these action weeks in order to inform on renewable heat in a more concerted way. In this regard regional (federal states) authorities could play an important role (BEE 2009).

- **Local companies** involved in renewable energy business, especially those only delivering certain components, often are **not very well known** by the general public. However, a high level of familiarity with local companies would provide a good basis for the further diffusion of RES, as people tend to identify more with the regional construction of regionally produced RES systems.
  Regional branch days or open days in companies, addressing consumers as well as local decision makers, could help in making local companies better known (BEE 2009).

- **Disregard for the general public:** Campaigns often have been targeted exclusively at professionals and specialists. There are not enough **campaigns targeting the general public.** This issue mainly concerns the heating sector. There are some programmes of this kind, but they are not sufficient. The Renewable Energy Agency advises to create more end-user oriented campaigns, particularly in the heating sector, that overcome emotional barriers, when high involvement is needed (Mayer 2010 II).

- **Lack of knowledge:** Even though the general public shows a very positive attitude towards renewable energy sources, certain negative prejudices still persist. Common beliefs are for example that RES are too expensive, renewable technologies need more energy for production than they can produce over their lifetime, there is not enough sun/wind in the region, renewables on their own cannot cover our energy needs or that bioenergy leads to food shortages.

Information and campaigns should thus focus on overcoming these reservations through education on the real potential of RES (Agentur für Erneuerbare Energien 2009, forsa 2009, Mayer 2010 I).

- **Lack of idealism:** According to communication professionals active in the field, a critical aspect of several campaigns for renewables in Germany is that they are often very factual and "frigid". The lack of emotions and direct contact with citizens does not envourage enough people to take a personal effort and invest in renewables. According to this view, campaigns targeting the general public should be easier to understand, contain less technical and more emotional arguments, leading to impressions of "you can do something!"/" you can change something!". (Mayer 2010 II).

7.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Is sufficient information on support measures available?	Very positive

7.3 Literature

AEE (2008): Agentur für Erneuerbare Energien e.V./ DIW/ ZSW Stuttgart. Vergleich der Bundesländer: Best Practice für den Ausbau Erneuerbarer Energien Indikatoren und Ranking, Berlin 2008

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AEE (2010): Agentur für Erneuerbare Energien 2010. Bilanz nach einem Jahr Erneuerbare-Energien-Wärmegesetz: Häuslebauer nehmen Vorgaben gut an. Hintergrundinformation zur tns emnid-Umfrage unter 500 Bauunternehmen, Planungs- und Architekturbüros (www.unendlich-viel-energie.de)

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forsa (2009): Gesellschaft für Sozialforschung und statistische Analysen mbH. Umfrage zum Thema „Erneuerbare Energien“ 2009 (www.unendlich-viel-energie.de)

Mayer (2010a): Jörg Mayer, Agentur für Erneuerbare Energien e.V. E-Mail questionnaire on 15.01.2010

Mayer (2010b): Jörg Mayer, Agentur für Erneuerbare Energien e.V. Interview on 8.02.2010

Rodehorst (2010): Oliver Rodehorst, heat pump producer, NIBE Systemtechnik GmbH. Telephone interview on 28.01.2010

Siegmund (2010): Thomas Siegmund, Bundesverband BioEnergie e.V. Telephone interview on 18.1.2010

Websites:
www.solarwaerme-jetzt.de
www.solarwirtschaft.de
www.unendlich-viel-energie.de
www.woche-der-sonne.de

8 Issue 6 Certification of installers

8.1 Introduction

In Germany the education of installers occurs within the standard vocational education. This education is based on the so-called "dual system" ("*duales system*"); it consists of both theoretical training in a vocational school and practical education in a company. This education lasts between 2 and 3.5 years and ends with a country-wide uniform examination, organized and executed by a regional chamber of crafts ("*Handwerkskammer*"). After attending these trainings and passing the examination, one is a certificated installer and officially doesn't need any additional certification for installing RES systems.

The contents of this training are regulated in a general curriculum and specified on the Federal States level. At least 20 craftsmen professions are concerned when it comes to renewables. The installers that are particularly concerned are heating, ventilation, and air conditioning (HVAC) mechanics, roofers and electricians for power engineering and building systems:

- Training for heating, ventilation, and air conditioning (HVAC) mechanics covers the installation of combustion heaters in general, solar thermal systems and heat pumps;
- The electricians for power engineering and building systems during the education concentrate within RES on the PV systems;
- The roofers learn the installation of solar thermal and photovoltaic systems (Hahne 2010).

The training in the RES area is a part of the education of installers. The general curriculum for all these professions covers environmental protection in general. For the concerned professions, it also features the ability to install RES-systems. The Federal Institute for Vocational Education and Training ("*Bundesinstitut für Berufsbildung*") recommends trainees interested in RES to attend the education for one of the three professions mentioned above, and to apply for a practical training in a company specialized in the installation of RES systems. Otherwise the practical part of the education occurs within corporate vocational training (for the profession of a roofer it lasts only for one week) (Hahne 2010).

In the year 2007, more than 260,000 persons were trained in the concerned professions within the vocational education system. In 2008, 15,800 trainees achieved the master craftsman degree. In the same year nearly 4,000 people took part in further education courses (ZDH 2008).

Apart from the trainings offered by vocational school, there are also numerous trainings for a master craftsman or further education possibilities. These trainings also end with the examination organized by a regional chamber of crafts. Two qualification options within a further education for a specialist for RES installations are particularly successful: the education for solar technique specialists, focusing on ST and PV installations, and the demanding training for the accreditation "Solarteur". Till 2007 more than 1000 trainees gained this qualification. This more demanding education covers solar thermal, PV and also heat pumps. Especially in those three fields die chambers of crafts are going to offer new education possibility in the next year (Hoffschroer 2010).

Furthermore, some adaptation trainings are offered by diverse education provider and some manufacturer schools. They are yet strongly specified and limited to one technology.

