

Non-cost barriers to renewables

– *AEON* study

Denmark

- Confidential -

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1 Issue 1 Administrative Procedures

1.1 Introduction

Denmark has a long history of using renewable energy sources (RES) partly due to the impact from the energy crisis in the 70's and as well as the political movements against nuclear energy. Prior to the energy crisis Denmark was dependant on the import of fossil fuels, the discovery of oil and gas in the North Sea did change this but not in a significant manner. The energy crisis lead to energy saving measures as well as investment in RES. Since the mid 70's the main focus has been on wind power leading to innovation and development of wind power technologies as well as increasing public awareness on RES. This is also the main reason for Denmark's role as a global leader in the wind power industry. Other RES have been explored but until recent they have been insignificant compared to wind power. RES such as biogas, bio mass, solar (heating as well as photovoltaic) and geothermal (heating and cooling) are becoming more interesting but they do have some barriers that have to be removed in order to make them attractive and relevant for investment. New RES are also being explored but they are vulnerable to lack of interest from investors as well as the legislature is not applicable for new technologies.

The general feedback from the interviews of the stakeholders indicates a general satisfaction with the administrative procedures compared to other European countries. Especially the one-stop shopping for permits is appreciated and the overall impression was that it made the application procedures easier and more swift. Despite the positive feedback there are still areas where improvements are necessary to ensure a continual growth and development in the use of RES.

A peculiar barrier mentioned was the lack of public awareness and ownership to RES. This is probably a product deriving from the change from small scale RES projects to larger industrialized projects. With the change the general public have lost their direct ownership and responsibility and in some cases have become a direct barrier against further development of RES.

The majority of the mentioned barriers are related to the RES technologies wind power, biomass, biogas and heat pumps.

The production of energy based on national produced RES in 2008 was 121522 TJ. Additional to this there was also an import of RES at a value of 21685 TJ.

Source of energy (locally produced in 2008)	Energy in Tera Joule
Solar	506
Wind power	24940
Hydro	93
Geothermal	875
Biomass	81714
Biogas	3928
Bio Diesel	3723
Heat pumps	5743

Apart from rather general considerations the discussion with a number of stakeholders showed that most of the barriers are quite technology specific. For this reason, after a short introduction of general issues, the barriers are described by technology.

1.2 Description of barriers & solutions

1.2.1 Detailed description of the barriers and solutions

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:

- Favouring of specific RES technologies:** The good intentions for the promotion of wind energy has lead to a situation where special measures were taken in order to ensure that more wind turbines were built. A significant raise in the size of the compensations to landowners who were affected by the erection of wind turbines was introduced. The compensation for wind energy is much higher than the compensations for other RES technologies and in this respect making them less attractive. The compensation paid for wind turbines is much higher than compensation for other infrastructure project such as highways, railroads, transmission lines etc. Ironically, this measure which was made to promote new windmill projects has become a barrier for new wind turbines as the high compensations are making it unattractive for investors to invest in windmill projects. **Possible solution:** The different RES technologies should be treated in the same manner promoting a specific technology can have negative or unintended consequences. Compensations should be harmonized, compensations for RES projects should be the same as for other infrastructure projects;
- Appeal cases:** Appeal cases can drag on leading to exhaustion and discouragement of project developers and investors so they in some cases finally discard the projects. There has been several cases where projects have been delayed or completely abandoned due to this barrier. **Possible solution:** A review of the regulation and actual practice concerning appeal cases would be desirable.

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

- The terms and definitions for biomass is unclear and this is also the same case with the residue from biomass. Danish law has a very narrow definition of biomass which

limits the use of different products from farming. This definition is a barrier for making use of the fractions of fibre in manure from livestock. Biomass can also be considered as waste making it a subject for waste fee. Biomass from Denmark is subject to duty this is not the case for imported biomass. Although there are measures planned there still is a need to make the farming sector aware of their role in taking a responsibility for the environment. **Possible solution:** The EU definition of biomass should be implemented in the Danish laws. The terms and definitions and the related regulations should be scrutinized to ensure that biomass is a relevant RES. Residue from livestock should be used in RES where it is applicable. Administrative barriers and subsidies should be removed;

- Heat distribution in Denmark is based on a cost-based system where prices for heat may only cover necessary costs. **Possible solution:** A more flexible price regulation system is needed. The Danish Energy Regulatory Authority shall still ensure that the prices and the price structure is fair.

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

- **Strict deadlines:** When a permit for offshore wind installations is granted there is also given a deadline for when the installation should be implemented. If the implantation is not finalized in time the energy company will have to pay very large fines. It is not reasonable that energy company should be liable for delays from other parties such as producers of wind turbines or contractors. The current system with the strict deadlines combined with high fines has kept energy companies from participating in tenders for large offshore wind power projects. **Possible Solution:** The tight scheme of deadlines and fees should be revised so that they still have an effect in case of delays but that they also proportionate to the projects and the risks involved.

