National Action Plan

For renewable energy in Denmark

June 2010

Contents

1. SUMMARY OF THE NATIONAL RENEWABLE ENERGY POLICY

Denmark has pursued an active energy policy since the 1970s, with energy saving and renewable energy as high priorities. There is still a need for ongoing efforts in these areas in order to deal with the many challenges faced by society today, whether it is in relation to the climate or environment, economic considerations, or ensuring a high degree of supply reliability.

It is Danish government policy that by 2020, Denmark will be a green, sustainable society and will be among the three most energy efficient countries in the OECD. Denmark must also be among the three countries in the world that fulfils its renewable energy share up to 2020. In the RE (Renewable Energy) Directive, Denmark has already committed itself to an ambitious target of 30% renewable energy by 2020, which the government initially hopes to fulfil via national initiatives. This Renewable Energy Action Plan describes the measures that will ensure energy savings and expansion with renewable energy up to 2020.

Measures for the promotion of renewable energy within the EU - including support schemes - are nationally based and like other EU countries, Denmark has developed its own national support system. It is, however, the Danish government's opinion that EU countries should also work together to avoid any inappropriate 'support competition' between Member States.

The government's long term energy-political vision is that Denmark will ultimately become independent of fossil fuels. A Climate Commission has been set up which will present suggestions for meeting this target in autumn 2010. It is estimated that the commission will recommend the implementation of significant energy savings, as well important developments in the supply of energy from renewable sources. Based on the Climate Commission's report and within its current period of office, the government will announce when and how its vision of independence from fossil fuels can be achieved.

Danish energy policy is also based on the Energy Policy Agreement of 21 February 2008, between the government (Venstre - The Liberal Party of Denmark and Det Konservative Folkeparti - The Conservative People's Party), Socialdemokraterne (The Danish Social Democrats), Dansk Folkeparti, (The Danish People's Party), Socialistisk Folkeparti (The Socialist People's Party), Det Radikale Venstre (The Danish Social-Liberal Party) and the New Alliance/Liberal Alliance. In accordance with this agreement, gross energy consumption must fall by 2 % up to 2011 and by 4 % up to 2020 in relation to 2006 figures, and renewable energy must make up 20 % of Denmark's gross energy consumption by 2020. The agreement contains a series of concrete initiatives which will ensure that these targets can be met. According to the Energy Policy Agreement, by the end of 2010, the parties behind it must discuss concrete supplementary initiatives for the period after 2011.

After the Climate Commission's report it is the Danish government's intention to present a proposal that could form the basis for discussions for a new energy-political agreement for further initiatives for the promotion of renewable energy and energy savings in addition to those described in the Action Plan. This will be described in more detail in the subsequent initiative reports to the Commission.

In the 1970's, the Danish energy system was based almost exclusively on the consumption of imported oil and coal. Today it is characterised by its great variety of energy sources and Denmark has become a net exporter of energy. There is also an ongoing development of renewable energy sources, especially wind power, biodegradable waste, biogas and straw. The measures that lie behind this development include subsidies, political agreements on the establishment of wind farms, tax exemption, a biomass agreement and support for information campaigns and research. A number of these measures have been broadened by the Energy Policy Agreement from February 2008.

Since the 1980's, a decentralisation of Danish energy generation has taken place. Whereas generation of electricity and heat was previously dominated by a number of central power stations situated in the larger towns and cities, it now takes place in many different locations throughout the country. There is also a significant increase in co-generation and district heating based on excess heat, which has contributed significantly to the fact that Denmark is currently one of the most energy-efficient countries in the world. Since 1980, it has been possible to keep energy consumption more or less stable whilst achieving an economic growth of about 80 %.

In February 2010, the government presented a report on security of energy supply, which illustrated some of the challenges facing the Danish energy system. In a few years, Denmark will be a net importer of fossil fuels. An active effort to achieve an effective and climate-friendly energy supply is necessary, not only to ensure a high security of supply and a robust economy, but also to achieve this in relation to climate policy targets. The report also indicates that in the long term the further inclusion of renewable energy itself may, in the long term, present a challenge to stability of supply. To achieve a more reliable inclusion of renewable energy, adjustments to the present electricity grid will be necessary, as well as achieving a greater degree of balance between electricity consumption and generation.

As a follow-up to the "Better Integration of Wind" agreement from October 2009, a series of initiatives have been planned for the roll-out of intelligent electricity consumption. New guidelines for the expansion and cabling of the electricity transmission network have been laid down in the Cable Action Plan of 2008. Connections to other countries will also be extended.

The government has presented a number of strategies for ways in which different sectors, including agriculture, transport and the building sector, can contribute to dealing with the challenges presented by climate and energy.

The government's Green Growth plan contains a number of initiatives for achieving its vision of a society which is committed to green behaviour and green technology in order to tackle the challenges of the environment, the climate and nature while at the same time creating a green growth economy. The plan includes the expansion of agriculture's role as supplier of green energy such as energy crops and biogas. A Green Development and Demonstration programme has been established in connection with the agreement, which is intended to create a better connection between the research, development and demonstration of knowledge in the food, agricultural, fisheries and aquaculture sectors. The "Green Growth 2.0" agreement from April 2010 contains further initiatives intended to support the use of biomass from agriculture.

The government's "Green Transport" proposal from December 2008 determined that the upward tendency of CO_2 emissions must be stopped. The political agreement "A Green Transport Policy" proposes an extensive series of initiatives intended to strengthen public transport and increase the utilisation and energy efficiency of existing vehicles. The government has decided to extend the tax exemption for electric cars up to 2015 and is also preparing a greener vehicle tax. The Ministry of Transport has set up the Centre for Green Transport which will carry out research projects with energy efficient transport.

Research and the involvement of business are central to a green restructuring of the energy system. In 2009, the government published "The Business Climate Strategy" which includes over 20 new initiatives and is intended to make Denmark a green laboratory for the development and testing of new green solutions.

Grants for energy research, development and demonstration have increased considerably in recent years. Most recently, in 2010, the government set aside over DKK 1bn to strengthen the entire innovation process for new technology, divided between a number of organisations including Strategiske Forskningsråd (The Danish Council for Strategic Research), (Energiteknologisk Udviklings- og Demonstrations Program (The Energy Technology Development and Demonstration Programme - ETDDP) the PSO (Public Service Obligation) funded programmes ForskEL (research into environmentally friendly technologies in electricity), Højteknologifonden (The Danish National Advanced Technology Foundation) and Green Labs DK.

The government has also produced "The strategy for the reduction of energy consumption in buildings", which includes a series of concrete suggestions for reducing energy in both new and existing buildings. In addition, a Centre for Energy Savings has been set up which will promote cost effective energy savings in businesses, households and the public sector. The increase in energy tariffs included in the government's "Spring Package 2.0" tax reform is also expected to affect energy consumption.

Local and regional authorities are important actors on the climate and energy front. Local authorities and regions have entered into agreements on energy savings and local authorities are also responsible for heating planning. The local authorities have shown interest in strategic energy planning as a tool for increasing the share of renewable energy in the energy supply. Strategic energy planning means that, after an initial mapping of local energy sources and energy saving potential, the local authorities will plan how the energy supply can be developed as efficiently as possible, maximising the potential for changing over to renewable energy.

With the introduction of these strategies and initiatives, Denmark is already well on the way to changing over to a green and flexible energy system. After the Climate Commission has presented its report, the government is expected to make proposals that will ensure that Denmark meets its international climate and energy commitments, eventually becomes independent of fossil fuels and that the change-over takes place in a cost-effective and economically viable manner.

2. EXPECTED FINAL ENERGY CONSUMPTION 2010-2020

With allowances for technical development, changes in prices, economic development etc., the annual basis projections for energy consumption and supply made by the Danish Energy Agency describe a potential development based on the assumption that no political initiatives or measures are carried out up to 2020. The basis projection only includes already approved measures. Announced political initiatives which have not yet taken shape and/or political agreements are not included. The basis projection is often described as a “frozen policy” scenario.

The preparation of this action plan is based on the Danish Energy Agency’s basis projection from April 2010. In this, consumption is projected using the EMMA (Energy Measurement. Monitoring and Analysis) model. This determines the development of energy consumption within the various sectors and areas of use on the basis of assumptions of economic growth and developments in energy prices. This includes a trend estimated on the development during the previous 10 years. It also reflects the technological development, structural effects within the individual areas of activity, scale effects and the effect of energy saving initiatives during the estimation period.

As a result of the Energy Policy Agreement of 21 February 2008, which states that there must be an annual energy saving corresponding to 1.5 % of the energy consumption, the energy saving initiative up to 2020 will be considerably greater than the initiative in the estimation period. The historic trends are therefore ascribed an effect that reflects these increased efforts. This means that all current energy saving activities are included in the base projection.

The basis projection, which as previously mentioned, only includes the already approved political initiatives shows a renewable energy share of 28.3 % and a reduction in energy consumption of 1.9 % in relation to 2006 figures by 2020, Further initiatives will therefore be required up to 2020 in order to meet the renewable energy target and the national target of a 4 % reduction in gross energy consumption.

It should, however, be emphasised that there is great uncertainty about the development in energy consumption up to 2020 which is partly related to the current conditions for economic growth and developments in energy prices and partly to uncertainty about the sensitivity of energy consumption to changes in energy costs in the long term and uncertainty about the accumulated effect of the current energy saving initiatives up to 2020.

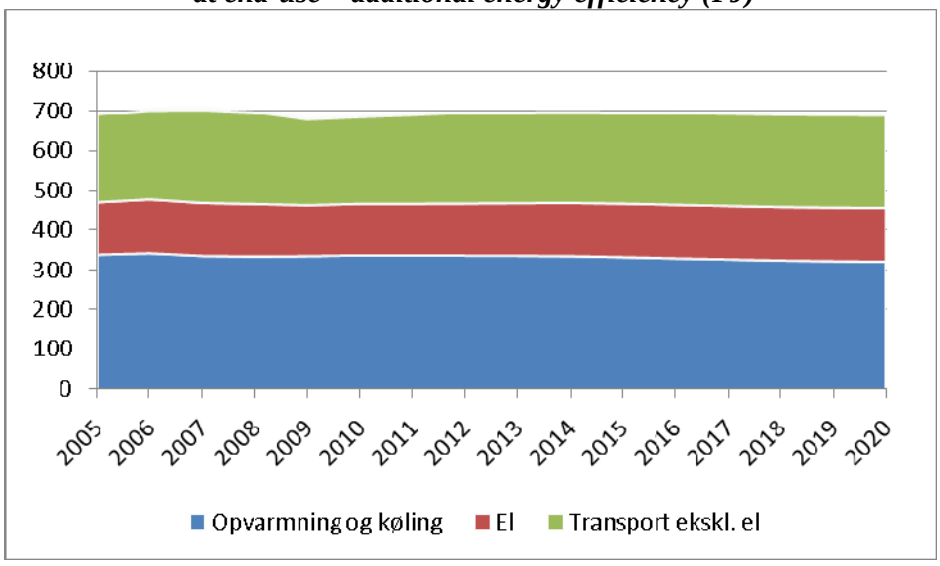
A base scenario for energy consumption is presented in the Action Plan which takes into consideration the energy efficiency and energy saving measures approved prior to 2009, as well as an additional scenario which includes planned reductions in energy consumption up to 2020.

In this Action Plan, the *additional scenario* corresponds to the base projection, although further energy savings are included as part of the calculation example that meet the Danish targets up to 2020. From a calculation point of view, this assumes that the gross energy consumption is reduced by 4 % by 2020 in relation to 2006, corresponding to the national targets for the reduction of gross energy consumption. Energy savings at end-use remain evenly spread over all sectors and areas of activity apart from transport. At present there are no specific means for achieving these savings.

Fig. 1. shows the expected additional final energy consumption in accordance with the additional scenario, as also shown in Table 1.

In the report, the tables are filled out using the energy unit stipulated in the template for the Action Plan - 1000 tons oil equivalent (ktoe). In Danish energy statistics and energy planning, it is the practice to use Joules as a measurement unit. Tables and figures in the report are therefore shown in Terajoules (TJ) or Petajoules (PJ). Conversion factor: 1 ktoe = 41.868 TJ

Fig. 1. Additional gross final energy consumption shown at end-use – additional energy efficiency (PJ)



Key for the above Graphic

Blue square: Heating and cooling

Red square: Electricity

Green square: Transport, excl. Electricity

In Denmark, a *reference scenario* showing the development in final energy consumption and gross energy consumption is not usually formulated if the various initiatives were not implemented. For the purposes of this action plan, however, an estimate was made of the final energy consumption up to 2020 without the most recent savings initiatives, corresponding to a development which only includes the historical trends and which, as mentioned previously, to a certain extent includes the effects of political initiatives. This can be seen in Table 1.

BOX – How to calculate the 'aviation capping mechanism' in the Renewable Energy Directive

Assume Country A has a share of aviation energy consumption (AEC) of its total gross final energy consumption (GFEC) of X:

$X = AEC/GFEC$

Assume that X>6.18 %

In this case the cap implies that for the purpose of assessing compliance,

$GFEC_{adjusted} = GFEC – AEC + AEC_{adjusted}$

where $AEC_{adjusted} = 0.0618 * GFEC$

In other terms

$GFEC_{adjusted} = GFEC – AEC + 0.0618 * GFEC=$

$=GFEC – X*GFEC + 0.0618 * GFEC=$

$= GFEC * (1.0618 – X)$

The 'adjustment' as a % of the real GFEC and as a function of X is therefore

$Adjustment = (GFEC – GFEC_{adjusted})/GFEC=$

$= X-0.0618$

In the case of Cyprus and Malta, the figures of 4.12 % and 0.0412 should replace the figures of 6.18 % and 0.0618 respectively.