Apart from the examination from the chambers of crafts, the implementation of common certification for all the RES technologies is planned. The German Heat Pump Association (BWP) in collaboration with the European Heat Pump Association (EHPA) developed a specific certification scheme for installers of heating pumps – EUCERT.

Best practice examples in the area of education of installers are the schools in Münster (training for specialist for solar technique – specialist for renewable and environmentally friendly energy technique HWK Münster) and Munich (educational centre for solar technique Munich), which offer a further education for interested installers (Hahne 2010).

8.2 Description of barriers & solutions

8.2.1 Detailed description of the Barriers and solutions

Barrier 6.1 - Lack of a certification scheme/body

Lack of specific uniform certification scheme: There is no uniform certification of installers which accounts specifically for the installation of RES systems. Instead, the following certification possibilities are given:

- The certification of installers occurs through country-wide uniform **examinations**. The examination takes place after finishing an education for installers in the dual system.that is offered by vocational school, training for a master craftsman or further education bodies;
- Competend bodies as the chambers of crafts offer further education certificates after finishing trainings in the further education system;
- Morevoer, installers can gain a specific qualification from a producer company (Hoffschroer 2010);
- There are also numerous trainings for the more demanding accreditation **"Solarteur",** which is a possibility to get a further education (Hahne 2010);
- For heat pumps, the German Heat Pump Association (BWP) in collaboration with the European Heat Pump Association (EHPA) developed the EUCERT scheme (Kirchensteiner 2010).

Barrier 6.2 - Lack of communication/information
This barrier is not relevant in Germany.

The German Confederation of Skilled Crafts (ZDH) finds the existing information on the training possibilities sufficient (Hoffschroer 2010). A list of numerous training possibilities is available online on the German Confederation of Skilled Crafts' website.

Barrier 6.3 - Lack of sufficient training possibilities
This barrier does not exist.

In general there are numerous training possibilities for installers in subject of RES installation. The installers have the possibility to attend the training in the dual system, training for a master craftsman or further education (Hoffschroer 2010). Morevoer, training possibilities are for example offered by the regional chamber of crafts ("*Handwerkskammer*") or directly by the manufacturer of the RES-systems. These offers cover both the general training and the specification for one of the RES-technologies.

Barrier 6.4 – Renewable energies not sufficiently covered by vocational training
The training in the RES area is officially a part of the education of concerned installers' professions. The training in the RES area is a part of the education of installers. 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 (ZDH 2008).

With the time renewable energies have been more and more sufficiently covered by vocational training. But there is still place for improvement.

Quality disparities: There are a lot of quality disparities on the regional and the individual basis between diverse chambers of crafts (Hahne 2010).

Lack of practical knowledge: The representative of a vocational school claimed that the education according to the new curriculum concentrates mostly on the ex-cathedra teaching and that the practical skills are not sufficiently covered (Kirchensteiner 2010).

Barrier 6.5 – Problems with the guarantee/warrantee/maintenance regime
With regard to implied warranties (national legislation governing the sale of goods) this barrier does not exist. The German implied warranty regime, which is regulated by the German Civil Code ("Bürgerliches Gesetzbuch"),[18] is in general in line with the requirements of the European directive 1999/44/EC[19] and efficiently executed by the German civil courts. Problems rather occur in case of express warranties, i.e. additional undertakings by producers. For instance, according to a recent report by a journal specialized on PV, most express warranties contain loopholes that make them useless (Podewils 2010).

[19] Directive 1999/44/EC of the European Parliament and of the Council of 25 May 1999 on certain aspects of the sale of consumer goods and associated guarantees.

Other barriers

The main problem concerning the training, education and certification of installers in Germany is the fact that older installers often don't participate in the further education. The quota of these participants should be raised. In other words the offer of lifelong-learning should be increased. This issue is not specific for the RES area, but concerns the whole spectrum of the further education offer in Germany (Hoffschroer 2010).

8.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Are certification schemes or equivalent qualification schemes available for installers?	Yes
2	Is sufficient training on RES provided during the standard education curriculum of installers?	Average

Best practice examples in the area of education of installers are the schools in Münster (training for specialist for solar technique – specialist for renewable and environmentally friendly energy technique HWK Münster) and Munich (educational centre for solar technique Munich), which offer a further education for interested installers (Hahne 2010).

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www.waermepumpe.de
www.wasserwaermeluft.de
www.zdh.de
www.bibb.de

9 Issue 7 Infrastructure Development

9.1 Introduction

The current situation of the electricity grid is quite positive. In 2008, the rate of RES plants for which the grid connection permission was rejected in 2008 laid between 0 % and 0.5 %, depending on the technology of the RES system (Bundesnetzagentur 2009). So far the infrastructure is compatible with high growth rates of RES. The availability and reliability of the transmission and distribution grids are very high in comparison with other countries.

Nevertheless, the development of the grid infrastructure has in the last years become a pressing issue for the growth of RES. The number of problems to integrate the electricity from the existing RES plants seems to increase. The amount of shortages in the transmission grid grew in the years 2007 and 2008 from 5 to 34. According to grid operators, this was mainly due to the expansion of RES capacities (Bundesnetzagentur 2009). In the North and Northeast Germany already situations occur when wind energy plants have to be shut down due to toolack of grid capacity. Until now this grid shortage occurs mostly in the distribution network (Forum Netzintegration 2010),

The most pressing issue however seems to be the question on how to transport the electricity from the offshore and onshore wind farms in the North of Germany to the industrial areas in the South and the West. These measures will lead to a completely new architecture of the grid: In the past the power plants were built close to the centres of consumption. Relying increasingly on RES technology the electricity must be harvested where its resources are available and then transported to consumption centres, which can be far away. The problem of the imbalance of a lot production in the North and more consumption in the South is intensified due to new fossil power plants in the north (Forum Netzintegration 2010).