Regarding **geothermal heat pumps**, there is a growing interest for heat pumps especially inspired by an initiative with financial support to private home owners.

Geothermal installations for groundwater cooling is a relatively new technology where there is a large potential for RES although there are very big concerns in relation to the possibilities of groundwater contamination as well as unnecessary heating of groundwater.

Regarding **deep geothermal installations** the issue of barriers is rather theoretical due to the fact that there are only a couple of installations installed in Denmark. There are plans to make some more installations in the near future but deep geothermal installations in Denmark are still at an experimental stage.

Regarding **emerging technologies** there is a need to include them as a relevant technology. Investors only invest in well know, proven technologies or in technologies that they are obliged to invest in. **Possible Solution:** Future energy plans should make it mandatory for energy companies to invest a certain percentage in emerging RES technologies.

Barrier 1.2 – Inexistent or insufficient spatial planning

The Danish spatial planning laws and processes are generally considered as favourable to RES although there are areas of improvement and areas where the implementation of the plans are not practiced.

Municipal authorities are not always perceived as instrumental in installations of RES installations. This is mainly due to the reluctance to find adequate locations for RES installations as they are not welcomed by potential neighbours. Some municipalities are more reluctant to find suitable areas than other municipalities. Municipalities with more influential residents tend to be more reluctant to new installations compared with municipalities with less influential residents. Residents do not want to be neighbours to a wind mill or biogas plant due to the changes in the view, noise or smell to their immediate neighbourhood.

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

- **Lack of Municipal commitment:** Municipal authorities need to identify areas for biogas installation in their municipal planning. **Possible solution:** The plan laws need to be changed in order to ensure that the municipal authorities designate areas for biogas installations. Municipalities that fail to comply should be penalized.

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

- **The general framework** for onshore power installations is evaluated as generally positive due to the historical reasons but there are areas where there are needs for improvement. The overall and widespread success of wind power installations has in some ways become one of the major obstacles for installation of more wind turbines. Some of the barriers have been mentioned in the earlier parts of this chapter and others belong under the section related to spatial planning;
- Compensations for expropriations and other side effects of the installation of wind installations are higher than the compensations for other RES as well for other infrastructure projects. Higher compensations make it more expensive to make use of wind power. **Possible Solution:** Compensations should be harmonized, compensations for wind power projects should be the same as for other RES projects as well as other infrastructure projects;
- Municipal authorities are not always perceived as instrumental in installations of new wind power installations. This is mainly due to the reluctance to find adequate locations for new wind power installations as they are not always welcomed by potential neighbours. **Possible Solution:** Municipalities that fail to find locations for wind power installations should be penalized accordingly;
- **Lack of suitable areas:** As the wind power installations have grown in their size they have also become more unwanted in the landscape. Municipal authorities need to identify suitable areas for wind power installations. **Possible solution:** The plan laws need to be changed in order to ensure that the municipal authorities designate areas for on shore wind installations. Municipalities that fail to comply should be penalized.

Barrier 1.3 – Competing public interests

- **Environmental investigations:** Environmental protection is very important for the society and the nature and environment in general and therefore it is necessary to have thorough environmental investigation prior to giving permits that can cause great impact on the environment. In some cases environmental investigations can be very complicated to carry through and they can delay projects unnecessary.

The process regarding environmental investigations should be more streamlined and simple where applicable.

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

- **Duty on biomass:** Locally produced biomass is subject to duty whereas imported biomass is exempted from duty. This is because locally produced biomass is regarded as waste due to the Danish waste regulations and foreign biomass is regarded as a bio fuel. **Solution:** There is a need to revise the current waste management regulations to ensure that locally produced biomass does not have poorer regulatory status than imported biomass.

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

- **Local interests:** Municipal interest towards local residents can collide with national interests to increase wind power installations. If the national plans are not specific enough then municipalities will in many cases try to satisfy their own residents. **Possible solution:** The plan laws need to be changed in order to ensure that the municipal authorities designate areas for on shore wind installations. The national plans have to be more specific in their requirements for remuneration of areas for wind power installations. Municipalities that fail to comply should be penalized.

Regarding **geothermal installations for groundwater cooling:**

- **Environmental interests:** Drinking water in Denmark is based on untreated groundwater this leads to very strict regulations of how groundwater is treated. The liquids used in geothermal installations pose a risk to contaminate groundwater. Geothermal installations can also alter temperature changes in groundwater which can change the quality of the water in the aquifer. **Possible solution:** A more pragmatic approach in areas without drinking water interests could be a way to make it easier to use this potential RES.

Barrier 1.4 – Other Barriers

Regarding **financial framework** the following barriers were identified:

- **Cost based system:** The cost based system can be counterproductive for promoting RES technologies. **Solution:** The pricing structure should be changed so it is possible for investors to make a reasonable profit from their investments. Danish Energy Regulatory Authority shall still ensure that the prices and the price structure is fair. This rule should be applied to all RES technologies;
- **Duty and tax:** Duties and taxes on RES make them less attractive compared to other technologies. **Solution:** Duties and taxes should be removed from RES.