Table 1: Expected gross final consumption of Denmark in heating and cooling, electricity and transport up to 2020, taking into account the effects of energy efficiency and energy saving measures[1] 2010-2020 (ktoe)

	2005	2010		2011		2012		2013		2014	
	Base year	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency
1) Heating and cooling[2]	8.071	8.161	8.042	8.232	8.021	8.320	8.021	8.400	8.012	8.467	7.991
2) Electricity [3]	3.166	3.144	3.108	3.199	3.130	3.247	3.148	3.308	3.179	3.367	3.214
3) Total transport (excl. electricity)	5.238	5.189	5.173	5.307	5.281	5.444	5.407	5.460	5.409	5.489	5.424
4) Transport, cf. Article 3(4) (a)[4]	4.145	4.207	4.191	4.293	4.267	4.397	4.361	4.397	4.350	4.411	4.353
5) Gross final energy consumption[5]	16.475	16.495	16.324	16.738	16.432	17.011	16.576	17.168	16.600	17.324	16.629

1 These estimates on energy efficiency and energy savings shall be consistent with other such estimates that Member States notify to the Commission, notably in Action Plans under the Energy Services Directive and the Energy Performance of Buildings Directive. If different units are used in those action plans, the conversion factors applied should be indicated.

2 It is the final energy consumption of all energy commodities except electricity for purposes other than transport, plus the consumption of heat for own use at electricity and heat plants and heat losses in networks (items '2. Own use by plant' and '11. Transmission and distribution losses' of Regulation (EC) No 1099/2008 (p. 23-24).

3 The gross electricity consumption is national gross electricity generation, including autogeneration, plus imports, minus exports.

4 Transport consumption as defined in Article 3(4)(a) of Directive 2009/28/EC. Renewable electricity in road transport for this figure should be multiplied by a factor of 2.5, as indicated by Article 3(4) (c) of Directive 2009/28/EC.

5 As defined in Article (2) (f) of Directive 2009/28/EC. This comprises final energy consumption plus network losses and own use of heat and electricity at electricity and heating plants (NB: this does not include consumption of electricity for pumped hydro storage or for transformation in electrical boilers or heat pumps at district heating plants).

The following calculation is needed only if final energy consumption for aviation is expected to be higher than 6.18 % (4.12 % for Malta and Cyprus):											
Final consumption for aviation	899	840	840	872	872	905	905	921	921	936	936
Reduction for Aviation[6] limit Article 5(6)	0	0	0	0	0	0	0	0	0	0	0
Total consumption after reduction for aviation limit	16.475	16.495	16.324	16.738	16.432	17.011	16.576	17.168	16.600	17.324	16.629

[6] According to Article 5(6) consumption for aviation has to be considered only up to 6.18 % (Community average), for Cyprus and Malta up to 4.12 % of gross final energy consumption.

	2015		2016		2017		2018		2019		2020	
	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency
1) Heating and cooling[7]	8.512	7.929	8.542	7.858	8.576	7.795	8.614	7.732	8.667	7.690	8.727	7.653
2) Electricity[8]	3.418	3.234	3.454	3.237	3.483	3.235	3.507	3.233	3.536	3.238	3.564	3.247
3) Total transport (excl. electricity)	5.522	5.432	5.556	5.459	5.589	5.480	5.619	5.493	5.658	5.510	5.693	5.520
4) Transport, cf. Article 3(4) (a)[9]	4.428	4.353	4.436	4.355	4.443	4.353	4.445	4.344	4.458	4.342	4.464	4.332
5) Gross final energy consumption[10]	17.453	16.596	17.553	16.553	17.648	16.510	17.740	16.458	17.861	16.438	17.984	16.419
The following calculation is only needed if final energy consumption for aviation is expected to be higher than 6.18 % (4.12 % for Malta and Cyprus):												
Final consumption in aviation	952	952	978	978	1.004	1.004	1.032	1.032	1.059	1.059	1.088	1.088
Reduction for aviation limit[11], cf. Article 5(6)	0	0	0	0	0	0	0	14	0	43	0	73
Total consumption after reduction for aviation limit	17.453	16.596	17.553	16.553	17.648	16.510	17.740	16.443	17.861	16.395	17.984	16.346

7 See footnote 4.
8 See footnote 5.
9 See footnote 6.
10 See footnote 7.
11 See footnote 8.

Table 1: Expected extended final consumption of energy for heating and cooling, electricity and transport in Denmark during the period up to 2020, allowing for the effect of energy efficiency and energy saving measures[12] 2010-2020 (PJ)

	2005	2010		2011		2012		2013		2014	
	Base year	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency
1) Heating and cooling[13]	338	342	337	345	336	348	336	352	335	355	335
2) Electricity[14]	133	132	130	134	131	136	132	138	133	141	135
3) Total transport (excl. electricity)	219	217	217	222	221	228	226	229	226	230	227
4) Transport as in Article 3(4) (a)[15]	174	176	175	180	179	184	183	184	182	185	182
5) Gross final energy consumption[16]	690	691	683	701	688	712	694	719	695	725	696

[12] These estimates on energy efficiency and energy savings shall be consistent with other such estimates that Member States notify to the Commission, notably in Action Plans under the Energy Services Directive and the Energy Performance of Buildings Directive. If different units are used in those Action Plans the conversion factors applied should be indicated.

[13] It is the final energy consumption of all energy commodities except electricity for purposes other than transport, plus the consumption of heat for own use at electricity and heat plants and heat losses in networks (items '2. Own use by plant' and '11. Transmission and distribution losses' of Regulation (EC) No 1099/2008 (p. 23-24).

[14] The gross electricity consumption is national gross electricity generation, including autogeneration, plus imports, minus exports.

[15] Transport consumption as defined in Article 3 (4) (a) of Directive 2009/28/EC. Renewable electricity in road transport should be multiplied by a factor of 2.5 as indicated in Article 3(4) (c) in Directive 2009/28/EC.

[16] As defined in Article (2)(f) of Directive 2009/28/EC. This comprises final energy consumption plus network losses and electricity and own use of heat and electricity at electricity and heating plants (NB: this does not include consumption of electricity for pumped hydro storage or for transformation in electric boilers or heat pumps at district heating plants).

The following calculation is needed only if final energy consumption for aviation is expected to be higher than 6.18 % (4.12 % for Malta and Cypern):											
Final consumption in aviation	38	35	35	37	37	38	38	39	39	39	39
Reduction for aviation limit[17]. Article 5(6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total consumption after reduction for aviation limit	690	691	683	701	688	712	694	719	695	725	696

[17] According to Article 5(6) has to be considered only up to 6.18 % (Community average), for Malta and Cyprus up to 4.12 % of gross final energy consumption.

	2015		2016		2017		2018		2019		2020	
	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency	(Reference scenario)	Additional energy efficiency
1) Heating and cooling[18]	356	332	358	329	359	326	361	324	363	322	365	320
2) Electricity[19]	143	135	145	136	146	135	147	135	148	136	149	136
3) Total transport (excl. Electricity)	231	227	233	229	234	229	235	230	237	231	238	231
4) Transport, cf. article 3 (4) (a)[20]	185	182	186	182	186	182	186	182	187	182	187	181
5) Gross final energy consumption[21]	731	695	735	693	739	691	743	689	748	688	753	687
The following calculation is only needed if final consumption for aviation is expected to be higher than 6.18 % (4.12 % for Malta and Cyprus):												
Gross final consumption in aviation	40	40	41	41	42	42	43	43	44	44	46	46
Reduction fir aviation limit[22], cf. Article 5 (6)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	1.8	0.0	3.1
Total consumption after reduction for aviation limit	731	695	735	693	739	691	743	688	748	686	753	684

18 See footnote 4
19 See footnote 5
20 See footnote 6
21 See footnote 7
22 See footnote 8

3. RENEWABLE ENERGY TARGETS AND TRAJECTORIES

3.1. National overall target

Table 2: National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2005 and 2020 (figures to be transcribed from Annex I, Part A Annex I to Directive 2009/28/EC:

A) Share of energy from renewable sources in the gross final energy consumption in 2005 (S2005) (%)	17
B) Target of energy from renewable sources in the gross final energy consumption in 2020 (S2005) (%)	**30**
C) Expected total adjusted energy consumption in 2020 (from Table 1, last cell) **(ktoe)**	16.346
D) Expected amount of energy from renewable energy sources, corresponding to the 2020 target (calculated as B x C) **(ktoe)**	4.904

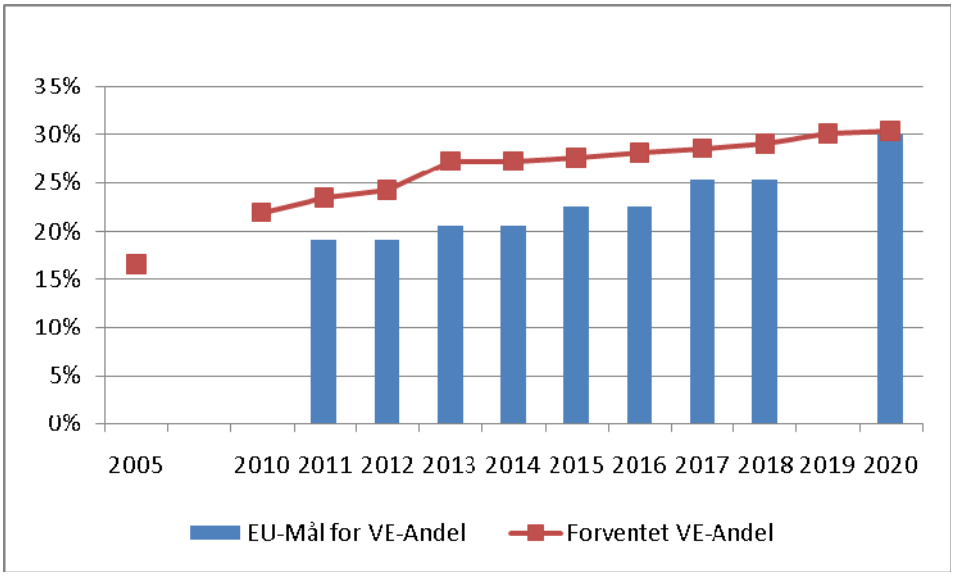
C) Expected total adjusted energy consumption in 2020 (from Table 1, last cell) (**PJ**)	684
D) Expected amount of energy from renewable energy sources, corresponding to the 2020 target (calculated as B x C) (**PJ**)	205

3.2. Sectoral targets and trajectories

Fig. 2 shows the estimated development in the general share of renewable energy up to the 30 % target in 2020. It can be seen that Denmark expects to exceed the indicative trajectory for all years up to 2020.

Denmark expects that the targets for renewable energy will be met mostly by national initiatives which will make energy consumption more efficient and increase the expansion with renewable energy, cf. Section 4.7.

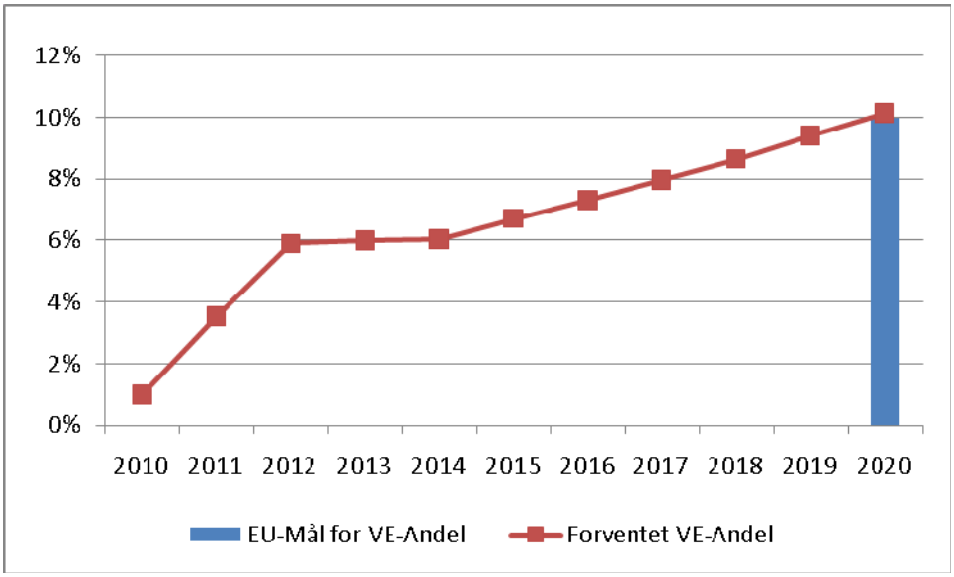
Fig. 2. Estimated development of the general RE share



Key for the above graphic
Blue: EU measurement of RE share
Red: Expected RE share

Similarly, Fig. 3 shows how the share of renewable energy in the transport sector is expected to increase towards a target of 10 % by 2020. The share of renewable energy in the transport sector in 2010 is estimated at 1.0 %, which is partly from electric trains and partly from first generation biofuels. By 2020, an increase in electric vehicles is also expected, as well as an increased consumption of first and second generation biofuels which will be expanded on in Section 5.

Fig. 3. Estimated development of the RE share in the transport sector



Key for the above graphic
Blue: EU measurement of RE share
Red: Expected RE share

As noted in Table 3 below, based on a series of calculation models further described in Section 5, the following general sectoral targets are expected for renewable energy by 2020:

- Heating and cooling 39.8 %.
- Electricity 51.9 %.
- Transport 10.1 %[23]

For calculation purposes, targets are assessed on estimated expansion with energy technologies in the three sectors. The anticipated contribution from the individual technologies and renewable energy sources can be seen in tables 10, 11 and 12 in Section 5.