The RES industry demands for that reason rapid optimisation and expansion of the grid in the short term, combined with the development of smart grid structures in the mid-term. The grid optimization and extension should lead by degrees to an infrastructure that suits a very high share of renewable energy supply (Forum Netzintegration 2010). In reality however, network optimisation or expansion planning has either not yet begun, or is behind schedule (BEE 2009). The current expansion of the grid is lagging behind. In second quarter of the year 2009, 159 expansion measures were foreseen; including 27 measures to connect offshore wind parks. According to the grid operators, 54 measures were delayed, which would amount to more than 1/3 of all activities (Bundesnetzagentur 2009).

Responsible for the development of the grid infrastructure on the extra high voltage level of 380kV are the transmission grid operators. Up to the present these grid operators were formally or informally identical to the main electricity suppliers (E.ON AG, Vattenfall Europe, RWE and EnBW Transportnetze AG). However, since the spring of 2010, this is about to change: E.ON Netz was renamed asTranspower and sold to Tennet in January 2010 as it was required by the European Commission; Vattenfall announced a similar transaction in March 2010. Now it is called 50 Herzt Transmission and belongs to Elia. The consequences of these transactions are not clear yet.

9.2 Description of barriers & solutions

9.2.1 Detailed description of the Barriers and solutions

Barrier 7.1 - Problems concerning development of electricity network infrastructures according to a long-term strategy

Assessment of demand: Germany is on a good way to assess the parameters for the coming expansion of the grid infrastructure. Most notably already in the year 2005 the Dena Grid Study prepared a forecast to which extent the grid had to expand to cope with the expected rates of RES development (Grid Study I 2005). The follow-up study (Dena Grid Study II), which will mainly focus on grid optimisation, is expected to be published by the end of 2010. Other studies are dealing with the constraints of the market or suggest strategies of how to realize the change to a smart-grid (Ecofys 2009).

Long-term strategy: An official concrete long-term strategy, in terms of an overall master plan that takes all these findings into account does not exist (Forum Netzintegration 2010). This is due to the distribution of responsibilities for the development of the grid: In Germany the grid operators and not the government have the initiative to plan and develop the grid infrastructure. The grid operators file the plan to the competent authority on Federal State level[20]. The Federal level is not involved in this process. Grid operators communicate among each other in their daily work. Up to now, a long-term strategy has not existed but has not been needed either.

Barrier 7.2 - Problems concerning grid expansion processes of existing electricity networks

The main barriers to the development of the grid infrastructure are as follows:

- **Civil protests against infrastructure development cause long lead time and uncertainty:** Protest groups or interest groups from the civil society are described as the main problem for the expansion of the grid infrastructure, i.e. the installation of overhead lines (Forum Netzintegration 2010, Bundesnetzagentur 2009). Their legal actions slow the building activities down. The motivations of the protest groups differ and can be categorized as follows (Forum Netzintegration 2010):
  - **Particular concern:** Some activists fear that the value of their real estate decreases or health risks are caused by electro-magnetic fields due to overhead lines (Forum Netzintegration 2010). Partly interests groups are showing here also

[20] Energiewirtschaftsgesetz vom 7. Juli 2005 (BGBl. I S. 1970 (3621)), das zuletzt durch Artikel 2 des Gesetzes vom 21. August 2009 (BGBl. I S. 2870) geändert worden ist

NIMBY attitude: In general they favour the expansion of the grid, but at the same time they do not want to be the group, which has to suffer disadvantages of it

- **Abstract values:** Some protest groups express concerns regarding nature conservation and landscape protection. In this point however, many civil groups show diverse opinions to the subordinate context: It makes a great difference for them, if the grid expansion is meant to support the development of an offshore wind park (positive) or of an coal plant (negative);
- **General discomfort:** Many citizens show a general discomfort, because they did not feel sufficiently involved during the planning phase. This is also due to the complex and non-transparent planning process, in detail:
  a. not all data, that are important to understand the planning process are published;
  b. the deadline for the participation are too short;
  c. alternatives are not discussed openly;
  d. technical and legal contexts are not adequately explained;
  e. the actual needs for the expansion of the grid are not satisfactorily explained to the citizens.

- **Possible Option:** It is obvious that it is not possible to develop a simple solution for such complex social problems:
  - **The reduction of legal means,** which protest groups can apply, may help in short-term. However, it embodies the risk that the expansion of RES in general will lose their reputation. Moreover, protest groups may find other means to express their hostility towards infrastructure activities (demonstration, sit-ins, etc.), which can also reduce perspectives and legal securities of the infrastructure development;
  - **More involvement:** A more laborious, but at the same time more sustainable alternative seems to be a better involvement of the protest groups through:
    a. **better explanation** of the technical principles and the planning process;
    b. **extensive publication** of the data which is used during the grid-development process in the internet such as environmental surveys and studies and
    c. Clear differentiation in the grid development plans which new lines are necessary for the development to an energy supply based on RES.

    The involvement will not spirit all protests away, in particular not the protest by NIMBY activists. Nevertheless, it could reduce the amount of citizens who reject the development due the general discomfort. This shrinks the group of opponents to the extend, where it does not reach the critical mass that leads to open protest;
  - **Utilization of underground cables:** In some cases the group of protesters is too big to be reduced by more involvement or modification of judicial means. In these cases it is necessary to look for less objectionable alternatives. One alternative would be to use underground cables. These prevent the visible disturbance of overhead lines. For that reason they are extremely popular among citizens and are seriously considered by the government: The Law for the Construction of Energy Lines ("*Gesetz zum Ausbau von Energieleitungen*") makes it for grid operators more easy to use underground cables in certain regions. Many representatives of the RES industry regard underground cables as the best solution and demand their utilization for high-voltage level as standard and for extra-high voltage in sensitive regions (BEE 2009). At the moment, it is

not clear whether a broad deployment of underground cables at extra-high voltage level is technically possible. Moreover, underground cables, especially on extra-high-voltage level, increase significantly the costs of grid development. A cost explosion which has to be paid by all energy users could damage the general reputation of RES. On the level of high-voltage grid (110kV) the utilization of underground cables is state of technology. Although they are more expensive than overhead lines the overall cost difference between both alternatives tends to zero because decreased protests lead to a faster and thus cheaper finalization of the project (Forum Netzintegration 2010).