1.2.2 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 technologies?	Yes
3	Are timetables and deadlines usually communicated and respected?	Yes
4	Amount of money to be invested in administrative process (including cost of work and costs like fees) (in EURO)	0
5	Time to be spent for administrative process (duration to get the main permits) (in weeks)	0 -50
6	Number of administrations that must be contacted	1

1.3 Literature

Websites: www.ens.dk, www.mst.dk, www.ove.org

Lov Nr. 1392 27/12/2008 – Law regarding the promotion of renewable energy REPAP 2020.

Aftale om Grøn Vækst – Agreement on Green Growth, by the Ministry of Environmental Affairs.

Lovbekendtgørelsen Nr. 753 25/08/2001- Law about environmental protection.

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

Future European Energy System, Presentation for ITRE Committee, European Parliament, by Danish Board of Technology, Risø - Danish Technical University and EA Energy Analysis, 2008.

2 Issue 2 Technical Specifications

2.1 Introduction

In general the issue of technical specifications as a barrier for RES in Denmark has not been mentioned as relevant during the interviews with the different stakeholders.

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

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.”

In Denmark the main support schemes available:

- **Quota system:** electricity generated from renewable energy sources is mainly promoted through a quota system (green certificates). The quota system obliges all producers and importers of electricity to generate a certain amount of electricity from renewable sources or purchase a certain amount of green certificates;
- **Feed in tariff:** renewable energy plants are promoted through several kinds of feed-in tariff systems;
- **Fiscal regulation mechanisms:** Heat pumps are eligible for subsidies.

Generally the technical specifications required for support schemes are based on European standards and do not constitute a barrier.

Since this kind of RES technologies is often supported by investment grants, the legislator or concession holders do frequently define in detail the technical specifications, in order to avoid subsidising systems that are not state of the art and not produce appropriate amounts of energy. This can result in discrimination of certain brands or products but the general opinion is that this is not a significant barrier.

2.2 Description of possible barriers & solutions

Barrier 2.1 – Weak definitions

The definitions are perceived as clear and understandable and therefore this issue is not seen as a barrier in Denmark.

Barrier 2.2 – no EU standards applied

In Denmark this has not been identified as a barrier.

Barrier 2.3 – Specified locations for testing and/or certification

In Denmark this has not been identified as a barrier.

Barrier 2.4 – Barrier to trade

In Denmark this has not been identified as a barrier.

2.2.1 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

2.3 Literature

BEK nr 1 af 06/01/2004 – Decree on guaranty of origin for RES based Electricity.

Lov Nr. 1392 27/12/2008 – Law regarding the promotion of renewable energy
www.ens.dk.

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

3 Issue 3 Building integrated technologies

The barriers related to small/medium scale renewable energy technologies installed in or on buildings are very multifaceted and interlinked with some of the other issues describes in the other chapters.

The Building Regulations is the basis of all regulations regarding buildings. The current building regulation is not ambitious enough and there is also a need to set higher standards for including energy saving measures as well as building integrated RES technologies when renovating old buildings.

A significant barrier for building integrated technologies relates to the neglect of the exemplary role of public buildings. The public authorities have to set good examples by extensive use of building integrated RES technologies. In this regard, there are certain efforts by public authorities in Denmark to include renewable energy sources into their buildings. Nevertheless, authorities could be more ambitious by using RES in new building projects as well in renovation of older buildings.

Another issue is whether renewable energy installations 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.

Barriers concerning tenancy and ownership law are also very relevant although they have not been thoroughly analysed in this report.

There also barriers that do not exactly fit in specific category. Many insurance companies have significant higher premiums for houses with building integrated RES. They have an unrealistic high assessment of the risks involved from RES such as flooding. **Possible solutions:** It is necessary to interact with the insurance companies and make a proper assessment of the risks involved and on this data make necessary requirements/standards to ensure a reasonable premium for buildings with RES.

3.1 Description of barriers & solutions

Barrier 3.1 – Renewables obligations insufficient:

- The obligation to renewables is in this context is insufficient and not ambitious enough to make a significant impact. This mainly due to the fact that the regulations on energy saving measures and RES technologies are not up to date in the current Building regulations. **Possible solutions:** Measures should be introduced to ensure

that the renewable obligations are taken in consideration in new building projects as well as renovation of older buildings. The planned revision of the Building Regulations should be fast forwarded to ensure that the planned requirements regarding RES and energy saving will be implemented earlier;

- Municipal plans can be the main obstacle for the implantation of RES technologies integrated in buildings. There are several municipalities that do not accept roof installed solar panels in their domestic housing areas as the municipal authority is of the opinion that they spoil the visible impression of the area. This is understandable regarding special buildings, old parts of cities, and special architecture but it is important to that it does not become a common obstacle for RES technologies.
Possible solutions: Municipal plans should be in harmony with the general obligation to renewables. Special consideration and exemption should be only taken in cases where it there are interests of historical or local heritage value at stake.