The development process contains a number of uncertainties which include anticipated fuel prices in particular as well as expectations of the effects of confirmed and planned measures for the promotion of renewable energy. For example, relatively small changes in the relationship between the price of coal and biomass and the development in prices of the CO_2 quotas could result in a change of fuel used in the larger powers stations and thus a greater fluctuation in the use of renewable energy. Similarly, there is great uncertainty as to which form of wind power the current planning and approved support rules will result in.

[23] Calculated according to the special requirements in the RE Directive, Article 3(4).

Table 3: National 2020 target and the estimated trajectory of energy share from renewable energy sources in heating, cooling, electricity and transport *(Calculation tables 4a and 4b are expected to be used in preparation of Table 3.)*

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Renewable energy sources for heating and cooling[24] (%)	23.2	30.8	31.8	32.1	35.2	35.3	36.0	36.7	37.2	37.7	39.3	39.8
Renewable energy sources for[25] electricity (%)	26.8	34.3	37.1	38.0	46.2	45.5	45.7	47.2	48.6	49.7	51.8	51.9
Renewable energy sources for[26] transport (%)	0.2	1.0	3.5	5.9	6.0	6.0	6.7	7.3	7.9	8.6	9.4	10.1
Overall share of renewable energy sources[27] (%)	16.5	21.9	19.2	19.2	20.5	20.5	22.6	22.6	25.3	25.3	30.1	30.0
Of which from cooperation mechanism[28] (%)	-	-	0	0	0	0	0	0	0	0	-	0
Surplus for cooperation mechanism[29] (%)	-	-	4.2	5.0	6.8	6.7	5.0	5.6	3.3	3.8	-	0.4

24 Share of renewable energy in heating and cooling: The extended gross final consumption of energy from renewable energy sources for heating and cooling (as defined in Articles 5(1)b) and Article 5(4) of Directive 2009/28/EC) divided by gross final energy consumption for heating and cooling. Line A from Table 4a divided by line (1) of Table 1.

25 Share of renewable energy in electricity: gross final consumption of energy from renewable sources for electricity (as defined in Articles 5(1) a) and 5(3) in Directive 2009/28/EC) divided by total gross final energy consumption for electricity. Row B from Table 4a divided by row (2) from Table 1.

26 The share of renewable energy in transport: final energy from renewable sources consumed in transport (cf. Article 5(1)c) and 5(5) of Directive 2009/28/EC) divided by the consumption in transport of 1) petrol, 2) diesel, 3) biofuels used in road and rail transport and 4) electricity in land transport (as reflected in row 3 of Table 1). Line (J) from Table 4b divided by row (3) of Table 1.

27 The share of renewable energy in gross final energy consumption. Row (G) from Table 4a, divided by row (4) of Table 1.

28 In percentage point of overall renewable energy source share.

29 In percentage point of overall renewable energy source share.

As Part B of Annex I of the Directive			2011-2012	2013-2014	2015-2016	2017-2018		2020
			S_{2005}**+20 %** (S_{2020}-S_{2005})	S2005 **+30 %** (S_{2020}-S_{2005})	S2005 +**45 %** (S_{2020}-S_{2005})	S2005 +**65 %** (S_{2020}-S_{2005})		S_{2020}
Minimum trajectory for renewable energy sources[30] (%)			19.2	20.5	22.6	25.3		30.0
Minimum trajectory for renewable energy sources (ktoe)			3.169	3.414	3.742	4.166		4.926
Minimum trajectory for renewable energy sources (PJ)			133	143	157	174		206

30 As Part B of Annex I B to Directive 2009/28/EC.

Table 4a: Calculation table for the renewable energy contribution of each sector to final energy consumption (ktoe)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A) Expected gross final consumption of renewable energy for heating and cooling	1.869	2.480	2.549	2.575	2.821	2.817	2.855	2.887	2.900	2.916	3.018	3.042
B) Expected gross final consumption of electricity from renewable energy sources	850	1.067	1.160	1.197	1.469	1.462	1.477	1.527	1.572	1.607	1.676	1.685
C) Expected final consumption of energy from renewable energy sources in transport	9	42	151	1.197	259	260	266	270	275	279	286	291
D) Expected total renewable energy consumption[31]	2.718	3.578	3.849	4.017	4.534	4.523	4.579	4.664	4.725	4.779	4.954	4.989
E) Expected transfer of renewable energy sources to other Member States	0	0	694	834	1.123	1.106	833	928	552	619	0	63
F) Expected transfer of renewable energy sources from other Member States and third countries	0	0	0	0	0	0	0	0	0	0	0	0
G) Expected consumption of renewable energy sources adjusted for target (D) (E)+(F)	2.718	3.578	3.155	3.182	3.411	3.417	3.746	3.737	4.173	4.160	4.954	4.926

[31] According to Article 5(1) of Directive 2009/28/EC, gas, electricity and hydrogen from renewable energy sources must only be considered once. Double counting is not allowed.

Table 4a: Calculation table for the renewable energy contribution of each sector to final energy consumption (PJ)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A) Expected gross final consumption of renewable energy for heating and cooling	78	104	107	108	118	118	120	121	121	122	126	127
B) Expected gross final consumption of electricity from renewable energy sources	36	45	49	50	62	61	62	64	66	67	70	71
C) Expected final consumption of energy from renewable energy sources in transport	0	2	6	50	11	11	11	11	11	12	12	12
D) Expected total renewable energy consumption[32]	114	150	161	168	190	189	192	195	198	200	207	209
E) Expected transfer of renewable energy sources to other Member States	0	0	29	35	47	46	35	39	23	26	0	3
F) Expected transfer of renewable energy sources from other Member States and third countries	0	0	0	0	0	0	0	0	0	0	0	0
G) Expected consumption of renewable energy sources adjusted for target (D)-(E)+(F)	114	150	132	133	143	143	157	156	175	174	207	206

[32] According to Article 5(1) of Directive 2009/28/EC, gas, electricity and hydrogen from renewable energy sources must only be considered once. Double counting is not allowed.

Table 4b: Calculation table for the renewable energy in transport share (ktoe)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C) Expected renewable energy consumption in transport[33]	9	42	151	257	259	260	266	270	275	279	286	291
H) Expected renewable energy consumption in road transport[34]	0	0	0	0	1	2	4	4	5	7	9	12
I) Expected consumption of biofuels from waste, residues, non-food cellulosic and lingo-cellulosic material in transport[35]	0	0	0	0	0	0	21	42	63	85	108	131
J) Expected renewable energy contribution to transport for the renewable energy target: (C)+(2,5-1)x(H)+ (2-1)x(I)	9	42	151	257	261	263	292	318	346	375	407	439

[33] Containing all renewable energy sources used in transport, including electricity, hydrogen and gas from renewable energy sources and excluding biofuels that do not comply with the sustainability criteria (cf. Article 5(1) last subparagraph).

[34] Specify here actual values without using the multiplication factors.

[35] Specify here actual values without using the multiplication factors.

Table 4b: Calculation table for the renewable energy in transport share (PJ)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C) Expected renewable energy consumption in transport[36]	0	2	6	11	11	11	11	11	11	12	12	12
H) Expected renewable energy consumption in road transport[37]	0	0	0	0	0	0	0	0	0	0	0	1
I) Expected consumption of biofuels from waste, residues, non-food cellulosic and lingo-cellulosic material in transport[38]	0	0	0	0	0	0	1	2	3	4	5	5
J) Expected renewable energy contribution to transport for the renewable energy target: C)+(2,5-1)x(H)+(2-1)x(I)	0	2	6	11	11	11	12	13	14	16	17	18

[36] Containing all renewable energy sources used in transport, including electricity, hydrogen and gas from renewable energy sources and excluding biofuels that do not comply with the sustainability criteria (cf. Article 5(1) last subparagraph).

[37] Specify here actual values without using the multiplication factors

[38] Specify here actual values without using the multiplication factors

4. MEASURES FOR ACHIEVING THE TARGETS

4.1. Overview of all policies and measures to promote the use of energy from renewable sources

Table 5 below, gives an overview of existing and planned measures that make the most significant contributions to expansion using renewable energy in Denmark. The table also shows the section in the Action Plan in which these measures are more fully described.

Table 5: List of all policies and measures

Name of measure and reference	Type of measure*	Estimated result**	Target group and/or target activity***	Existing or planned	Start and end dates for measure	Section in Action Plan
Subsidies for RE generation installations (RE Act)	Economic	Increased RE electricity generation	Investors, RE-electricity generation	Existing	Latest amendment, Jan 2009	4.3
Tendering of offshore wind turbines (RE Act and political agreements)	Economic	Increased wind power capacity	Investors, wind power	Existing	Latest amendment Jan 2009	4.2.1 and 4.3
Four schemes for the promoting expansion using onshore wind: value loss scheme, purchasing rights scheme, green scheme, and the guarantee scheme (RE Act)	Economic, regulation	Increased wind power capacity	manufacturers of and neighbours to onshore wind turbines	Existing	Jan 2009 →	4.2.1
Scrappage scheme for wind turbines (RE Act)	Economic	Increased wind power capacity	Manufacturers and investors, wind power	Existing	2004 → 2011	4.3
Funding for small RE technologies (RE Act)	Economic	Promoting generation from solar panels, wave power etc.	Investors and manufacturers	Existing	2008 → 2011	4.3
Prioritised access to the electricity grid for RE electricity	Regulation	Ensured transport of RE electricity	RE electricity producers	Existing	1999 →	4.2.6 and 4.2.7
Local authority planning for scrappage scheme with effect for 75 MW for 2010 and 2011 (agreement between the Minister for the Environment and the Chairman of Local Government Denmark)	Political agreement	Increased wind power generation	Local Authorities	Existing		4.2.1
National Test Centre for larger wind turbines at Østerild and planning for areas for testing wind turbines up to 2020	Political agreement	Testing of new wind power systems	Industry and research	Planned	2010 →	4.2.1
Biomass agreement	Regulation	Promotingthen use of biomass in power stations	Power stations	Existing	1993 →	4.6.2
Various initiatives to promote biogas generation (Green Growth)	Economic, regulation, information	Promotion of biogas generation	Agriculture and producers of biogas	Planned	-	4.2.8, 4.3 and 4.6
Various initiatives to promote the generation of energy crops (Green Growth)	Economic, regulation	Promotion of generation of energy crops	Agriculture and producers of biogas	Planned	-	4.6
Free choice of fuel for smaller co-generation plants (Green Growth 2.0)	Regulation	Promotion of the use of biomass	Co-generation plants < 2 MW	Planned	-	4.2.9 and 4.6

Name of measure and reference	Type of measure*	Estimated result**	Target group and/or target activity***	Existing or planned	Existing or planned	Section in Action Plan
Tax exemption for RE heating and cooling	Economic	Promotes RE for heating and cooling	Heating and cooling producers	Existing		4.2.9 and 4.4
Act on local authority cooling	Regulation	Promotion of energy efficient cooling of buildings	Local Authorities	Existing	July 2008 →	4.2.1, 4.2.9 and 4.4
Scrappage scheme for oil-fired boilers (Finance Act 2010)	Economic	Reduces CO_2 emissions and increases the installation of RE installations/connection to district heating	End-users with oil-fired central heating	Existing	March 2010 →	4.2.3 and 4.4
Roll-out plan for intelligent electricity consumption (various initiatives)	Regulation, analyses	Promotes intelligent electricity consumption	Electricity producers and users	Existing/ planned	2008 →	4.2.6
Building Regulation	Regulation	Promotes energy saving	Building sector and consumers	Existing	Latest amendment Feb 2008	4.2.3
Act on the promotion of energy savings in buildings	Regulation	Promotes energy saving	Building sector and consumers	Existing	2005 →	4.2.3
Centre for Energy Savings	Information	Promotes energy savings	Consumers	Existing	March 2010 →	4.2.4
Knowledge Centre for Energy Savings in Buildings	Information	Promotes energy savings	Building sector	Existing	2008 →	4.2.4
Agreements on public buildings	Regulation	Reduces energy consumption in public buildings	State authorities	Existing	2009 →	4.2.3
Optional agreements for energy savings in local and regional authorities	Political agreement	Reduces energy consumption in public buildings	Local and regional authorities	Existing	2007/2009 →	4.2.3
Tax exemptions for electric vehicles	Economic	Promotes the use of electric vehicles	Manufacturers and consumers	Existing	→ 2015	4..5
Test schemes for electric vehicles (Consolidation Act on state subsidies for testing of electric vehicles)	Economic, information	To gain experience and knowledge on the use of electric vehicles and their interrelation to the electricity system	Businesses, authorities, institutions and organisations	Existing	2008-2012	4..5
Sustainable biofuels (Act on Sustainable Biofuels)	Regulation	Mixing sustainable biofuels with petrol and diesel	Importers, producers and sellers of petrol or diesel	Existing	Jan 2010 →	4.2.10 and 4.5
Exemption from CO_2 tax for biofuels	Economic	Increases generation and consumption of biofuels	Producers and consumers of petrol or diesel	Existing		4.5

Name of measure and reference	Type of measure*	Estimated result**	Target group and/or target activity***	Existing or planned	Existing or planned	Section in Action Plan
ETDDP (Energy Technology Development and Demonstration Programme (ETDDP Act)	Economic, information	Research into biofuels, intelligent electricity, etc.		Existing	Jan. 2008 →	4.5
Changes in vehicle taxation	Economic	Reduces greenhouse gas emissions and increases consumption of renewable energy in the transport sector	Consumers and producers	Planned	-	4.5

* State whether this is (in all significant aspects) a legislative measure, an economic measure or a" soft" measure (e.g. information campaign).

** Is the estimated result a change in behaviour, installed capacity (MW or t/year) or (ktoe)?

*** Which target group does this refer to: investors, end-users, public authorities, planners, architects, technicians etc? Which activity/sector is the measure aimed at: generation of biofuels, utilisation of manure for energy generation etc?