- **Lack of financial incentives for development of grid infrastructure and innovative measures:** The grid operators have no financial incentive to invest in the construction of an innovative grid infrastructure. The grid operator has to bear the costs for the expansion, which will be distributed among all final customers through apportioning the costs to the grid usage fees. In order to control the costs for the grid users the relevant law, the Incentive Regulation Decree ("*Anreizregulierungsverordnung*") stipulates that grid operators must always use the most efficient method when developing the grid infrastructure. The Federal Network Agency ("*Bundesnetzagentur*"), which regulates the costs of the grid usage fees, intents to keep the raise of usage fees as low as possible. Therefore, it defines "efficiency" by mainly quantitative parameter; the least expensive way is the most efficient. This definition hinders long-term or innovative investments from grid operators. For such measures additional funds are available. However, the grid operators evaluate the rules to get this funding as being too restrictive (Forum Netzintegration 2010).

  Possible Option: An option to overcome this problem is to apply more qualitative parameter for the evaluation of efficiency. If for example the grid operator is applying technologies which accelerate the infrastructure development (such as underground cable) the Federal Network Agency should take this into account when assessing whether or not the expenses by the grid operator are efficient.

  Another option would be to create a public Federal Grid AG, which will be responsible for all further investments (Forum Netzintegration 2010). Considering the ongoing transactions of grid operators this alternatively seems quite unlikely.

Barrier 7.3 - Problems concerning development of a Trans-European Electricity Network

Lack of coordination: The lack of coordination is currently the main barrier for the development of a Trans-European Electricity Network. The areas which need more coordination are:

- **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) support schemes to clarify which shares of RES of 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 various approval procedures (different time limits) in the particular Member states (on national or even regional level) (Ecofys 2009). 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 more in regional planning and establish common guidelines in order to mitigate this barrier efficiently.

9.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Is the lack of developed grid preventing the grid connection of RES installations?	Only in case of offshore Wind power
2	Does the distribution of costs for the development of the grid in order to connect the RES installation prevent the RES installation?	No

9.3 Literature

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10 Issue 8 Power Grid Issues

10.1 Introduction

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.

10.2 Description of the barrier

10.2.1 Detailed description of the Barriers and solutions

Barrier 8.1 - Problems concerning grid connection

In general the RES industry evaluates the **conditions for the connection** to the grid as good. RES plants generally enjoy privileged and preferentially connection to the grid. The rate of RES plants for which the grid connection permission was rejected in 2008 is very low: 0,0 % - 0,5 % depending on the technology of the RES plant (Bundesnetzagentur I 2009). The German rules are in general very favourable for the RES installer.

Nevertheless, the rules, which regulate the conditions for the connection to the grid are sometimes complicated in the individual case: according to Section 5 of the Renewable Energy Sources Act, the Grid Operator has to connect the RES system without delay. In case of need, the grid operator is also obliged to expand the grid without delay unless the expansion is economically unreasonable (Section 9 Renewable Energy Sources Act). The main barriers are as follows:

- **Priority connection:** From the legal point of view the Renewable Energy Sources Act requires priority connection of RES installations that must take place without delay. If grid operators do not fulfil this duty, they are liable to compensation for damages. In practice, it seems that delays of grid connection have recently increased (BEE 2009, Ecofys 2009). It is still unclear if the grid operators have changed their attitude towards RES installations or if the capacities of the grids were overloaded; the number of applications for grid connection strongly increased during 2009 (BEE 2009, PV LEGAL 2010);

- **Distribution of costs:** The distribution of costs for the connection of the RES plant is an important factor for the feasibility of the whole project. The plant operator bears the costs of connecting the plant to the technically and economically most favourable

point of the grid (connection point) as well as the costs of the necessary measuring devices (Section 13 Renewable Energy Sources Act). The grid operator bears the costs for the development of the grid (Section 14 Renewable Energy Sources Act). Since the distribution of costs depends on the exact location of the connection point, this issues has been object to a constant discussion for the last years (Longo 2010). The current definition in the Renewable Energy Sources Act has been widely criticized, as its structure is unclear and the term "connection point" is defined in an ambiguous way, which leads to legal uncertainty. In the end, the precedent definition according to the former Renewable Energy Sources Act of 2004 seemed more clear (Oppen 2010, Law firm 2010 I).

- **Lack of grid expansion:** The grid has not enough capacity to take up the electricity generated by RES. Apparently this problem is particularly severe with regard to wind plants in Schleswig-Holstein and PV plants in Bavaria: the mass of new installed plants partly threatens to overload the medium voltage distribution network (Forum Netzintegration 2010). This leads to long connection times (BEE 2009). The general obligation of the grid operators to expand the grid applies only when the expansion is "economically reasonable". This term is not clearly defined and is often interpreted against the development of RES. Especially operators of small RES systems face difficulties due to the unclear definition of this term. (Oppen 2010);

- **Grid connection process lacks of transparency:** A serious barrier, especially for small projects, is the insufficient transparency during the grid connection process. The applicant cannot review procedures and requirements of grid operators. Those are mainly internal (Oppen 2010) and based on discretionary regulations, which are set up by the grid operators themselves (PV LEGAL 2010). It seems that the lack of transparency has decreased recently (BEE 2009). It is problematic how this problem could be resolved. Lawsuits are not really helpful in the individual case, because they would only lead to prolonging the time of connection and this would be disadvantageous due to the degression of the German Feed-in-Tariff (Oppen 2010);

- **Inadequate technical requirements:** Some technical regulations include requirements, which make the connection of RES installations more difficult. The core of the problem seems to be the fact that these technical requirements are defined by boards, which are dominated by grid operators (PV LEGAL 2010);