Barrier 3.2 – Exemplary role of public buildings neglected:

- Renewable energy sources have been installed in quite a number of public buildings. However, it is not yet a widely used standard. For new buildings, and for the renovation of existing buildings, the use of renewable energy sources is neither required nor implemented to an appropriate degree in order to make a considerable impact. Individual cases of a successful integration of renewable energy sources are promoted as flagship projects but can rather be considered as an exception, than really demonstrating a high engagement for renewable. **Possible solutions:** The public administrations should requirement RES in new public buildings as well as when renovating old public buildings. There is a need to find the appropriate way to finance building integrated RES technologies so that the public sector can make a substantial impact and set a good example.

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

- **Problems concerning the installation of the system:** 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. Tenancy is regulated by the Consolidation Act on rent the purpose of the act is to ensure that landlords respect the rights of tenants. Some landlords have used renovation and improvements as tools for increase in rent. The landlord should have means of financing their investments but this has to be regulated in order to prevent misuse. It is legally unclear, whether the installation of a renewable energy system is considered as an energy saving measure. The act 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. **Possible solutions:** A clear definition of "energy saving measures" as "measures leading to savings in final and primary energy" should be introduced. A general promotion of RES to landlords and tenants could be a way to promote the use of building integrated RES technologies;
- **Problems concerning the refinancing of the system:** The landlord has the legal possibility to refinance his investments through increasing the rent. Nevertheless, the form of these rules does not encourage the landlord to make use of them for RES and

thus constituting an economic barrier rather than an administrative barrier. **Possible solutions:** The RES related investments should be encouraged and should be legally defined as one aspect constituting the dwelling value. Otherwise it will be very difficult to encourage landlords to invest in RES technologies.

Barrier 3.4 –Building integrated RES technologies combined with conventional energy sources:

- **Flexibility for user who use RES combined with conventional energy:** A significant barrier lies within the area where a user needs conventional energy to support a RES technology. User with RES technologies normally need to purchase extra energy at night time since their RES technology has the highest production during the daytime. Users who need to supplement RES with electricity to have sufficient energy can not purchase electricity when it is cheaper at night although there is a surplus of electricity available at night. **Possible solutions:** There is a need for a more dynamic duty and tariff structure for electricity so that purchasers of electricity can purchase green and cheaper energy;
- **District heating:** The pricing structure/policy for district heating with a partly fixed price combined with a price for actual consumption makes it unprofitable for consumers to invest in RES. **Possible solutions:** The price structure for district heating should not prevent homeowners to invest in RES technologies. The fixed parts of the prices should be minimized in order to make RES attractive.

3.1.1 Best practice elements and indicators

No.	Benchmark	Result
1	Is this installation type in normal cases exempted from an authorization procedure (building permit)?	No
2	Are legal-administrative requirements inadequate for this installation type?	Yes
3	Is there a Renewables Obligation that operates sufficiently?	No
4	Number of administrations that must be contacted	1-2

3.2 Literature

Lov Nr. 1392 27/12/2008 – Law regarding the promotion of renewable energy.
www.sbi.dk – Danish Building Research Institute.

BR08 – Building Regulations 2008.

Lejeloven – Consolidation Act on rent www.ism.dk.

4 Issue 4 – Promotion of energy efficient renewable energy equipment

4.1 Introduction

This issue is related to the provisions of article 13 (6) of the Directive (the selection of the words in bold is ours):

“With respect to their building regulations and codes, Member States shall promote the use of renewable energy heating and cooling systems and equipment that achieve a significant reduction of energy consumption. Member States shall use energy or eco-labels or other appropriate certificates or standards developed at national or Community level, where these exist, as the basis for encouraging such systems and equipment.

In the case of biomass, Member States shall promote conversion technologies that achieve a conversion efficiency of at least 85 % for residential and commercial applications and at least 70 % for industrial applications.

In the case of heat pumps, Member States shall promote those that fulfil the minimum requirements of eco-labelling established in Commission Decision 2007/742/EC of 9 November 2007 establishing the ecological criteria for the award of the Community eco-label to electrically driven, gas driven or gas absorption heat pumps.

In the case of solar thermal energy, Member States shall promote certified equipment and systems based on European standards where these exist, including eco-labels, energy labels and other technical reference systems established by the European standardisation bodies.

In assessing the conversion efficiency and input/output ratio of systems and equipment for the purposes of this paragraph, Member States shall use Community or, in their absence, international procedures if such procedures exist.”

In Denmark there are support schemes for promotion of energy efficient RES technologies. The general opinion from the stakeholders is that there is sufficient support for promotion of energy efficient renewable energy equipment.