4.2. Specific measures to fulfil the requirements under Articles 13, 14, 16 and 17-21 of Directive 2009/28/EC

4.2.1. Administrative procedures and spatial planning (Article 13(1) of Directive 2009/28/EC)

a) List of current national and (if applicable) regional legislative rules for approval, certification, licensing procedures and spatial planning applied to plants and associated transmission and distribution network infrastructure:

Electricity

Installations for the generation, transmission and distribution of electricity are regulated by the Electricity Supply Act (Consolidation Act No. 1115 of 8 November 2006, with later amendments), the Promotion of Renewable Energy Act (Act No. 1392 of 27 December 2008, with later amendments) and the Act on Energinet.dk (Consolidation Act No. 224 of 16 March 2009 with later amendments) as well as Executive Orders issued in pursuance of these.

The Electricity Supply Act which implements the EC Electricity Directive contains rules for the licensing requirements for larger electricity producers (with over 25 MW capacity) and for grid and transmission companies. The act also includes rules for the approval of electricity generating installations. Objective criteria for approval are stated in accordance with the Executive Order on conditions and procedures for the notification of permission for the establishment of new electricity generation installations as well as significant changes to existing installations, cf. below. In addition, the Electricity Supply Act and the Act on Energinet.dk contain rules for licensing the establishment etc., of certain transmission networks, including electrical supply networks offshore and in the exclusive economic zone.

The Promotion of Renewable Energy Act (RE Act) which was approved at the end of 2008 is primarily concerned with the regulation of wind turbines. The Act contains provisions for the following:

- National targets for the combined local authority planning for wind turbines.
- Four new schemes for the promotion of expansion using wind turbines:
  a) Loss of value of property due to the erection of wind turbines.
  b) Model for local ownership through purchasing rights to wind turbines for local inhabitants.
  c) A Green plan for reinforcing local countryside and recreational values.
  d) A guarantee scheme for financing preliminary investigations by local wind turbine associations etc.
- Rules for authorisation for offshore electricity generation etc., (including the tendering of offshore wind farms).
- Rules for connecting wind turbines to the network.

- Technical and safety requirements for wind turbines.
- Rules on the regulation of electricity generation from tendered offshore wind turbines.
- Subsidies for RE electricity generation installations.
- Pool for small RE technologies.

The onshore erection of wind turbines is also regulated by the Planning Act, cf. below. The rules for spatial planning do not apply offshore, which is why licenses for the establishment of electricity generating installations etc, (primarily wind power, although they can also be wave power, or similar) are issued in pursuance of the Renewable Energy Act.

These acts also contain regulations on Environmental Impact Assessment (EIA) and other impact assessments. A number of Executive Orders have been issued in pursuance of the above Acts, the most significant of which are:

- Executive Order No. 493 of 12/06/2003 on conditions and procedures for the notification of authorisation for the establishment of new electricity generation installations as well as significant changes to existing installations (the Executive order contains objective approval criteria and exempts smaller RE installations from approval)
- Executive Order No. 1463 of 19/12/2005 (with later amendments) on companies responsible for the system and the use of the electricity transmission network etc.
- Executive Order No. 896 of 24/08/2006 on the grid connection of electricity generation installations using environmentally friendly fuels (Grid connection is usually regulated directly by law although normal power stations are independently regulated)

The following Executive Orders and Circulars also relate to wind turbines:

- Executive Order No. 651 of 26/06/2008 on the technical approval scheme for the construction, presentation, erection, maintenance and service of wind turbines
- Executive Order No. 1365 of 15/12/2004 on the network connection of wind turbines and price supplements for wind turbine generated electricity etc.
- Executive Order No. 815 of 28 August 2000 on the environmental impact assessment (EIA) of offshore electricity generation installations
- The Circular on the planning of and land zone authorisation for the erection of wind turbines with accompanying guidelines
- Consolidation Act No. 936 of 24 September 2009 on the environmental assessment of plans and programmes
- Consolidation Act No. 1102 of 20 November 2009 on concerned authorities and on public announcement in accordance with the Act on the environmental assessment of plans and programmes

- Executive Order No. 1335 of 6 December 2006 on the environmental impact assessment (EIA) of certain public and private installations in pursuance of the Planning Act
- Guideline No. 9339 of 12 March 2009 on EIAs in the Planning Act.Vejledning nr. 9339 af 12. marts 2009 om VVM i planloven

If a significant impact on Natura 2000 areas is unavoidable, the establishment or expansion of installations will be covered by the impact assessment in the Executive Order on Habitats, if they require previous planning or permission etc., in accordance with the Executive Order on Habitats, cf. Sections 6-9. If the establishment or expansion in a Natura 2000 area requires planning permission, this must be applied for in advance cf. Section 5 of the Executive Order on Habitats. In addition, there are special regulations which take into consideration the generally protected Annex 4 species. This also applies outside Natura 2000 areas; cf. Section 11 of the Executive Order on Habitats and Section 29a of the Protection of Nature Act.

Geothermal energy

Authorisation for the reclaiming of geothermal heat from the underground can be granted in pursuance of Section 5, subsection 1 of the Danish Subsoil Act (Consolidation Act No. 889 of 4 July 2007 with later amendments). The Minister of Climate and Energy can grant authorisation following presentation to the Parliamentary Energy Policy Committee (Folketings Energipolitiske Udvalg).

Heat

The Heat Supply Act (cf. Consolidation Act No. 347 of 17 may 2005 with later amendments) promotes the most economic and environmentally friendly use of energy for heating and hot water supplies to buildings. The Act contains the general framework for the expansion of the direct heating network, including heat supplies based on renewable energy. Projects of under 25 MW including electricity generation, approved in accordance with the Heat Supply Act do not require approval under the Electricity Supply Act.

Consolidation Act No. 1295 of 13 December 2005 on the approval of projects for combined heating supply installations (project provision) states that the District Council is the body that can approve heating projects. The District Council must also ensure that heating plans are is included in the spatial planning and is also coordinated with the legislation on spatial planning.

Cooling

The District Cooling Act cf. Act No.465 of 17 June 2008 allows Local Authorities to establish and operate district cooling installations. Projects for the establishment of new installations etc., must be approved by the District Council.

Spatial Planning

The Planning Act (Consolidation Act No. 1027 of 20 October 2008 with later amendments) ensures that the coordinated planning unites the local interests in the use of the area and contributes to the protection of nature and the environment so that social development can take place in a sustainable way with respect for the living conditions of the local inhabitants and for the protection of animal and plant life.

The generation of electricity with wind turbines plays a significant part in Danish energy policy. At the same time, the erection of wind turbines on land has a significant effect on the local environment. In order to be able to use the wind as an energy resource, sustainable expansion with wind turbines requires careful planning and a land zone consultative process which takes the surrounding area, the local nature, countryside, cultural and historical and agricultural interests into consideration as much as possible (Circular on the planning of, and land zone authorisation for, the erection of wind turbines, Section 1).

The government has decided that Denmark will have a national test centre for large wind turbines of up to 250 metres in height (20 MW), which will give both the wind turbine industry and research institutions the optimum opportunity for staying ahead of the field. The government has the support of a parliamentary majority for situating the national test centre for large wind turbines at Østerild, as part of a total solution for the erection of test turbines up to 2020.

Biofuels

The Act on Sustainable Biofuels (Act No. 468 of 12 June 2009). The Act aims at promoting the use of sustainable biofuels in land transport so that Denmark can meet its international climate commitments.

There are no regulations governing the process of transforming biomass into biofuels.

b) Responsible ministries/authorities and their competences in the field:

The Climate and Energy Ministry and the Danish Energy Agency

Climate and Energy Minister has overall responsibility for energy and also undertakes political negotiations with the parties in Folketing (Danish Parliament). The Minister presents proposals for legislation and is responsible for the legislative process.

The administration of the energy area and its actors is the undertaken by the Danish Energy Agency.

Owners of electricity generation installations of over 25 MW must be licensed by the Energy Agency. Licensing is dependent on the fulfilment of the necessary technical and economic capacity requirements.

The Energy Agency must approve the establishment of and changes to all larger electricity generating installations. Installations of less than 5 MW and renewable energy installations under 10 MW are exempt. Applications will be approved if a number of publicly announced, objective criteria can be met.

Larger electricity transmission installations and marine cables may be approved under the terms of the Electricity Supply Act.

Offshore wind turbines are regulated independently under the RE Act. This stipulates Energy Agency requirements for tendering and approval for preliminary investigation, establishment and generation. This also applies to demonstration installations for wave power.

The Energy Agency approval is not necessary for the erection of land wind turbines unless these are in excess of 10 MW. The appropriate approvals and permissions in accordance with the Planning Act are issued by local authorities for wind turbines up to a height of 150 metres, cf. below. Permission for wind turbines higher than 150 metres will be approved by the Regional Environmental Centres, in accordance with EIA rules in the Planning Act, following an EIA.

The Climate and Energy Minister approves authorisations for geothermal energy reclamation through the Energy Agency, after presentation to the Parliamentary Energy Policy Committee.

Energinet.dk

Energinet.dk, the state-owned company responsible for the system, owns and operates the overall electricity and natural gas grid. In addition, Energinet.dk calculates and finances support for renewable energy installations in agreement with the support tariffs recommended by the Electricity Supply Act and the RE Act. Energinet.dk's business is regulated by the Act on Energinet.dk cf. Consolidation Act No. 224 of 16 March 2009.

Spatial Planning:

The main principles for competence in accordance with the Planning Act are as follows:

The Agency for Spatial and Environmental Planning at **The Ministry of the Environment** determines the overall framework for planning. This takes the form of a national planning report, an overview of national interests reflected in national planning directives, including a planning directive for the Greater Copenhagen Area. The **Regional Environment Centres** under Agency for Spatial and Environmental Planning administer a number of these tasks in relation to planning and environmental protection.

The five regions will formulate a regional development plan which will provide a vision for overall regional development in terms of structure, nature, the environment, business - including tourism, employment, education and culture, but will not include precise details.

The Local Authorities will plan development in urban areas and the open countryside under the guidance of the national sector organisations and the Regional Council's visions. This will collect all the threads of the local plans. The local plan contains the framework for planning as well as the guidelines for area use in projects which are not achievable through the local plan. Ultimately, the local authorities will formulate local plans with more detailed guidelines for land use and building in the area. The local plan has direct legal implications for owners and users.

Local authorities are responsible for the EIA of renewable energy installations, including wind turbines under 150 metres.

The Environmental Centres are responsible for coordinating and carrying out EIAs for wind turbines over 150 metres.

An EIA process has three significant aims:

- To ensure that projects that may have a significant impact on the environment are required to have authorisation which includes protecting and having consideration for the environment.
- Ensuring that an environmental assessment is undertaken as a basis for the license. The environmental impact of wind turbine projects must be documented in special reports.
- Ensure that the appropriate authorities and the general public have the opportunity to become involved in the decision-making process prior to authorisation being given for the project.

The local authorities have an important role to play in connection with approval of projects for combined heating supplies. The rules for this can be found in the Heat Supply Act, cf. above. The local authorities can also carry out heat planning in for the area in cooperation with the supply companies and other related organisations.

Section 3, subsection 1 of the Wind Turbine Circular stipulates rules for local plan guidelines for areas for the erection of wind turbines. The provisions should be seen in relation to Section 4, subsection 1 of the circular, which states that the local authority may only implement frameworks for local plans for wind turbines in areas designated by local plan guidelines and with Section 5, subsection 2, which states that with the exception of privately owned wind turbines, land zone authorisation may only be granted for the erection of wind turbines within specially designated areas in the local plan. Taken together, these three provisions emphasise the main principle that large wind turbines can only be situated in specially designated wind turbine areas, in accordance with local authority guidelines.

The provision does not make it mandatory for the local authority to designate special wind turbine areas, although it is recommended that there is a general plan to find more suitable locations for the erection of larger wind turbines which can be followed up by a more detailed plan. This planning will ensure that areas designated for larger wind turbines are kept free of buildings or facilities that may hinder the later erection of wind turbines.

The Wind Turbine Secretariat was set up by the Ministry of the Environment and is intended to help local authorities promote wind turbine planning. The Secretariat provides support to local authorities in relation to placement, the planning process and problem solving in connection with the local authority planning process for the erection of onshore wind turbines. The Secretariat has organisational links to the Regional Environmental Centres but does not undertake the work of an authority.

The ministry has also established a special **Biogas Secretariat** that supports local authorities with planning biogas installations.

The **Energinet.dk "Front Office"** is state-owned Energinet.dk's recently established service organisation whose specific job is to service and coordinate enquiries from external agencies. Front Office also provides a flexible and effective response to customer enquiries regarding the four new schemes in the RE Act for the promotion and expansion of onshore wind turbines, as described previously.

As part of its administration of the four schemes in the RE Act as described in section 4.3, Front Office is also the secretariat for the Appraisal Authority. The Appraisal Authority is an independent body that estimates compensation for value loss on property caused by the erection of wind turbines. The Authority has been appointed by the Climate and Energy Minister and comprises the five regions, each with a chairman from each and 17 professional members (property assessors).

Front Office also deals with external enquiries concerning the network connection of new electricity generation installations, including renewable energy installations. This could be questions on cost sharing, connection deadlines, technical approval of wind turbines etc.

c) Revision foreseen with the view to take appropriate steps as described by Article 13(1) of Directive 2009/28/EC will be carried out at the latest by (date)

The need for a revision of current provisions for authorisations and licenses etc, for energy producing plants is assessed on an ongoing basis, although there are no plans for amendments at present, as it is would appear that Denmark currently meets the requirements of the Directive.

d) Summary of existing and planned measures at regional/local levels (where relevant)

There is currently no regional legislation for this in Denmark, so there are therefore no planned measures at regional/local levels.

e) Are there unnecessary obstacles or non-proportionate requirements in relation to authorisation, certification and licensing procedures applied to plants and associated transmission and distribution network infrastructure for the generation of electricity, heating or cooling from renewable energy sources, and to the process of transformation of biomass into biofuels or other energy products? If so, what are they?