- **Disadvantage for small installations:** Some technical and legal requirements from grid operators are specifically disadvantageous for small operators, because certain costs and efforts (such as duration of connection, leasing of devices, costs for reactive energy, ambiguous contracts by grid operator) are more difficult to bear for them (Oppen 2010);

Regarding **offshore wind power installations** the situation seems quite special:

To ensure the grid connection, the grid must be developed simultaneously to the construction of the wind park. The grid development takes about 3 years and requires large investments. From the legal point of view grid operators are obliged to develop the grid, so that it is possible to connect the offshore wind park the moment the wind farm is

ready to start operation. The grid operator has to bear the costs for the connection which will be distributed among all final customers by apportioning the costs into the grid usage fees (Wustlich 2007). The Federal Network Agency ("*Bundesnetzagentur*"), which regulates the costs of the grid usage fees intents to keep them as low as possible. This constellation can lead to the following problems:

- **"Chicken and Egg" problem:** The grid operator must make large investments to provide the wind parks with the needed grid connection. The decisions upon such investments must be taken at a time, in which it is not yet absolutely certain if or when the wind park will finally come into existence. The developer of the wind park on the other hand needs the decision that the wind park will be connected to the grid in time to get the financing for the wind park. As a result both conditions depend on each other. In the past it had been unclear in what extent the wind park must be developed so that the grid operator could expect to reimburse his costs. The Federal Network Agency was quite restrictive and risk-avers in giving permissions; this slowed down the wind offshore process (Forum Netzintegration 2010). However, the agency has recently defined these conditions more clearly in a position paper (Bundesnetzagentur II 2009, Prall 2010);

- **Difficulty of sustainable investments:** In the past the rigid cost policy of the Federal Network Agency made strategic and sustainable investments from the grid companies more difficult. A typical example was the development of joint links. Joint links allow for the connection of several wind parks to one common grid and reduce the overall costs for all connections. The first connection however, would be more expensive. At the beginning it was not clear to the grid operators, under which conditions they could apportion the costs for the development of such joint links. The position paper of the Federal Network Agency defines these conditions (Bundesnetzagentur II 2009). These criteria are regarded as very strict, but the industry accepts them for the time being and will monitor the process (Prall 2010).

Barrier 8.2 - Problems concerning grid access

In general the RES industry evaluates the **conditions for the access** to the grid as good:

- **Priority grid access is guaranteed** through **clear and strong regulations:** The 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 calculable costs for market actors. The priority access also reduces the influence of the existing grid companies monopole (BEE 2009);

- **Curtailment of RES installations:** The Renewable Energy Sources Act uses the term “Feed-In management” ("*Einspeisemanagement*") in regard to “curtailing” of RES installations. In the beginning of 2009 Germany has overhauled the respective rules in the Renewable Energy Sources Act.
  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);
- compensates operators of RES & CHP installations in case of Feed-In management (Sections 11, 12 Renewable Energy Sources Act).

Since the rules are still quite new, systematic barriers in this regard have not been reported yet (Oppen 2010).

Parallel to these rules of the Renewable Energy Sources Act, which apply specifically to RES and CHP installations, there are also general rules on the curtailment of electricity installations. These apply to all electricity installations, regardless which energy source they use (RES or fossil resources). They are laid down in Section 13 of the Energy Industry Act ("*Energiewirtschaftsgesetz*"). These rules can lead to diverse consequences for RES installations. The correlation between the Feed-In management according to the Renewable Energy Sources Act on one hand and the curtailment rules according to the Energy Industry Act on the other hand is not completely clear (Schumacher 2009). This may lead to legal uncertainty. For the time being grid operators are applying both regulations when curtailing RES installations (Forum Netzintegration 2010.

- **Further options:** Apart from the existing regulations the following steps may be taken in order to reduce the danger of curtailment:
  - **Use of technical solutions:** Technical solutions such as temperature monitoring, and use of high temperature conductors would help to fully utilize 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 on regional level so far. They should be expanded to cover the national grid (BEE 2009);
  - **Development of good forecast systems** would also help preventing curtailment (BEE 2009);
  - **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 (BEE 2009).

Barrier 8.3 (former barrier 9) - Problems concerning TSOs and DSOs

Grid operators which are at the same time energy suppliers have an economic disadvantage, if they connect RES installations of independent suppliers, because this makes the sale of their electricity more difficult and increases the number of their competitors and may lead to grid expansion costs. For this reason it seems understandable that grid operators are interested to prevent connection of new installations (Ecofys 2009). Due to the unbundling of companies into electricity suppliers and grid operators and increased experiences this barrier seems to diminish (Forum Netzintegration 2010,

Law firm 2010 II). Moreover, at least with regard to the connection of offshore wind power plants, no preference of installations belonging to the grid operator has been observed (Prall 2010 I).

10.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Are there sufficient rules to ensure the priority of grid connection?	Yes
2	Are there sufficient rules to regulate dispatchment in an adequate way?	Yes

10.3 Literature

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11 Issue 9 Gas Network Issues

11.1 Introduction

Germany is one of the leading countries in the use of biogas, and at the same time a pioneer in terms of the injection of biogas into the natural gas grid. However, also in Germany this is still quite a new issue. Nevertheless, a rather efficient set of rules has been established throughout the past years in order to ensure good conditions for grid access for biogas. The main barriers seem not be lying in missing or prohibitive legal regulations but in the lack of cooperation on the side of the grid operators. For this reason, it may be most promising to find ways of encouraging grid operators to adopt a more positive attitude towards biogas, e.g. through involving them, as well as gas utilities, into biogas projects in order to gain their acceptance. In addition, certain changes to the legal framework might also be useful, even though some solutions might only come up at a later stage of the current learning process.