The Danish Energy Agency is responsible for making a positive list of energy efficient equipment that can be supported through a national support scheme.

A good example is the “Skrot dit oliefyr” (scrap your oil burner) campaign where the government has allocated 54 million Euros in 2010 to support house owners to change

their oil burners to heat pumps. On the website you can see who can apply and there is a positive list of energy efficient which heat pumps are supported under the scheme.

4.1.1 Detailed description of the Barriers and solutions

Barrier 4.1 – Non-compliant promotion schemes

In Denmark this has not been identified as a barrier.

Barrier 4.2 – Lack of substitution of existing inefficient systems

In Denmark this has not been identified as a barrier.

Barrier 4.3 – Use of national procedures

In Denmark this has not been identified as a barrier.

Barrier 4.4 – Insufficient information

In Denmark this has not been identified as a barrier.

4.1.2 Best Practice Elements and Indicators

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

4.2 Literature

Lov Nr. 1392 27/12/2008 – Law regarding the promotion of renewable energy.

Aftale om Grøn Vækst – Agreement on Green Growth, by the Ministry of Environmental Affairs.

Websites: www.ens.dk, www.skrotditoliefyr.dk and www.varmepumpeinfo.dk.

5 Issue 5 Information/awareness raising

5.1 Introduction

Information and awareness raising measures with regard to renewable energy sources are in general widely spread in Denmark. 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 least if compared with other European countries.

Of course, there is still a potential for improvement, particularly with the purpose of motivating different kind of building owners and particularly public and private investors who own large numbers of rental houses- to invest in renewables. Especially campaigns aimed at dealing with the general reservations regarding that RES technologies are too expensive, inefficient or unreliable would be fruitful.

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.

All together, there is a broad information available on support measures on a national, regional and local level. There are web based services where a broad spectre of information can be found. Search functions allow for a structured investigation of the suitable programmes by the different target groups. On the website of the Danish Energy Agency you can find information for about the different kinds of RES technologies and targeted at different groups of the public.

The Climate and Energy Guide (www.klimaogenergiguide.dk) by the Danish Energy Agency and the Ministry of Climate and Energy gives a good introduction and information about RES technologies.

Energy Service Denmark is a good example of an organisation that delivers information about energy saving measures and RES technologies to the general public, schools, businesses as well as they have mobile exhibitions.

On the other hand OVE, the Danish Organisation for Sustainable Energy states that the public commitment is the key to further acceptance and deployment of RES technologies. Ownership and commitment from the general public is a cardinal issue for the further deployment of RES. If neighbours to wind turbines, biogas plant etc. are offered shares in the RES plants then they will be more positive towards them and they will achieve a direct ownership and commitment to them. One of the reasons for the historical development and acceptance of RES technologies was the issue of local ownership and

commitment to the RES. As the RES technologies have become more commercialized this aspect has become less dominant and therefore they do not have the same local acceptance and goodwill.

It seems therefore as there is a need to try to involve the general public and specifically the neighbours of existing and future RES installations.

5.2 Description of barriers & solutions

5.2.1 Detailed description of the Barriers and solutions

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

This has not been identified as a relevant barrier. Planners and architects are generally up to date with knowledge of the subject. Energy saving measures and RES technologies are part of the basic curriculum for engineers and architects. Trade magazines and other relevant sources of information have articles about experiences from projects where RES technologies have been used as well as articles about emerging technologies. In general many consultants and producers try to promote their knowhow within the use of RES technologies in order to keep them in front of their competitors.

An area that could be relevant to explore is within the banking and financial sectors as they play an important role in guiding loan takers. If they knew more about RES technologies they could probably be good ambassadors in promoting investment in RES technologies from a financial and future sustainability view when their clients are seeking loans renovation projects.

Barrier 5.2 – Insufficient public funding for campaigns/programmes

Public institutions in Denmark are relative active in initiating and funding campaigns for renewable energy sources. Insufficient public funding of campaigns is not identified as barrier in Denmark.

Barrier 5.3 – Insufficient campaign-/programme-design:

- **Local companies** involved in renewable energy business, especially those only delivering certain components, are relatively unknown 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 utilized RES systems. **Possible solutions:** Regional RES days or open days in companies, addressing consumers as well as local decision makers, could help in making local companies being better known as well as exposing new RES technologies;
- There is a very positive attitude towards renewable energy sources in the public but despite the positive attitude there is still prejudice regarding RES. A common perception is that RES technologies are too expensive, renewable technologies are not efficient or reliable enough. **Possible solutions:** Campaigns should focus on overcoming those reservations through education on the real potential of RES.

Other barriers

Not detected.