There appear to be no unnecessary problems or non-proportionate requirements, as stated in the question. The Energy Agency has not received any queries or requests from actors in the energy field requesting amendments to the rules which apply to authorisation, certification and licensing procedures that are applied to plants and associated transmission and distribution network infrastructures for the generation of electricity, heating or cooling from renewable energy sources, and the process of transformation of biomass into biofuels or other energy products.

f) What level of administration (local, regional and national) is responsible for authorising, certifying and licensing renewable energy installations and for spatial planning? (*If it depends on the type of installation, please specify.)* If more than one level is involved, how is the coordination between the different levels managed? How will coordination between different responsible authorities be managed in the future?

As stated previously, two state secretariats have been established; The Wind Turbine Secretariat and the Biogas Secretariat, whose job is to advise local authorities on questions of planning for wind turbines and biogas installations.

Owners of energy plants that generate and distribute electricity must to a further specified extent be licensed and authorised by the Energy Agency, which is a part of the Climate and Energy Ministry. The criteria for this is stated in the Electricity Supply Act with associated Executive Orders, cf. Section 4.2.1 a) above. All competence is thus at a national level.

With regard to installations for the generation and distribution of heat; national heating planning has already been carried out by the Energy Agency. The nationally approved plans primarily divide the country up into areas with natural gas supply and co-generation, although they also include planning for other energy sources including renewable energy. From their inception, the plans have formed the framework for the expansion of the combined heating supplies although competence for the authorisation of concrete projects has now been transferred to the local authorities.

Consolidation Act No. 1295 of 13 December 2005 on the approval of projects for combined heating supply installations states that the District council, which is the body that approves heating projects, must ensure that heating planning is included in the spatial planning and is also coordinated with the legislation on spatial planning.

g) How is it ensured that comprehensive information on the processing of authorisation, certification and licensing applications is made available to potential applicants? What information and help do potential applicants receive on the application form itself?

The conditions for obtaining a license for the generation, transmission and distribution of electricity can be found in the Electricity Supply Act and associated Executive Orders cf. Section 4.2.1 a) above.

The requirements for obtaining an authorisation for the establishment of, or alteration to an electricity generation installation are stated clearly in Section 5 of Executive Order No. 493 of 12 June 2003. If these requirements are fulfilled, the applicant may be granted permission, cf. Section 3 of the Executive Order.

The support allocated to renewable energy installations in Denmark is set in concrete amounts by the RE Act. It is thus not necessary to apply for support as the producer is legally eligible to receive the support amount as stated in the Act.

Under certain circumstances, application forms are not applicable.

The Energy Agency has the most comprehensive website, (www.ens.dk) which provides guidance and information on all the requirements necessary for obtaining authorisation etc. Furthermore, the Energy Agency offers actors telephone advice, or if necessary a meeting, to clarify any areas of doubt in connection with an application.

h) How is horizontal coordination facilitated between different administrative bodies responsible for different parts of the permit? How many procedural steps are needed to receive the final authorisation/license/permit? Is there a one-stop shop for coordinating all steps? Are timetable for processing applications communicated in advance? How long does it take on average to reach a decision on an application?

The competence for making decisions on authorisations, licenses calculation of support etc. for energy installation is centred on one national authority. There is normally no need to facilitate a horizontal coordination. In exceptional situations, e.g. in connection with the establishment of transmission installations for offshore wind turbines for which there may be a need for horizontal coordination, this will be normally be undertaken by the Energy Agency, so that applicants do not themselves need to obtain the results of consultations, authorisations etc, from other state authorities.

An example of this is the “One-stop shop” procedure, which is used for the administration of applications for the erection of offshore wind turbines. A number of state organisations could have opinions on or interest in this, so a procedure has been developed in which the Energy Agency handles the application on behalf of the applicant and negotiates with the other authorities. The Energy Agency is also the EIA authority for the project. Once the Energy Agency’s decision is reached, it is then cleared with the other authorities so that there will not normally any need for the applicant to obtain further permission from other authorities.

It is difficult to give an average case administration time, as this is very much dependent on the individual project. Larger projects must often undergo a spatial planning process which will take time, in part due to the involvement of the local populace and other authorities.

Certain smaller renewable energy projects such as solar heating or geothermal heating projects can often be initiated simply by applying to the District Council, thus bypassing the authorities. However, this is on the precondition that the project does not contravene current provisions, e.g., current local plans.

As the procedure and deadlines usually follow set time schedules, applicants will normally be informed of administration time when they make their initial applications. It is the normal procedure to acknowledge receipt of an application, give the name of the contact person at the authority and possibly also the estimated administration time.

i) Do authorisation procedures take into account the specificities of the different renewable energy technologies? If yes, please describe how. If no, do you envisage taking them into account in the future?

The rules for authorisation are largely dependent on the technology and type of installation and its size. One main precept is that both in relation to spatial planning requirements and authorisation in accordance with energy legislation, smaller installations are treated more carefully.

Onshore wind power installations can only be authorised in accordance with the Executive Order on Authorisations (Executive Order No. 493 of 12 June 2003), if the installation is over 10 MW. In addition, the wind turbine must adhere to a series of type approval requirements, further described in Section 4.2.2. Furthermore, the installation site must be designated for the erection of wind turbines in the local authority planning. Local authorities are encouraged to formulate a general plan for suitable sites for larger wind turbines in the area which can form the basis for the following detailed plan. This planning ensures that areas which are considered suitable for larger wind turbines are kept free other buildings or facilities which might hinder the later erection of wind turbines.

Onshore wind turbine projects are furthermore bound by the EIA rules in the Planning Act which make EIAs obligatory for wind turbines over 80 metres, with mandatory screening for other wind turbines. However, EIAs are obligatory for wind turbine projects with more than three turbines, irrespective of height. In cases of obligatory EIAs, the project must not begin until the EIA procedure is completed and notice of approval has been given to the constructor.

Specific rules apply for offshore wind turbines as these can either be established by tender or application. If an application is to be successful, the Energy Agency must first issue a preliminary investigation authorisation, the intention of which is to clarify whether there are spatial or legislative circumstances which might hinder the construction.

Wave power installations follow the same procedure as offshore wind turbines (RE Act provisions on the authorisation of offshore electricity producing installations). However, from an administrative point of view, it is important to take into take the operator's limited organisational capacity and experience with legislation and authorisations into consideration. In addition, all current Danish wave power projects are test and demonstration projects and have therefore only been given temporary authorisation for their implementation and for electricity generation. This, and the relatively limited physical extent of this type of project also makes it possible to apply a more simplified administrative practice than that for offshore wind turbine projects, as preliminary investigation authorisation is not required prior to applying for (temporary) establishment authorisation.

With plants producing electricity and heat – or electricity or heat – the authorisation process is more or less identical irrespective of the type of fuel used. However, plants bound by the CO_2 quota rules do not need to meet the requirements for CO_2 emissions, as this would give a double adjustment.

Special rules apply for waste burning plants cf. the Waste Burning Directive and Executive Order No. 43 of 13 January 2010 on waste.

Approval of geothermal installations have other rules as they involve permission to use the underground in accordance with the Subsoil Act which is further described in Section 4.2.1 a) and 4.2.9.

j) Are there special procedures, for example simplified notification procedures for small decentralised installations such as solar panels or biomass boilers in buildings? If so, what are they? Are the rules publicly available to citizens? Where are they published? Is the introduction of simplified notification procedures planned for the future? If so, for which types of installation/system? (Is net metering possible?)

As mentioned above, electricity generating renewable energy installations under 10 MW do not require authorisation under the Electrical Supply Act. This is stated clearly in Section 1 of Executive Order No. 493 of 12 June 2003. Establishment of electricity generating installations which do not require authorisation in accordance with Section 1, subsection 2 of Executive Order No. 493 must, however, be registered with the Energy Agency. Registration is important for, among other things, the compilation of energy statistics by the Energy Agency.

The establishment of smaller installations must, however, fulfil the requirements of the local authority spatial planning. This may mean that these smaller installations must fit into the framework of an approved local plan.

With regard to the heating sector, the Heat Supply Act and the so-called Project Executive Order stipulate the authorisation requirements for projects including requirements for a viable economy. Block heating installations, i.e. for larger buildings such as hospitals, blocks of flats, shopping centres etc., under 0.25 MW are, however, exempt from this.

A legislative amendment is under preparation for the introduction of a minimum limit so that combined heat supply facilities other than block heating installations under 0.25 MW may also be exempted.

All rules are published and are comprehensively described on the Energy Agency's website. The same applies for rules on spatial planning and EIAs, for which information may also be found on the Agency for Spatial and Environmental Planning's website.

k) Where are the fees associated with applications for authorisation/licenses/permits for new installations published? Are they related to the administrative costs of issuing the permits? Is there any plan to revise these fees?

The rules for this are stated in the Act or Executive Order and are published in Retsinformation (The Danish legislative information portal www.retsinformation.dk) and on the Energy Agency's website.

Fees are only liable to a limited extent for the administration of authorisation etc., of new installations. The rules for this are to be found in the provisions in Section 51 of the Electricity Supply Act, and in a special Executive Order, as well as in Section 58 of the RE Act. Any fees which may be liable are limited to covering direct administrative costs.

There are no current plans to revise the Executive Order on Fees.

l) Is official guidance available to local and regional bodies on planning, designing, building and refurbishing industrial and residential areas to install equipments and systems using renewable energy sources in electricity and heating and cooling, including district heating and cooling? If such official guidance is not available or insufficient, how and when will this be addressed?

As described in Section 4.2.3 there are, to a certain extent, rules on this in Danish Building Regulations and in the optional agreements on energy saving work which Local Government Denmark and the Danish Regions entered into with the Minister for Transport and Energy in 2007.

At the same time, local authorities are able to stipulate requirements in their local plans that new buildings in a given area should be low-energy buildings, in agreement with the requirements in Building Regulations. There are no plans for changing the rules to allow local authorities to make demands for the use of renewable energy. The requirements of Building Regulations are intended as a combined energy framework for supplied energy and local renewable energy installations can contribute to meeting these. A specific requirement for renewable energy installations will therefore not generally mean a reduced demand for supplied energy and at the same time will not limit contactors' flexibility.

In accordance with the Heat Supply Act, local authorities must authorise projects for possible collective heating supplies. In the future, local authorities will therefore play an important part in determining which areas are to be supplied with district heating.

m) Is there specific training for case officers who administer the procedures for authorisation/certification and licensing procedures for new renewable energy installations?

The employees at the Energy Agency whose job it is to carry out these tasks are primarily persons with a relevant university degree, e.g. in law or economy and are therefore qualified to undertake them. Should the need for a professional technical opinion arise, experts in the relevant technologies, including those employed at state centres, e.g. for energy savings in buildings or wind power technology.

In addition, certain tasks may be undertaken privately, e.g. monitoring of schemes in connection with the Buildings Directive, in which certified companies undertake work on behalf of the authorities. These certified companies must meet the requirements for a consistent quality of work, e.g. via regular supplementary training. The same applies to certified companies that test new types of wind turbine.

4.2.2. Technical specifications (Article 13(2) of Directive 2009/28/EC)

a) To benefit from support, do renewable energy technologies need to met certain quality standards? If so, which installations and what quality standards? Are there national or regional standards that go beyond European standards.

There are no specific technical requirements for qualifying for support for renewable energy installations apart from wind turbines.

For connection to the network, wind turbines must meet the requirements of Executive Order No. 651 on the technical certification for the construction, presentation, erection, maintenance and service of wind turbines. The aim is to ensure that wind turbines and their foundations are constructed, presented, erected, serviced and maintained in accordance with established requirements for safety, energy and quality.

The certification scheme is based on requirements and procedures for the construction, presentation and erection of wind turbines, as stipulated in the international rules in IEC WT01. The IEC WT01 system constitutes a basis for the mutual international recognition of the certification and type testing reached at national level. It also provides a basis for the mutual recognition and approval of current quality control systems for manufacture and product control.

IEC WT01 sets out requirements and procedures for the assessment and testing of wind turbines in accordance with technical standards and other technical requirements of importance for safety, operational capacity and efficiency, testing and the electricity network. It includes two main elements: Type Certification (including component approval) and Project Certification.

Type Certification in accordance with IEC WT01 contains these elements:

- Design evaluation.
- Type Testing.
- Manufacturing Evaluation.
- Foundation Design Evaluation.
- Type Characteristics Measurements.
- Final Evaluation Report.
- Type Certificate.

Project Certification in accordance with IEC WT01 contains these elements:

- Site Assessment.
- Foundation Design Evaluation.
- Installation Evaluation.
- Project Certificate.
- O&M Surveillance.

In addition, the wind turbine must be CE marked. CE marking should be accompanied by a statement that confirms the standards to which the wind turbine has been completed and a manufacturer statement on compliance with personal safety requirements and requirements for electrical installations.

There are no national or regional standards that go beyond EC standards.

4.2.3. Buildings (Article 13(3) to (6) of Directive 2009/28/EC)

Please note that when referring to increasing the use of renewable energy sources in buildings, the supply of electricity from the national grid should not be included. The focus here is on increasing the supply of heat and/or electricity to individual buildings. The direct supply of heating or cooling through district heating may also be included.