11.2 Description of barriers & solutions

11.2.1 Detailed description of the barriers and solutions

Barrier 9.1 – Problems related to the upgrading process

- Grid operators ask for **very strict technical minimum standards** concerning the biogas quality as a prerequisite for grid injection. Legal provisions, barely prescribing "technically compatible gas", give a large scope of interpretation. The very high costs of the procedure of upgrading biogas to the quality of natural gas, as well as little quality margins constitute a burden for biogas system operators (Klinski 2005).
  Possible solutions: As one solution to this problem, the shifting of the compatibility requirements from the entry point to the exit point is discussed. This would mean that the responsibility for upgrading will be transferred from the biogas system operator to the grid operator (FNR 2006). The latter would probably pass the costs on to the final consumers in a further step. This is quite a controversial idea, as the general public would bear a huge share of the costs of biogas development, while biogas system operators might make excessive profits due to oversubsidising (Interview Thole 2010).

  A different approach would consist in loosening the compatibility requirements for biogas (FNR 2006). In this regard, a balanced solution would have to be found, taking into consideration the interests of the biogas system operators to have a larger margin concerning biogas quality, as well as those of the grid operators interested in the injection of high quality gas due to technical reasons.

Barrier 9.2 – Lack of information

- Biogas system operators are confronted with a **lack of information on grid conditions.** This makes the planning phase of biogas systems unnecessarily complicated, as it is not possible to take the grid conditions into consideration for the choice of an ideal location. The suitability of the location can only be determined after the grid operator has given its assessment on a formal request. This procedure creates significant upfront costs that in case of refusal can prove to be useless.

  Possible solutions: Publishing information on the current grid conditions as well as on plans for grid expansion would enable biogas system operators to make a pre-choice of suitable locations before investing resources into filing a formal request for connection. The requests could then be evaluated quicker and in a more cost-efficient way (Fachverband Biogas 2009, Interview Thole 2010).

- Biogas system operators in Germany are highly interested in using the produced biogas for electricity generation in cogeneration units, as this offers the possibility of benefitting from the feed-in tariffs set in the Renewable Energy Sources Act (EEG). A problem in this regard is that biogas system operators encounter **difficulties in finding cogeneration units** open towards shifting to biogas, as they lack information on their location.

  Possible solutions: This problem could be easily solved through obliging gas grid operators to make information on the location of cogeneration units publicly accessible (BEE 2009).

Barrier 9.3 – Inefficient authorisation procedures

- **Authorisation procedures for grid access** are sometimes **unnecessarily long-lasting,** especially for independent biogas system operators not cooperating with energy suppliers. This is mainly due to unclear legal provisions, resulting in tedious negotiations on the exact conditions for grid connection between system and grid operators. The main controversial issues are questions concerning gas quality requirements (see also Barrier 9.1), as well as the distribution of costs of grid connection.

  Possible solutions: More detailed legal provisions would help in minimizing the scope for interpretations and thus the potential for conflict. The idea of setting certain standards for grid connection has already been taken up by the Federal Network Agency (Bundesnetzagentur) but has not yet been put into practice (Altrock/Thole 2009, BEE 2009, Interview Thole 2010).

- Grid operators show a certain tendency to charge biogas system operators **excessive costs for the grid connection assessment.**

  Possible solutions: This practice could be prevented with the help of stricter controls by the regulating authority (Interview Thole 2010).

- The **Federal Network Agency** functions as an arbitrator in case of disputes between grid operators and system operators. Its decisions concerning grid access and biogas accounting are not legally binding and often **not transparent and unpredictable.** The resulting insecurities hinder investments.

  Possible solutions: New provisions should be introduced in the Energy Industry Act (EnWG) and the Gas Grid Access Ordinance (GasNZV), obliging the Federal Network Agency to give advance ruling on request of a market actor (Fachverband Biogas 2009).

- Current legal provisions on grid connection encourage the biogas system operator to choose the **shortest distance for connection.** This is of course convenient for the biogas system operator, who currently bears only 50 % of the cost of the connection up to a pipeline length of 10 km where at the same timethe full costs for all parts of the pipeline exceed this limit. However, the shortest way is not always the best one from a general economic point of view. Sometimes, it may be more desirable to construct a slightly longer direct connection to the upstream grid level than a shorter connection to the nearest pipeline.

  Possible solutions: A solution to this problem could consist in an obligation to choose the economically most suitable connection point when taking into consideration the gas grid development. To avoid an excessive economic burden on the biogas system operators, instead of applying the current cost-sharing rules, they could bear only 50 % of the costs for the distance that would have been the shortest possible one. The remaining costs could be taken over by the grid operators and would thus, in a further step, be borne by all end consumers (Interview Thole 2010).

- The **distribution mechanism for the connection costs** between grid operators is considered as being rather **inefficient.** Currently, the costs are only distributed between grid operators belonging to the same market area. This could lead to increasing problems in case of rising biogas injection combined with an unequal geographical distribution of biogas systems (Altrock/Thole 2009).

  Solution: This could be solved through a nation-wide cost distribution system similar to the one in the Renewable Energy Sources Act.

Barrier 9.4 – Insufficient cooperation of grid operators

- **Biogas plants not (partially) operated by gas suppliers encounter problems** with regard to grid access due to missing acceptance on the side of the grid operators.

  Possible solutions: For this problem, a variety of proposals exist. The first type of solutions focuses on the extension of priority rules for biogas and obligations for grid operators. For biogas, a feed-in law similar to the Renewable Energy Sources Act (EEG) could be implemented with an obligation to connect, purchase and transmit (BEE 2009). Possible alternatives could be a biogas quota obligation for gas suppliers, privileged access for biogas to storage facilities, a priority allocation of capacities in an "entry-exit-model", or an obligation for grid operators to realise energy efficiency projects (FNR 2006, Interview Thole 2010).