5.2.2 Best Practice Elements and Indicators

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

5.3 Literature

Vi har energien 2009 - We have the necessary energy – Adaptation to sustainable energy in 20 years, OVE.

www.ove.org

www.ens.dk

www.energitjenesten.dk

www.klimaogenergiguide.dk

6 Issue 6 Certification of installers

6.1 Introduction

The Danish Ministry of Education is the governing body that is overall responsible for the certification of installers. In practice it is the AMU (Adult vocational training programmes) that is responsible for certifying the installers. TEKNIQ (Danish Mechanical and Electrical Contractors' Association) provide courses to train and upgrade the knowledge of its members and they are also a main stakeholder in this respect.

RES technologies are also a basic part of the curriculum for vocational training of apprentices and is therefore an integrated part of their education.

Certification of installers was not considered a significant barrier, this mainly due to the requirement for installers firms as well as personnel have to be authorized to carry out installation within the respective installation trades. Specific effort to keep installers up to date are in process and further steps have been taken to make a centre knowledge as well further training for installers to become energy specialists. The energy specialists will have a broader knowledge of RES technologies and energy saving technologies and thus be able to provide better advice to customers.

A concern raised was that the interpretation and understanding of the EU Directive 2009/28/EC has in some ways become a barrier for certification of installers in Denmark. A specific problem mentioned was that the refrigerant in heat pumps has become a problem because the necessary requirements needed to work with refrigerants are extensive and are mainly aimed at installers or refrigeration engineers working on industrial cooling systems. The amount of refrigerant in a heat pump is limited and the refrigerant system is not the focal point for installation and service of heat pumps, The focal point of heat pumps is the dimensioning, installation and integration of heat pumps with other installations which normally would be in the responsibility of heating and plumbing engineers. Refrigeration engineers on the other hand are not used to working with the other areas of heating and energy supply to the private housing sector. This issue complicates the work process and making it necessary to involve both heating and plumbing engineers and refrigeration engineers just because heat pumps contain a refrigerant.

In order to make heat pumps more attractive there is a need in finding a proper solution that makes it more simple for heating and plumbing engineers to obtain a certificate to work with refrigerants in heat pumps. A possible solution could be to make a more simple course for heating and plumbing engineers regarding work with refrigerants in heat

pumps. A similar approach has been used in relation to certification of mechanics to work on air-conditioning of vehicles.

6.2 Description of barriers & solutions

Barrier 6.1 – Lack of a Certification body

This has not been identified as a relevant barrier as there is a relevant body for the installers that takes care of the certification of installers.

Barrier 6.2 - Lack of guidelines

This has not been identified as a relevant barrier.

Barrier 6.3 Lack of training

This has not been identified as a significant barrier. More training can train more installers and teach them new areas and technologies. This is an ongoing process and therefore it is not seen as a major obstacle for RES.

6.2.1 Best Practice Elements and Indicators

No.	Benchmark	Result
1	Is there an appointed national certification body?	Yes
2	Is there a sufficient training on RES issued during the education of installers, planners, architects?	Yes

6.3 Literature

Directive 2009/28/EC of 23 April 2009.

Commission Regulation EC 303/2008.

Directive 2006/40/EC of 17 May 2006 relating to emissions from air-conditioning in motor vehicles.

www.tekniq.dk

www.uvm.dk

www.mst.dk

7 Issue 7 Infrastructure Development

7.1 Introduction

The infrastructure in Denmark is in general very developed this is mainly due to the historical reasons. The areas with barriers are more related to administrative issues rather than infrastructure related issues.

The development of the infrastructure is highly dependent on the long term strategic plans for the development and deployment of RES technologies. The development of the national networks as well as the trans national networks are dependant of the long term plans. Infrastructure development is not the main barrier for further development of the network, the main barrier is the lack of specific long term plans for RES deployment.

In order to do this it is necessary to see the European electricity market as on market with a common goal to ensure the best possible market conditions where RES technologies can get access to the most attractive markets under reasonable conditions.

Protectionism by member state should be dealt with and there is a need to ensure that all states participate in constructive manner in order to improve the conditions for RES.

7.2 Description of barriers & solutions

7.2.1 Detailed description of the Barriers and solutions

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

This was not perceived as a relevant barrier in Denmark as the domestic infrastructure by large is being developed at an acceptable pace. The main obstacle is the transnational issue, as long as it is unclear it will prevent the national network to be developed properly.

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

The main barriers to the current problems in the development of the grid infrastructure are the civil protests against grid expansion. The protest are based on the fear of devaluation of property and health related issues.

Underground cables have been the solution in some areas.

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

The lack of the development of Trans-European Electricity Network is perceived as one of the main barriers to enhance the use of RES. National plans are dependant of the future of the Trans-European Electricity Network. It will be difficult to find investors (both public and private) that are willing to invest in development of infrastructure as long as the Trans-European issues are unclear. **Possible solutions:** Transnational issues should be addressed as soon as possible. Currently they are posing a significant barrier to the countries that are ambitious in pursuing a higher deployment of RES technologies.

7.2.2 Best Practice Elements and Indicators

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

7.3 Literature

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

Aftale om Grøn Vækst – Agreement on Green Growth, by the Ministry of Environmental Affairs.