The current use of renewable energy sources for heating and cooling buildings is comprised partly of the local use of renewable energy in the form of biomass, solar heating etc., and partly of renewable energy sources in the district heating supply system. The latter is extremely important in Denmark as around 40 % of the gross final energy consumption for domestic heating comes from district heat (about 25 % for single unit and 82 % for multiple units) and about 65 % of consumption for heating of commercial premises (incl. the public sector) comes from district heating.[39]

The share of renewable energy for heating and cooling buildings can be increased by:

- Reducing energy consumption for heating and cooling by increasing the energy efficiency of buildings
- the increased local use of renewable energy (relevant for buildings which are not supplied with district heat)
- an increased share of renewable energy in the district heating supply.

a) Reference to existing national and regional legislation (if any) and summary of local legislation concerning the increase of the share of energy from renewable sources in the building sector.

As described in the following, there are various national legislative regulations. Some of these involve local authorities. There are no regional provisions regarding renewable energy in the building sector.

Building Regulation (BR08) includes an energy framework, i.e. the maximum framework for energy supplied to a building.

[39] All figures are for 2008 and are taken from the Energy Agency's Energy Statistics 2008.

Act No. 585 of 24 June 2005 on the promotion of energy savings in buildings contains a number of general provisions and establishes the rules for the energy marking of buildings, as well as the maintenance regulations for boilers and ventilation systems.

The Heat Supply Act (cf. Consolidation Act No. 347 of 17 May 2005) contains general frameworks for the expansion of the collective district heating supply including heat based on renewable energy.

In a circular on 1 October 2009, the government implemented its decision that the state must reduce its energy consumption by 10 % by 2011 in relation to 2006.

The 2010 Finance Act has earmarked DKK 400 million for the scrappage of inefficient oil-fired boilers. The scrappage of oil-fired boilers will release a subsidy for the purchase and installation of an energy efficient heating system; cf. Consolidation Act No. 188 of 25 February 2010 on subsidies for energy efficient heating systems on the scrappage of oil-fired boilers.

The Planning Act (cf. Consolidation Act No. 937 of 24 November 2009) allows local authorities to stipulate that all new buildings within a given area must meet the low-energy criteria in the Building Regulations. A number of local authorities have taken this up.

b) Responsible ministries/authorities:

The Danish Enterprise and Construction Authority is responsible for the Building Regulations.

The local authorities are the responsible authorities for local plans.

The Energy Agency is the responsible authority for heating planning, including projects for future supplies for areas and for the regulation of fuel use in the generation of district heat.

c) Revision of rules: Expected in 2010

On 18 April 2008, the government presented its strategy for the reduction of energy consumption in buildings. The strategy contains 22 initiatives intended to reduce energy consumption in new and existing buildings. A large number of these initiatives will be included in the 2010 Building Regulation currently under preparation.

d) Summary of the existing and planned measures at regional and local levels:

In accordance with the Planning Act, local authorities are able via their local plans, to require that all new buildings in a given area must meet the low-energy criteria stated in the Building Regulations, i.e. better than the binding requirements. This will help promote the use of renewable energy and increase the relative share of renewable energy via reduced consumption. A number of local authorities have taken this up.

In accordance with the Heat Supply Act, local authorities must approve project proposals for collective heat supply, including the supply of district heating to new areas.

e) Are there minimum levels for the use of renewable energy in building regulations and codes? In which geographical areas and what are these requirements? (Please summarise). In particular, what measures have been built into these codes to ensure the share of renewable energy used in the building sector will increase? What are the future plans related to these requirements/measures?

In agreement with the EU Directive on the energy efficiency in buildings, Building Regulation (BR08) stipulates an energy framework which is the maximum required for energy supplied to a building. The Energy framework applies to all new buildings and for more extensive renovations to buildings in Denmark.

As the energy framework is set in relation to the requirement for supplied energy, local renewable energy installations that do not require fuel (i.e. primarily solar heating, solar cells and ambient heat), can contribute to ensuring compliance with the energy framework. Alongside the reduction in consumption through better insulation etc, they can also be included when calculating the energy consumption of a building. Similarly, the energy efficiency of supply installations (boilers etc) can also be included in the calculation of the energy framework.

When calculating the energy consumption of a building in relation to the energy framework, the various forms of energy are compared. Oil, coal, natural gas and biomass have a factor of 1.0 and electricity a factor of 2.5.

The inclusion of local renewable energy installations into consideration of the energy framework was introduced in 2006. In connection with this, energy requirements were tightened up by 25 %. At the same time, two low-energy classes were introduced in which the framework is respectively 25 % and 50 % lower than the binding framework.

Experiences with the framework show that contractors compare the various possibilities, including the opportunity of using local renewable energy installations. In connection with the creation of low-energy buildings that comply with the defined low-energy classifications, experience shows that a great many of the buildings not supplied with district heating will use solar heating.

As mentioned previously, the government are planning a series of new initiatives intended to reduce energy consumption in new and existing buildings. The following are relevant in regard to renewable energy:

- Energy consumption in new buildings must be reduced by at least 25 % in 2010, at least 50 % in 2015 and at least 75 % in 2020 in relation to current standards. In practice, this will mean a tightening up of the energy frameworks. It also means that in order to comply with the energy framework, part of the energy consumption of many new buildings must be renewable energy. With the tightening up in 2010, all new buildings will comply with the current low-energy class 2.

- A factor of 0.8 for district heating will be introduced in connection with the tightening in 2015. This is intended to ensure that district heating supply based on co-generation becomes an energy efficient form of supply and that a considerable portion of district heating comes from renewable energy. At the same time, the factor will prevent it becoming necessary to use local renewable energy installations in buildings already supplied with district heating as it would not be appropriate.
- Buildings that are not supplied with district heating will have better opportunities of including common renewable energy installations in the energy framework. This indicates an extension of current rules in which a group of houses which has a common heating installation (block installation) will, for example, be able to include a common solar heating installation. The reason for this extension is that larger common solar heating installations are cheaper than a small installation for individual buildings.
- Provided that it is economically viable for the inhabitants, it will become a requirement in connection with roof refurbishment, that solar heating should be installed in existing buildings which have a hot water consumption of over 200 litres per day. This does not apply to buildings already connected to district heating.

In terms of the formulation of the energy framework, there will be no need for specific minimum requirements for the use of renewable energy as this would only limit the flexibility of the framework and would not result in a lower consumption of fossil fuels. As described in Sections 4.2.3 g) and 4.2.9, Denmark uses a considerable amount of biofuel in district heating installations.

f) What is the projected increase of renewable energy use in buildings until 2020? (If possible differentiating between residential — 'single-unit' and 'multiple unit', commercial, public and industrial.) (To answer this question, you may use a table such as Table 6, below). Data to be given yearly or for selected years. Both heating and cooling and electricity consumption from renewable energy should be included.

In 2008, the local use of renewable energy was around 46 % of the gross final energy consumption for heating of individual households (around 50 % in single units and 1 % in multiple units) and around 13 % of the gross final energy consumption within the trade and service industries.

In 2008, 30 % of district heating generation came from renewable energy sources but due to the advantage afforded by co-generation, renewable energy comprised 37 % of the total fuel used in the generation of district heat generation.

Table 6 shows the development in the share of renewable energy used as fuel in individual buildings, for district heating supply and finally for electricity supply.

Table 6: Estimated share of renewable energy in the building sector (%)

	2005			2010			2015			2020		
	Individual	Electricity	District heating	Individual	Electricity	District heating	Individual	Electricity	District heating	Individual	Electricity	District heating
Residential	37	27	28	50	34	35	57	45	44	64	51	51
Commercial	12	27	28	10	34	35	9	45	44	9	51	51
Public	14	27	28	20	34	35	20	45	44	20	51	51
Industrial	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total	33	27	28	45	34	35	51	45	44	56	51	51

g) Have obligations for minimum levels of renewable energy in new and newly refurbished buildings been considered in national policy? If so, what are these levels? If not, how will the appropriateness of this policy option be explored by 2015?

In relation with the 2010 amendments to the Building Regulations, in connection with roof refurbishments, existing buildings with a hot water consumption of more than 2000 litre per day will be required to install solar panels as far as this is economically viable. This will not apply to buildings supplied with direct heat.

As described above and in Section 4.2.9, Denmark uses a considerable amount renewable energy in the direct heating of buildings. Under the terms of the Heat Supply Act, a study has been made of areas which have been designated for direct heating. Generally speaking, connection to the district heating system is high in these areas and great efforts are bring made to ensure that all buildings are ultimately connected. In certain local authorities, there is an obligatory connection to the collective heating system, including district heating.

When developing new areas for residential or other building projects, local authorities must state what are the most appropriate and economically viable forms of heating in their project plan. The local authority can also decide to introduce obligatory connection for new buildings. Low-energy buildings are, however, exempt and in connection with the tightening up of energy requirements in 2010, the possibility of introducing obligatory connection for new buildings will be removed.

Apart from this, there are no current plans for introducing special requirements for the use of renewable energy as this is generally not appropriate when the current energy framework and the high share of district heating are taken into consideration.

h) Please describe plans for ensuring the exemplary role of public buildings at national, regional and local level by using renewable energy installations or becoming low-energy buildings from 2012 onwards? (Please take into account the requirements under EPBD)

Various measures have been agreed for the state, local authorities and region in relation to energy efficiency.

At the end of 2008 the government decided that the state must reduce its energy consumption by 10 % in 2011 in relation to 2006 figures. In practice, this means that each ministry must reduce its energy consumption by 10 %. The decision was implemented in a circular on 1 October 2009.

At the end of 2007 Local Government Denmark (the association of local government authorities) entered into an agreement with the Minister of Transport and Energy in regard to energy saving in local authorities. In this agreement, local authorities must meet the same requirements as were applicable to the state at that time. This meant that local authorities must introduce energy management and implement the energy savings required by the energy marks, which have a reimbursement time of up to five years.

The Danish Regions have a corresponding agreement from the beginning of 2009.

These measures for state, local authorities and regions give indirect incentive for the introduction of more renewable energy in public buildings. Both the agreement with Local Government Denmark and the Danish Regions will be assessed in 2012 after which, a decision will be taken on their continuation.

As described in Section 4.2.4 g), the Ministry of Climate and Energy has designated six 'EcoCities' which are good examples of how local authorities can work with the challenges presented by climate and energy. This initiative also contributes to energy efficiency and an increased use of renewable energy in public buildings.

i) How are energy efficient renewable energy technologies in buildings promoted? *(This may include biomass boilers, heat pumps and solar thermal equipment which meet eco-label requirements or other standards developed at national or Community level (cf. text of Article 13(6)))*.

As further mentioned in Section 4.4 and elsewhere, the 2010 Finance Act has earmarked DKK 400 million for the scrappage of inefficient oil-fired boilers. This funding is primarily aimed at helping Denmark reach its CO_2 reduction target of 21 % between 2008 and 2012. It will also contribute to the increase in the use of renewable energy in buildings, as the scrapped oil-fired central heating will be replaced by energy efficient renewable energy installations or by connection to the district heating system.

Subsidies are given for the following heating systems:

- Geothermal heating (liquid/water heat pumps)
- Air/water heat pumps
- Connection to the district heating system (i.e. partial renewable energy)
- Solar heating (can be combined with a new boiler).

4.2.4. Information provisions (Article 14(1), Article 14(2) and (4) to (6) of Directive 2009/28/EC)

Current and future information and awareness raising campaigns and programmes, as well as planned revisions and expected results must be described. Member states should also indicate which responsible authority will monitor and review the effects of the programmes. When regional/local authorities have a substantial role, please indicate and summarise it.

a) Reference to existing national and/or regional legislation (if any) concerning information requirements according to Article 14 of Directive 2009/28/EC:

Supporting measures for renewable energy also appear in the Act on the Promotion of Renewable Energy and the Act on Sustainable Biofuels and associated Executive Orders, as described in Sections 4.3, 4.4 and 4.5.

Denmark has a long tradition of informing and involving the public on questions regarding the promotion of renewable energy. The above legislation does not state specific requirements for information on supporting measures. The public authorities have, however, a general obligation to inform, cf. the Public Administration Act and the energy authorities are obliged to offer support and guidance to citizens and legal persons who make enquiries within the field.

Further provisions on information can also be found in:

- The Act on savings in energy consumption, the Act on state subsidies for product-oriented energy savings and the Act on Electricity Tariffs and on the repealing of the Act on Elsparefonden (a former Danish energy organisation), an electricity saving organisation now replaced by the Centre for Energy Savings, etc.
- The Act on an Energy Technology Development and Demonstration Programme and associated Executive Orders.
- Executive Order No. 188 of 25 February 2010 on subsidies for energy efficient heating systems following scrappage of oil-fired boilers. The scheme is described further in Section 4.4 and 4.2.3.

b) Responsible body (bodies) for the dissemination of information at national/regional/local levels.

The energy authorities provide information on renewable energy. These are: The Ministry for Climate and Energy, The Danish Energy Agency, The Centre for Energy Savings, The Energy Technology Development and Demonstration Programme (ETDDP), Energinet.dk and the Danish Energy Regulative Authority.

Other ministries such as the Ministry of the Environment, The Ministry of Transport, the Ministry of Taxation and the Ministry of Food, Agriculture and Fisheries can also inform on conditions for support for, or information on renewable energy.

In addition to the national public authorities, there is close cooperation on the dissemination of information with the local authorities, Local Government Denmark and the Danish Regions and organisations such as the Danish Energy Association, the Confederation of Danish Industries and the Danish District Heating Association.

The Danish Energy Association subsidises Energy Service Denmark which has offices throughout the country. Energy Service Denmark gives free advice on energy savings and the use of renewable energy to households and small to medium sized businesses.

c) Summary of the existing and planned measures at regional/local levels (where relevant):

d) Please indicate how information is made available on supporting measures for using renewable energy sources in electricity, heating and cooling and in transport to all relevant actors (consumers, builders, installers, architects, suppliers of relevant equipment and vehicles). Who is responsible for the adequacy and the publishing of this information? Are there specific information resources for the different target groups, such as end consumers, builders, property managers, property agents, installers, architects, farmers, suppliers of equipment using renewable energy sources, public administration? Are there information campaigns or permanent information centres in the present or planned in the future?