The second type of solutions is developed according to a different point of view. Its supporters share the opinion that legal provisions on grid access for biogas are on the whole satisfying and even when making them stricter, grid operators will always find gaps that allow them to block the connection of a biogas plant if they want. It may thus be more promising, to find ways of encouraging grid operators to cooperate with biogas system operators. This could for example be done by incorporating biogas projects into larger regional development concepts or by supporting joint projects between farmers and regional or local gas utilities (Longo 2007, Interview Thole 2010).

Other barriers

- The **segmentation of the gas market into market areas** ("Marktgebiete") poses barriers to the injection of biogas into the grid. In special biogas balancing groups, (consortia assembling only biogas producers and acting as interface between grid users and grid operators), the small number of market actors makes it difficult to share the risks connected to gas volume, structure and price. An additional restriction arises through the high number of market areas. The balancing between entry and exit points is only possible in a limited way, which makes it difficult to balance the volatile feed-in of biogas from one biogas system through other biogas systems.

  Possible solutions: The establishment of one market area per gas quality, with the following characteristics is being proposed: free allocation of entry and exit capacities across Germany, deviation only in case of enduring bottlenecks, grid operators shall be required to eliminate enduring bottlenecks. For a transition period, a transitory system (e.g. accounting across market areas) should be established (Fachverband Biogas 2009).

- The **infrastructure of the German gas grid** is in general very well developed; some measures to increase the gas grid capacity for biogas could nevertheless still be taken. **Possible Solution:** Through very simple measures such as the energy recovery into higher pressure stages, the capacity of gas grids with low pressure stages could be increased (BEE 2009).

11.2.2 Best practice elements and indicators

No.	Benchmark	Result
1	If green certificates and/or subsidies for biogas are in place, do they de facto make unattractive to feed green gas into the grid due to the high level of subsidy for biogas used for electricity generation?	No
	Are the costs of grid connection for producers of gas from renewable energy sources objective, transparent and non-discriminatory?	Negative

11.3 Literature

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12 Issue 10 District Heating

12.1 Introduction

The status of District Heating in Germany is ambivalent. In absolute terms, i.e. measured by the amounts of heat delivered, Germany is, together with Poland the biggest market for District Heating in the European Union. However, this is mainly due to the size of the country. In proportion to the population, district heating is not very widely used in Germany. While Eastern and Northern European Countries achieve a penetration of district heating between 40 % and up to more then 70 %, in Germany only 13% of the residential units are covered by district heating (DLR 2009). This share is unevenly distributed. It is around 9 % in West-Germany and around 30 % in East-Germany.

The share of renewable energy sources in the heating market was at around 6.6 % in 2007 (Ecoheat4EU 2010).
These numbers show that there still is a large potential both for increasing the penetration of district heating in Germany, and for increasing the share of renewables in district heating systems.

12.2 Description of barriers & solutions

12.2.1 Detailed description of the Barriers and solutions

Barrier 10.1 – Lack of positive conditions for the increase of the share of renewables in existing DHC systems

Approximately 84 % of District Heating is generated in Combined Heat and Power. Natural gas and hard coal are the main types of fuel being used in Combined Heat and Power with biomass gaining in importance (Ecoheat4EU 2010). The potential of DHC is estimated differently, depending on the question to which extends local heat is taken into account and which sources are used. According to a study by the Federal Ministry of Environment which assumes a wide use of RES in local heat systems DHC can gain a share of 50 % of overall space heating and hot water (Nitsch 2007).

Most of the conditions which hinder such an increase of the share of RES in existing DHC systems are related to cost and technical issues (high investment costs and logistical problems due to low energy density):

- **Insufficient support scheme:** The current German support schemes do not provide sufficient incentive for increasing the share of RES. The main German support scheme for renewable electricity, ("*Gesetz für den Vorrang Erneuerbarer Energien* [21]) provides no direct incentive for district heating, but it incentives the utilization of CHP-biomass plants with an additional bonus. However, the support is limited to a maximum of 20 MW and does not support co-firing, but only the exclusive utilization of biomass;

- **Security of biomass supply:** Biomass fuel prices are not predictable. The security of supply and the availability of biomass were identified as main barriers for the use of these sources in DHC (Ecoheat4EU 2010). This insecurity can be partly explained with political faults: The current biomass policy lacks an overall strategy (Bap Driver 2009), this makes resource planning more difficult;

Structural problems: Another set of problems could be subsumed as structural problems. For many district heating operators, the use of renewables does not seem the top priority.

- **Lack of experiences:** Relatively new technologies, such as solar thermal technology, face the barrier that the market lacks of experience and standards. The use of ST is still seen as very unusual. Therefore, most district heating operatotrs are still reluctant to use such a special solution (Pauschinger 2010).

- **Third party access:** Traditionally, DHC networks are operated as a natural monopoly by an operator who, at the same time, also generates the heat fed into the network. Third parties are not allowed to feed (renewable) heat into existing DHC networks. Some experts regard the lack of a regulatory framework explicitly allowing for third-party access as a barrier. According to other stakeholders, mandatory third party access would be a potential threat to the market position for DHC. Security of supply, maintaining technical compatibility (for instance pressure and temperature levels) and higher costs for customers are some of the main concerns in this regard (Ecoheat4EU 2010).
  Similar arguments were used two decades ago against the liberalisation of the electricity markets. However, the analogies are limited, because DHC networks are by their nature relatively small and therefore they may not provide the depth for a real competition among different generators. An assessment of the risks and opportunities of a (legally mandatory) third party access would go beyond the scope of this study. Policy makers and stakeholders may consider examining this point in more detail.