DENA Grid Study by the German Energy Agency.

www.energinet.dk

www.windpower.org

www.ens.dk

8 Issue 8 Power Grid Issues

8.1 Introduction

The access of electricity from RES into the grid has been under constant development and improvement in Denmark. The barriers related to the power grid issues are mainly transnational issues rather than domestic barriers. The power grid in Denmark is well developed and the main bottleneck for the expansion of RES is mainly outside Denmark. These issues tend to become more administrative than technical due the legislation in the involved countries as well as protectionism to some extent. There are also financial aspects of this issue as how to ensure fair distribution of cost of a power grid. Norway gets more benefits from the Danish grid infrastructure compared to Denmark as they deliver more power to Denmark than they receive from Denmark.

In order for Denmark to be able to produce much more sustainable RES there must be made better connections to the markets south of Denmark.

A fundamental condition for the further development of the power grid and therefore the use of RES is to look at the European market as one electricity market. The only way this can be achieved is if there European Regulations that ensure that the different stakeholders live up to their responsibility and by that ensure a non-discriminating and transparent market..

8.2 Description of the barrier

8.2.1 Detailed description of the Barriers and solutions

Barrier 8.1 - Problems concerning grid connection

In general the opinion is that the conditions for the connection to the grid are perceived as good. RES plants generally enjoy privileged and preferential connection to the grid:

- **Disadvantage of small installations:** Some technical and legal requirements of 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 for them more difficult than other operators.

Barrier 8.2 - Problems concerning grid access

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

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

No barriers were mentioned as problematic. Undoubtedly there are areas where there is competitive interest but this was not seen as a barrier.

8.2.2 Best Practice Elements and Indicators

No.	Technology	Benchmark	Result
8.1		Are the rules on cost sharing and bearing of grid connection objective, transparent and non-discriminatory ?	yes
8.2		Is the denial of grid connection by TSOs and DSOs a common problem, constituting an important barrier for RES development?	no
8.3		Number of months for getting grid connection (considering also approval of grid connection)	0
8.4		Estimated connection costs in Euros (in case producer pays)	0

8.3 Literature

Lov nr 549 af 06/06/2007 - Law regarding the alterations of the Law about Electricity Supply, Law about Natural Gas Supply and the Law about Heat Supply.

BEK nr 1227 af 10/12/2009 - Decree about income frameworks for grid operators and TSO's under the Electricity Supply Law.

BEK nr 486 af 29/05/2007 – Decree on Electricity Suppliers billing of and specification of costs for transport and energy supplies.

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

Aftale om Grøn Vækst – Agreement on Green Growth, by the Ministry of Environmental Affairs.

www.energitilsynet.dk _Energy Regulations Authority

www.danskenergi.dk

www.energinet.dk

www.windpower.org

9 Issue 9 Gas Network Issues

9.1 Introduction

The natural gas grid in Denmark is well developed and therefore a good foundation for the use of biogas. There are different barriers related to the gas network regarding biogas the main barrier is that biogas is inferior compared to natural gas. The natural gas used in Denmark is from the North Sea and is of a higher quality compared to the natural gas used in Germany and central Europe. All systems in Denmark are designed to the standards of the North Sea gas. As biogas is of a lower quality compared to the North Sea it is necessary to upgrade biogas so that it can meet the standards for natural gas. The forecast for North Sea gas indicates that the reservoirs will be empty by 2016 – 20018. There is therefore a need to ensure that the gas sector is upfront and prepared to use a more inferior gas which will be the dominant type of gas on the market in the future. This could have a positive effect on the interest in biogas.

The storage of biogas is difficult unless it is sent to the gas grid, this also makes it more relevant for the production of electricity compared to if it was supplied to a decentralized heating plant.

Many of the barriers related to biogas have been mentioned in the chapter about administrative issues.

The stakeholders mentioned a certain lack of interest or cooperation towards biogas. If this is the case then the most sensible solution is to encourage 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.

9.2 Description of barriers & solutions

9.2.1 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. This barrier has a technical issue, an economical issue as well as an administrative issue. In order to make biogas attractive for biogas system operators as well as gas distributors there is a need to find a better solution

to the upgrading process of biogas. **Possible solutions:** Biogas could be exempted from duty in order to make it more feasible to use biogas.

The responsibility for upgrading biogas could be transferred from the biogas system operator to the grid operator this would probably result in the cost be passed on to the final consumers.

Barrier 9.2 – Lack of information:

Was not mentioned as a relevant barrier.

Barrier 9.3 – Inefficient authorisation procedures

This was not mentioned as a specific barrier but there are probably some minor issues here.

Barrier 9.4 – Insufficient cooperation of grid operators:

Biogas plants not (partially) operated by gas suppliers encounter problems in practice with regard to grid access due to missing acceptance on the side of the grid operators. **Possible solutions:** A relevant way to deal with this issue could be to introduce ambitious biogas quotas for the gas distributed through the grid. Grid operators who fail to achieve the quota should be penalized.