Information on support measures for the use of renewable energy for the named purposes is available on a number of websites including:

- The Danish Energy Agency website: www.ens.dk
- The website on the scrappage scheme for oil-fired boilers administered by the Energy Agency: www.skrotditoliefyr.dk aimed especially at end-consumers
- The Energinet.dk website: www.energinet.dk
- As described in Section 4.2.5, the relevant information for installers can be found on these websites: www.kso-ordning.dk and www.vpo-ordning.dk (for installers)

As further described in Section 4.2.4 g), there are also a number of campaigns and websites which give more general information on the use and development of renewable energy, as well as a series of relevant initiatives including the following:

- **The Climate and Energy Guide, www.klimaogenergiguiden.dk:** This website includes general information on the energy system and has a number of links to direct the reader on to the relevant websites on climate and energy.
- **The Centre for Energy Savings:** From 1 March 2010, Elsparefonden will be replaced by the Centre for Energy Savings which will contribute to promoting energy savings through campaigns, knowledge sharing, market introductions and the development and presentation of standard energy saving products and solutions. The centre will contribute to the promotion of all forms of energy saving in all sectors apart from transport. It can also provide subsidies for projects that promote the propagation of energy efficient products and solutions.
- **www.energisparebolig.dk:** The website has been set up as part of the Ministry for Climate and Energy's "One ton less" campaign.
- **The Campaign for Heat Pumps and www.varmepumpesiden.dk:** As part of the Energy Agreement which was passed on 21 February 2008, DKK 30 million was earmarked for a two year campaign intended to promote the most effective heat pumps and ensure their correct use. The funding is administered by the Energy Agency.
- **Energy Service** Denmark is a nationwide network of local advisory offices giving free advice and independent information on energy savings and renewable energy.

e) Who is responsible for publishing information on the net benefits, costs and efficiency of equipment and systems using renewable energy sources for heating, cooling and electricity? (*Supplier of the equipment or system, public body or someone else?*)

The public authorities provide general information on the advantages and costs of various technologies and supply solutions, including renewable energy installations. This information is general for a typical generic installation and does not normally include recommendations for specific models or makes.

It is usually the supplier of the equipment and system that has the responsibility to inform about the advantages and costs for a specific type of installation, including guarantees, etc.

f) How is guidance for planners and architects provided to help them to properly consider the optimal combination of renewable energy sources, high efficiency technologies and district heating an cooling when planning, designing and renovating industrial or residential areas and who is responsible for this?

As described previously, the local authorities prepare local plans with detailed guidelines for land use and building in the area. Local authorities can stipulate in their local plan that all new buildings within a given area must fulfil the low-energy requirements in Building Regulations.

The Energy Agency and the Danish Enterprise and Construction Authority inform about the requirements in Building Regulations and have prepared a series of examples of best practice, including examples using renewable energy.

Planners and architects can also get advice on effective combinations of energy solutions from the Knowledge Centre for Energy Savings in Buildings: www.byggeriogenergi.dk. The Knowledge Centre collects and disseminates knowledge to the building sector on concrete and practical ideas for reducing energy consumption in buildings.

g) Please describe the existing and planned information, awareness raising and training programmes for citizens on the benefits and practicalities of developing and using energy from renewable sources. What is the role of regional and local actors in the designing and managing these programmes?

There are a series of information and consciousness-raising initiatives for renewable energy, including the following:

- **EcoCities, www.energibyer.dk:**
  The Climate and Energy Ministry has designated six Danish local authorities as "EcoCities". EcoCities are front-runners in the Climate and Energy field. These are towns that have made a special effort to save energy and reduce CO_2 emissions. The idea behind the project is to motivate and promote local climate and energy work in both Danish and foreign local authorities. The EcoCities are committed to implementing a number of further initiatives intended to inspire other local authorities to begin similar projects. Ideas and experiences can be found on the website: www.energibyer.dk.

- **climate Communities:**
  A Climate Communities agreement has been reached with the Danish Society for Nature Conservation and commits the local authority to reducing CO_2 emissions from its various activities by, at a minimum, 2% annually. The agreement helps local authorities to implement concrete climate initiatives in their local plans and also inspire others via the website: www.dn.dk.

- **Climate Education 2009, www.klimaundervisning.dk:**
  was an initiative proposed by the Ministry of Education and implemented in partnership with The Danish Society for Nature Conservation. The website (now dormant) was intended to give an overview of the many climate education initiatives in schools, Upper Secondary Schools, vocational and further education courses and in Higher Education, leading up to COP 15. The project was concluded on 1 July 2010.

4.2.5. Certification of installers (Article 14(3) of Directive 2009/28/EC)

a) Reference to existing national and/or regional legislation (if any) concerning certification or equivalent qualification schemes for installers according to Article 14(3) of Directive 2009/28/EC:

There is no Danish legislation on this. There are, however, quality assurance agreements formulated in cooperation with the Danish Technological Institute, installers associations and the Danish Energy Agency.

b) Responsible body (bodies) for setting up and authorising certification/qualification schemes by 2012 for installers of small-scale biomass boilers and stoves, solar panels and solar heating systems, shallow geothermal systems and heat pumps?

The Energy Agency is the responsible authority for ensuring that these schemes are available to installers.

In connection with an initiative for the promotion and correct use of the most effective heat pumps, as described in Section 4.2.5 c), the Energy Agency began to work with heat pump installers on the formulation of the coming certification.

c) Are such certification schemes/qualifications already in place? If so, please describe.

In 1992 a Quality Assurance Scheme was set up, (in Danish - KSO) as an optional scheme for the solar heating field. The scheme was later extended to include biomass fuel installations and solar cells. A similar scheme has been set up for heat pumps and heat pump installers - the Heat Pump Scheme, (in Danish – VPO).

The Quality Assurance Scheme

The current Quality Assurance Scheme was established in 2002 on the basis of an initiative by the Danish Technological Institute and two installers associations; Tekniq and DS Håndværk og Industri.

The aim of the QAS is to ensure a high standard of quality for the installation and service of biofuel, solar heating and solar cell installations as well as the offer of a binding service scheme to encourage the customer to undertake the appropriate maintenance of the installation.

Installations are covered by the scheme when the following general conditions are fulfilled:

- Newly installed systems must be approved in Denmark in accordance with current standards, or fulfil corresponding conditions of approval.
- The installer of a new system must use approved parts.
- Fitting instructions must be provided by the manufacturer.

- The installation of new systems and service of existing systems must be undertaken by a company that is a member of the QA scheme.
- Delivery of the system must be undertaken by a person who has a current certificate for the installation and service of the specific type of system. The installation instructions must be adhered to.
- The installer must use quality assurance when installing the system.
- The purchaser of the new installation must be offered the service scheme.

A series of other conditions must also be fulfilled according to the type of installation.

The Danish plumber, electrician and heating fitter training courses cover the requirements for basic theoretical training cf. Annex IV (6) of the Directive. The QA scheme also certifies installers working with solar heating, solar cells and biofuels.

The content and extent of the training courses in the various fields are determined by the QAS Coordination Committee, which includes representatives from the Danish Technological Institute, the installers associations and the Energy Agency.

The training courses are primarily offered by approved vocational schools in collaboration with the plumbing, heating and sanitation sector. Course plans and teaching materials are prepared by the QAS Coordination Committee in cooperation with sector professional organisations and the Plumbing and Heating and Sanitation Sector Training Board.

Course plans and teaching materials for solar heating and biofuels courses are formulated by the Electricity and Plumbing, Heating and Sanitation Sector Training Board and approved in cooperation with the QAS Committee. Course plans and teaching materials for solar cell courses are formulated by the Danish Technological Institute and approved in cooperation with the QAS Committee.

The competence-giving examination for the QA scheme includes a written examination marked by an external adjudicator.

On passing the competence-giving examination for either biofuels, solar heating or solar cells, a personal certificate is issued for the specific field, with the examinee’s name and a certification number. The certificate is valid for three years, after which it must be renewed.

There is no practical examination in the QA scheme. Instead, practical skills are tested by an assessment and inspection of the first installed system. Inspections of solar heating installations are carried out by DANAK - the Danish Accreditation and Metrology Fund according to their guidelines and following a specific procedure.

In addition to certification of individual installers and fitters, the QAS includes the registration of each company that is part of the QA scheme. This is additional to the requirements described in the Directive.

Heat Pump Scheme

The quality assurance scheme for heat pump installers is aimed at ensuring that only heat pumps that satisfy the approved standards for heat pump aggregate (Type Certification), size, installation and maintenance can be installed, and also that the entire installation operates economically throughout its lifetime.

The Danish training courses in plumbing, heating and sanitation, electricity and cooling cover the requirements for practical and theoretical training in accordance with Annex IV (6).

The awarding of an HPO certificate requires that installers to pass two categories of written examination:

1. Heat Pump installer (HP installer)
2. Heat Pump Service installer (HPS installer)

To be registered as a member of the scheme, the heat pump installation company must use a quality assurance system. In addition, the installer is required to have a heat pump certificate. A heat pump certificate is acquired through participation and satisfactory completion, including examinations passed, of one of the required courses.

As part of the Energy Agreement which was passed on 21 February 2008, DKK 30 million was earmarked for a two year campaign intended to promote the most effective heat pumps and ensure their correct use. The funding is to be administered by the Energy Agency. The main focus of the campaign is heat pumps designed to cover all domestic requirements including hot water.

The campaign to promote the use of heat pumps includes:

- An overview of energy efficient heat pumps.
- An information campaign.
- A measurement programme for energy efficiency, a demonstration programme for heat pumps as flexible energy consumption.
- Quality assurance of installation.

Up until now, the installation of heat pumps as not been covered by legislation for, for example, liquid/water heat pumps (geothermal). Legislation has only covered systems which require work with coolant systems and connection to the national grid and possibly domestic hot water connections.

In cooperation with installation sector organisations, the Energy Agency has begun a further development of the existing training courses for installers to ensure a unified course of training.

d) Is the information on these schemes publicly available? Are lists of certified or qualified published and if so, where? Are other schemes accepted as equivalent to the national/regional scheme?

The schemes are further described on www.kso-ordning.dk and www.vpo-ordning.dk, on which there is also a list of certified installers.

Denmark recognises and will recognise future schemes from Member States.

e) Summary of existing and planned measures at regional/local levels (if relevant)

Not relevant

4.2.6. Electricity infrastructure and development (Article 16(1) and (3) to (6) of Directive 2009/28/EC)

a) Reference to existing national legislation concerning requirements related to the energy network (Article 16)

- The Electricity Supply Act (ESA) Section 4, Sections 19-26 on the national grid, Section 5, Sections 27 A – 32 on companies responsible for the system.
- The Energinet.dk Act
- The Renewable Energy Act (RE Act)
- The Planning Act
- Executive Orders issued in pursuance of this legislation.

b) How is it ensured that transmission and distribution grids will be developed with a view to integrating the targeted amount of renewable energy while maintaining the secure operation of the electricity system? How is this requirement included in the transmission and distribution operators' periodical network planning?

As the organisation responsible for the system, it is one of Energinet.dk's main tasks to ensure that the electricity transmission network and the electricity system can cope with the increasing amounts of electricity generation from renewable energy sources. Section 28 of the ESA contains provisions for research and development activities.

Among other things, Energinet.dk must ensure that research and development activities are undertaken that promote future environmentally friendly and energy efficient electricity transmission. Energinet.dk must also cooperate with network companies to ensure network access etc.

From October 2008, new guidelines for the extension and cabling of the electricity transmission network were initially implemented in order to accommodate increased current from renewable energy sources. Over a 20 year period the entire 132 and 159kV network will be cabled. At the same time, there will be a restructuring of the network to fit its changing function as electricity generation from the central plants decreases and electricity generation from renewable energy installations increases.

Furthermore, as described below, a series of initiatives have been initiated for the roll-out of intelligent electricity consumption which will ensure the integration of renewable energy whilst at the same time maintaining network reliability.

c) What will be the role of smart grids, information technology tools and storage facilities? How will their development be ensured?

During the last 25 years, an enormous amount of electricity from renewable sources has been absorbed into the Danish electricity system at the same time as maintaining a high level of security of supply. Intelligent control of energy generation and consumption and new storage facilities will play a vital role in the expansion of electricity generation from renewable sources in Denmark up to 2020.

Energinet.dk has developed and is currently working with a wide range of initiatives including smart grids, monitoring of electricity consumption, heat pumps and probably, in the long term, electric cars. In its report "The effective use of wind-generated electricity in Denmark", Energinet.dk expands on possible initiatives for, among other things, a greater symbiosis between wind power, heat pumps and electric vehicles.

It is the Danish Government's vision to further disseminate intelligent and flexibly priced electricity up to 2020. A number of studies and initiatives have been implemented for developing intelligent electricity consumption based on the Energy Agreement of 21 February 2008.

- The Act on Heating Elements that recommends the use of heating elements to reduce the costs of electricity used in the generation of district heating, will be made permanent. The aim is to be able to use co-generation plants more effectively to regulate electricity consumption more quickly upwards or downwards.
- Energinet.dk is investigating the possibilities for developing frameworks for regulation power so that smaller electricity consuming units can also be included in the upwards and downwards regulation of electricity consumption.
- At the earliest opportunity, the Climate and Energy Minister is expected minimum requirements for intelligent meters, so that the meters fitted by the network companies support the propagation and use of intelligent electricity consumption. Initially, it will be the larger consumers that are supplied with intelligent meters.
- Even though it is not a requirement by the authorities, a number of companies are already supplying and installing customers with intelligent meters. It is expected that half the consumers will have intelligent meters within a few years. Negotiations are under way with the Danish Energy Association to determine how to ensure that consumers who have had intelligent meters installed can utilise the new opportunities they afford.