[21] Erneuerbare-Energien-Gesetz vom 25. Oktober 2008 (BGBl. I S. 2074), das zuletzt durch Artikel 12 des Gesetzes vom 22. Dezember 2009 (BGBl. I S. 3950) geändert worden ist.[22] Verordnung über Allgemeine Bedingungen für die Versorgung mit Fernwärme vom 20. Juni 1980 (BGBl. I S. 742), die zuletzt durch Artikel 20 des Gesetzes vom 9. Dezember 2004 (BGBl. I S. 3214) geändert worden ist

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

The main barrier for the initiation and expansion of DH system seem to be cost issues: High investment costs, which are associated with DHC, do not fit to the current market conditions that rely on quick return of investment (Ecoheat4EU 2010). One of the key issues is how to guarantee a sufficient demand that makes the investment in DHC infrastructure profitable. DH systems require a minimum connection density and heat consumption to be profitable:

- **European Union Emission Trading Scheme:** In this context the European Union Emission Trading Scheme, which applies to DHC systems but not to small systems (below 20 MW) is considered as a main barrier, because it distorts the market in favour of individual heating devices, that are not subject to the emission cap, whike DHC heat generators in many cases are (Ecoheat4EU 2010). On the other hand, Emission Trading may be also regarded as an opportunity to increase the share of RES in DH systems.

- **Lack of compulsory connections scheme:** In order to guarantee a sufficient connection density, market stakeholders suggest a compulsory scheme, which requires new buildings to be connected to a local heating network (BEE 2009). In fact most of the German municipal codes (“*Gemeindeordnung”)*, which are enacted by the German States, allow municipalities to introduce such compulsory schemes (*“Anschluss- und Benutzungszwang”)*. In the past, legal insecurity was created by the fact that only few municipal codes explicitly stated that the compulsory scheme could be introduced for the purpose of climate protection. The introduction of a federal regulation in § 16 German Renewable Heating Act, should have solved this barrier (DLR 2009).

- **Stranded Investments:** The realization of a DHC project is only economically feasible if a great share of the generated heat is utilized from the very beginning. Therefore, it is not possible to wait until existing heating systems are old enough to be replaced by a connection to the DHC. Thus, it may happen that also relatively new heating systems have to be replaced. This results in stranded investments (DLR 2009);

- **Competition with thermotechnical refurbishment:** Currently, there is an ongoing discussion whether or not thermotechnical refurbishment (increased insulation and other measures that reduce heat demand) will make investments in DHC unattractive in the medium term. In March of 2010 the Technical University of Berlin published a study claiming this development would strongly reduce the advantages of DHC projects by 2030 (TU Berlin 2010). However, other experts do not subscribe to this point of view. They assume that the thermotechnical refurbishment would take much longer and would lead to additional positive effects. For these reasons, they do not consider thermotechnical refurbishment as a real barrier to the dwvelopment of DHC networks (DLR 2009);

- **Demographic development:** Another risk related to insufficient heat demand is the demographic development. The expected decline in population in Germany may decrease the heat demand and thus make investment in DHC less profitable. However, according to experts it is still unclear whether such a decline is actually happening. Moreover, currently there is a strong tendency towards an increase of the residential surface per capita. Thus, a demographic decline does not necessarily lead to a reduction of heat demand (DLR 2009);

- **High costs for consumer:** DHC has the reputation of being quite expensive. This is partly due to the fact that in case of DHC the costs are calculated as effective energy. Another reason is the attitude of some energy suppliers to take advantage from the fact that consumers depend on them. This barrier may be mitigated by providing for transparent pricing structures. The legal framework established by the relevant decree on supply by DH ("Versorgung über Allgemeine Bedingungen für die Versorgung mit Fernwärme"[22]) does not offer best opportunities for adequate prices (DLR 2009) and could be improved;

With regard to legal-administrative and planning procedures the following barriers were identified:

Insufficient planning laws: The current planning laws are evaluated as a particular problem (Ecoheat4EU 2010). As described above (see Issue 1), municipalities have the power to establish urban development plans in which they can prescribe how and to which extent certain areas in their territories have to be used by their inhabitants. Besides the above described opportunity to introduce compulsory schemes to connect buildings to the existing DHC system urban the enactment of development plans is the most important tool of municipalities to boost the use of DHC in their territory. This tool, however, is facing the following problems:

- According to § 9 of the Federal Builing Code ("*Baugesetzbuch*[23]") communities can stipulate in the urban development plans that buildings have to be connected to grids for supply. However, DHC systems are not explicity mentioned. As a result, municipalities can prescribe the connection to DHC systems only if they develop a completly new urban development plan for an area of their territory (DLR 2009);

Possible option: § 9 Federal Builing Code could be adapted in order to allow municipalities to prescribe the connection to DHC systems in certain areas (DLR 2009).

- Apart from this, it is not clear whether municipalities can justify prescriptions in the urban development plans on grounds of general public goals such as the protection of the climate. These issues create legal uncertainty and make planning in favour of DHC more difficult (DLR 2009);

Possible option: In § 9 Federal Builing Code it should be stated more clearly that prescriptions by the municipalities can be also based on the protection of the climate;

[23] Baugesetzbuch in der Fassung der Bekanntmachung vom 23. September 2004 (BGBl. I S. 2414), das zuletzt durch Artikel 4 des Gesetzes vom 31. Juli 2009 (BGBl. I S. 2585) geändert worden ist.

- **Administrative procedures:** The construction of a DHC system, i.e. the pipes, requires a building permit in accordance with the building codes of the Federal States. In general, the procedures for obtaining a building permit do not constitute a problem. If an EIA is required the procedures are more difficult. Nevertheless, this barrier is a rather minor one (DLR 2009).

Moreover, the following barriers were described:

- **Competition with existing gas utilization:** Local gas suppliers regard DHC as a competitor and show the tendency to thwart DHC project if they are not involved in the project (DLR 2009);

- **Disadvantage of rural areas:** Biomass projects usuall ytake place in rural, scarcely settled areas. In such areas, the number of connections to DHC systems is considerably low. As a result connection lines are quite long; resulting in loss of heat and higher infrastructure costs (DLR 2009).

12.2.2 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Are there policies to promote the increase of the RES share in existing DH networks?	Yes
2	Are there policies to promote the initiation / expansion of DH networks?	Yes

12.3 Literature and Sources

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