Barrier 9.5 – Discrimination of biogas:

Biogas delivered to a decentralized district heating plant is subsidized while biogas delivered to natural gas grid does not receive subsidies. It is necessary for biogas producer to have alternative consumers otherwise they become vulnerable to changes in the need for biogas. Biogas producers have to pay duties/fees in order to make use of existing gas net which results in the lack of using the RES potential in the slurry from livestock manure despite that it is significant resource and that it could have a major positive effect on emissions as well as the environment in general. **Possible solutions:** Biogas suppliers should have access to the existing gas net. A new pricing structure should be introduced to ensure investors a reasonable payback on their investments.

9.2.2 Best practice elements and indicators

No.	Benchmark	Result
9.1	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?	Yes, partly for decentralized CHP
9.2	Are the costs of grid connection for producers of gas from renewable energy sources objective, transparent and non-discriminatory?	Yes
9.3	Do transmission and distribution tariffs discriminate against gas from renewable energy sources?	No
9.4	Average time needed for grid connection approval (from application for grid connection to formal approval) in months (#).	Not a problem

9.3 Literature

BEK nr 1090 af 06/12/2000 – Decree on access to upstream grid.

LBK nr 1116 af 08/11/2006 - Decree on Law on Natural Gas Supply.

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

Aftale om Grøn Vækst – Agreement on Green Growth, by the Ministry of Environmental Affairs.

www.energitilsynet.dk

www.ens.dk

www.energinet.dk

www.dongenergy.dk

www.danskenergi.dk

10 Issue 10 District Heating

10.1 Introduction

District heating is very integrated in the Danish society as they cover roughly 60% of all households. It is based on a natural monopoly that eliminates outside competition. District heating in Denmark regulated as a cost based system making it unattractive for most investors. District heat is produced on variety of fuels such as: coal, oil, natural gas, waste, industrial surplus heat and a mixture of different RES.

Although district heating is a very effective and an environmentally correct source of energy there are areas of improvement such as reliance on fossil fuels, energy efficiency as well as misuse of their monopolized status.

10.2 Description of barriers & solutions

10.2.1 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

This has not been identified as barrier in Denmark.

Barrier 10.2 – Lack of positive conditions for the increase of the share of renewables in existing DHC systems:

- Prices for heating are fundamental for the overall economy of a project. A CHP and the heat distributor can agree a price for heat but that price can at any time be challenged by a heat consumer where after they can bring it forward to the Danish Energy Regulatory Authority resulting in a lower prices and therefore changing the financial premises for the agreement. **Possible solution:** It is necessary to have a system that enables prior authorization of prices that can not be challenged afterwards. A review of the regulation and actual practice concerning appeal cases would be desirable;
- The cost based system makes it unattractive to invest in biomass plants, there is a need for incentives to encourage a to make use of biomass as a RES. **Possible solutions:** A possible solution could be that CHP and DH agree on an acceptable model to share the cost and the income;
- A natural area to increase the use of RES is to make use of biogas from the farming industry, mainly pig farms. This would involve major investments and there are concerns to if it is realistic that the production of pigs stays the same. **Possible**

solutions: It is difficult to challenge the monopoly status but it would be relevant to impose ambitious benchmarking and look into the policies of the tariffs.

Barrier 10.3 –Other Barriers:

- The monopoly status together with the cost based system poses the risk of inefficiency and does not have incentives for improvement. It can also be a barrier against the deployment of other RES technologies within their geographical distribution area. **Possible solutions:** It is difficult to challenge the monopoly status but it would be relevant to impose ambitious benchmarking and look into the policies of the tariffs. District heat distributors should have positive view on households that want to use RES. This could be enhanced by letting the distributor use the specific RES production as part of their RES quota.

10.2.2 Best Practice Elements and Indicators.

No.	Benchmark	Result
10.1	Are there policies to promote the increase of the RES share in existing DH networks? (yes/no)	yes
10.2	Are there policies to promote the initiation / expansion of DH networks? (yes/no)	yes
10.3	Percentage present renewable share (see ECOHEATTOOL)	40%
10.4	Percentage CHP share (idem)	60%

10.3 Literature and Sources

LBK nr 347 af 17/05/2005 – Law on Heat Supply.

BEK nr 31 af 29/01/2008 – Decree regarding connection to District Heating.

BEK nr 175 af 18/03/1991 – Decree on depreciation of operation costs.

BEK nr 596 af 08/06/2007 – Decree of changes in the Decree of depreciation of operations cost and allocation for investments.

Barriers, Challenges and Opportunities RETD, by Kofoed-Wiuff, Sandholt and Marcus-Møller, 2006.

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www.energitilsynet.dk

www.fjernvarme.dk

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www.euroheat.org