- Possibilities are being investigated to introduce more varied collective electricity prices (using dynamic tariffs or dynamic charges) that could increase consumer incitement to move consumption from hours during the day where the energy price - and consequently also load on the electricity system - is low, to cheaper hours.
- The possibility of being able to lower the limit for which customers are hourly metered and which hourly billed is also being considered. This is especially relevant for consumers with heat pumps or electric vehicles. The present limit is an annual consumption of at least 100.000 kWh.
- The introduction of electric vehicles as flexible storage in the Danish electricity system is expected to be a central element in the future introduction of renewable energy. Before the end of 2010, The Climate and Energy Minister will present an analysis of the framework conditions for the setting up of charging stands for electric cars. This will also include assessments of whether the distribution network can cope with the increased load.

These initiatives will create the framework for the roll-out of flexible and intelligent electricity consumption over the next 10 years. Development will take place concurrently with the expected rise in requirements.

Research and development grants within these areas will also increase over the same time period.

d) Is the reinforcement of the interconnection capacity with neighbouring countries planned? If so, which interconnectors, for which capacity and by when?

Strong connections with neighbouring countries are of vital importance for the inclusion of electricity from renewable sources. This will also be the case in the future. The increased input of electricity from renewable energy sources will be facilitated both by expanding connections to neighbouring countries and by national initiatives, cf. answer in Section 4.2.6 c).

The following new interconnections are included in Energinet.dk's planning:

- The Great Belt connection (600 MW) connecting East and West Denmark. The connection will be operational in the second half of 2010.
- Skagerrak 4 to Norway (700 MW). Authorisation has been applied for with expected operation in 2014.
- The Cobra cable to Holland has also been included in planning, but not yet applied for.
- Combined grid solution at Kriegers Flak (600 MW) to Germany. The project also requires a decision on the erection of offshore wind turbines in the location.

e) How is the acceleration of grid infrastructure authorisation procedures addressed? What is the current state and average time for getting approval? How will it be improved? (*Please refer to current status and legislation, bottlenecks detected and plans to streamline procedure with timeframe of implementation and expected results*.)

The establishment of overhead transmission cables is known to take many years, partly due to the authorisation process in accordance with the Planning Act, which requires an assessment of the environmental impact (EIA). The process through energy legislation (ESA or the Act on Energinet.dk) has been complicated as the authorisation process for cable projects is typically faster than for overhead cable projects.

The processing of cases in accordance with the ESA or the Act on Energinet.dk (apart from new overhead lines) typically takes about one month for smaller projects, to about a year with larger investments. Irrespective of complexity, this must be coordinated with the Planning Act so that energy authorisation is not delayed in relation to the project.

A large number of applications for cabling are expected in the coming years in connection with the political decision. In preparation for this, Energinet.dk and Energy Agency are analysing possibilities for optimising the administration process in accordance with the legislation.

f) How is coordination between grid infrastructure approval and other administrative planning procedures ensured?

With investments in large infrastructure installations, there is close cooperation between the Ministry of the Environment - which includes all the regional Environmental Centres - and the Ministry of Climate and Energy. As mentioned above, this is most often with processes in relation to the Planning Act where local or political opposition may occur.

g) Are priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources?

New installations that produce electricity from renewable sources have the right to be connected to the grid. The legislation does not prioritise cases where a number of producers wish to be connected at the same time. The network companies do not, however, usually dimension expansion of the network for one project, but make allowances in the network plan for plans that are aimed at new generation capacity at a given time.

h) Are any renewable installations ready to come online but not connected due to capacity limitations of the grid? If so, what steps are taken to resolve this and by when is it expected to be solved?

Up until now there have only been a few examples of delays in the connection of renewable energy installations due to limited network capacity. However, it must be anticipated that as renewable energy installations become larger (especially onshore wind farms), there will more often be a need for more reinforcements of the network than has previously been the case.

In cooperation with the transmission companies, the Energy Agency estimates that there is a need for amended authorisation procedures for network reinforcement.

i) Are the rules on cost sharing and bearing of network technical adaptations set up and published by transmission and distribution system operators? If so, where? How is it ensured that these rules are based on objective, transparent and non-discriminatory criteria? Are there special rules for producers located in peripheral regions and regions with low population density? (Cost bearing rules define which part of the costs is covered by the generator wishing to be connected and which part by the transmission or distribution system operator. Cost sharing rules define how the necessary cost should be distributed between subsequently connected producers that all benefit from the same reinforcements or new lines.)

j) Please describe how the costs of connection and technical adaptation are attributed to producers and/or transmission and/or distribution system operators? How are transmission and distribution system operators able to recover these investment costs? Is any modification of these costs bearing rules planned in the future? What changes do you envisage and what results are expected? (*There are several options for distributing grid connection costs. Member States are likely to choose one or a combination of these. According to the 'deep' connection cost charging the developer of the installation generating electricity from renewable energy sources bears several grid infrastructure related costs (grid connection, grid reinforcement, and extension). Another approach is the 'shallow' connection cost charging, meaning that the developer bears only the grid connection cost, but not the costs of reinforcement and extension (this is built into the grid tariffs and paid by the customers). A further variant is when all connection costs are socialised and covered by the grid tariffs.)*

k) Are there rules for sharing the costs between initially and subsequently connected producers? If not, how are the benefits for subsequently connected producers taken into account?

Combined answer of i), j) and k):

The rules in Section 67 of the ESA apply for environmentally friendly electricity generation installations and for wind turbines, Section 30 of the RE Act.

The ESA states that the owner of the installation is solely responsible for costs associated with connection to the 10-20 kV network, or if a higher level of current is desired, the costs associated with connection to this level of current. Additional costs, including network reinforcement and expansion are borne by the network companies.

With wind turbines, the share of costs for connection are further regulated in Executive Order No. 1365 of 15 December 2004 on the network connection of wind turbines and price subsidies for wind turbine produced electricity etc. As a consequence, all costs for network reinforcement and expansion are borne by the network companies.

Network companies' costs in relation to the connection of renewable energy installations, including network reinforcement and expansion are borne by all electricity consumers via the PSO tariff. In connection with this, producers are exempted from all costs relating to network reinforcement and expansion. There are therefore no rules for the sharing of these between previous and future producers.

l) How will it be ensured that transmission and distribution system operators provide new producers wishing to be connected with the necessary information on costs, a precise timetable for processing their requests and an indicative timetable for their grid connection?

Connection conditions for electricity generation installations, including those based on renewable energy are publicly available and non-discriminatory.

In principle, the installation owner finances the direct connection, while the network company finances any possible indirect network reinforcement in the overall net. The rules are stated in the ESA.

Network companies are currently working on time schedules for the connection of wind turbines. The requirement does not appear in the legislation.

The requirements of Article 16(5) of the RE Directive in Directive 2009/28/EC will be implemented in Danish law.

4.2.7. Electricity grid operation (Article 16(2), Article 16(7) and (8) of Directive 2009/28/EC)

a) How is the transmission and distribution of electricity from renewable energy sources guaranteed by transmission and distribution system operators? Is priority or guaranteed access ensured?

According to the ESA, transmission and network companies have a commitment to ensure the sufficient and efficient transport of electricity and associated services. Part of this is making the appropriate transport capacity available and providing access for the transport of electricity through the network and measuring its supply and utilisation.

Distribution and transmission of electricity from renewable energy sources is guaranteed via the requirements for the network and transmission companies to ensure sufficient and efficient transport of electricity and connection.

Electricity generation from decentralised co-generation plants and electricity generation installations that produce electricity from renewable energy or use waste products as fuel, have priority access to the grid.

b) How is it ensured that transmission system operators, when dispatching electricity generating installations give priority to those using renewable energy sources?

Energinet.dk is responsible for the operation of the combined electricity supply system and for maintaining the balance and supply stability of the network. Energinet.dk does not produce or trade in electricity.

Among other things, Energinet.dk ensures balance in the grid by restructuring (upwards and downwards regulation) electricity generation from plants connected to the grid. With restructuring of electricity generation, Energinet.dk can only reduce or alleviate prioritised electricity generation if the reduction of electricity generation from other installations is not sufficient to maintain the technical quality and balance within the combined electricity supply system.

Energinet.dk determines the objective criteria for restructuring, including deregulation of prioritised electricity generation on economic and environmental grounds. The criteria are publicly available.

Prioritised access also applies to electricity from tendered offshore wind farms in accordance with the RE Act, as this can only happen with a deregulation of certain wind farms under special circumstances and against compensation for operational loss.

Energinet.dk determines the general criteria for deregulation, which must also be publicly available.

c) How are grid- and market-related operational measures taken in order to minimise the curtailment of electricity from renewable energy sources? What kinds of measures are planned and when is implementation expected? *(Market and grid design that enable the integration of variable resources could cover measures such as trading closer to real time (changing from day-ahead to intra-day forecasting and rescheduling of generators), aggregation of market areas, ensuring sufficient cross border interconnection capacity and trade, improved cooperation of adjacent system operators, the use of improved communication and control tools, demand-side management and active demand-side participation in markets (through two-way communication systems — smart metering), increased distributed generation and domestic storage (e.g. electric cars) with active management of distribution networks (smart grids).)*

The Danish national grid is connected to the Nordic water-power based electricity system and to Germany by robust international connections. The capacity of these international connections is so powerful that it corresponds to around 85 % of the peak load from the combined Danish consumption or almost twice the installed capacity of Danish wind turbines. These strong international connections have contributed in particular to the fact that it is possible to operate the Danish electricity system with wind power corresponding to around 20 % of consumption.

There is currently intensive research and development being undertaken in domestic methods for handling a much greater generation from RE installations, which will be able to supplement the strong international connections in the future.

In relation to concrete measures, please refer to answer b) above for operation and answer e) for market.

d) Is the energy regulatory authority informed about these measures? Does it have the competence to monitor and enforce implementation of these measures?

Criteria for deregulation as mentioned in the answer to question b) must be approved by the authorities. Criteria for deregulation outside of tendered offshore wind farms are approved by the Danish Energy Regulatory Authority. According to the current rules, similar criteria for the named wind farms are approved by the Energy Agency. Following a change in legislation in preparation at the time of writing, the general regulative authority is expected to be the Energy Agency.

There are no specific rules for reporting whether significant measures are taken to limit the renewable energy sources as well as the improvement measures. Rules will be formulated on this that fulfil the terms of the Directive.

Once specific rules are formulated, it will be possible for the Energy Agency to issue injunctions if the reporting obligation is not adhered to.

e) Are plants generating electricity from renewable energy sources integrated in the electricity market? Could you please describe how? What are their obligations regarding participation in the electricity market?

The structure and dynamic of the Danish electricity market allows for the integration of electricity from renewable sources on a number of points.

The Danish electricity market is liberalised and there is an open price policy. This also applies to the sale of electricity from renewable energy as there is no utilisation obligation for consumers.

Financial support can be granted for RE electricity in the form of subsidies which are payable by the state transmission operator Energinet.dk. Costs are thus borne by the consumers via Energinet.dk's tariffs. Price subsidies are determined by the RE Act or the ESA and are differentiated in relation to the specific type of RE electricity, so the support is targeted and predictable. See also Section 4.3 in the Action Plan.

There is a dynamic element to support for RE electricity as support is given to the development of small domestic installations (solar panels, small wind turbines, etc).

In order to overcome economic barriers for new offshore wind farms, these will be offered for tender for which the awarding criteria is the size of the guaranteed sales price (market price + price subsidy) offered by the tenderer.

There is a free exchange of electricity in the Nordic electricity market, which in Denmark's case is with Norway and Sweden. A common Nordic electricity market with a common action plan has been established by Nordpool, the power derivatives exchange. Nordpool is the result of a Nordic cooperation and is owned by Energinet.dk and the other Nordic transmission operators.

This market operates with an open pricing policy, partly via bilateral agreements and partly via day to day and hour to hour trading on Nordpool, as well as the spot futures markets. Pricing on Nordpool reflects pricing in general.

Danish electricity producers with a capacity of over 5 MW are part of the Nordic electricity market and as such, as also part of Nordpool. Electricity producers are responsible for their own sales or have an agreement with an actor responsible for their balance and must cover the costs of imbalance. RE electricity is traded under the same conditions as other electricity generation, but with special regulations for certain categories.

A balancing subsidy of 2.3 øre per kWh is granted to new wind turbines erected outside the tendered offshore wind farms as balancing costs tend to be especially high for wind turbines. With tendered offshore wind turbines, the electricity produced would normally be included in the tender amount.

Energinet.dk must also provide support the owners of older wind turbines and small-scale RE installations (biogas installations etc) with balance responsibility and sale of their electricity generation on Nordpool so that the costs are borne by consumers via the tariffs.

See also description of the plan for the roll-out of intelligent electricity consumption in Section 4.2.6 c).

f) What are the rules for charging transmission and distribution tariffs to generators of electricity from renewable energy sources?

Feed-in tariffs in Denmark are very low – no more than 0.2 or 0.4 øre respectively, depending on locality. Wind turbines and all decentralised plants that still have a purchase obligation irrespective of fuel type, are exempted from the network tariff. In 2010, standard nationwide tariffs will be established. The Danish system already takes renewable energy installations into consideration as the low tariffs apply to all.

Tariffs for transmission and distribution of electricity are identical irrespective of the energy source. There are no special tariffs for 'øre regions, (i.e. those Nordic countries that have øre as currency).

Tariffs are set by the transmission and distribution companies in accordance with the rules in Section 10 of the ESA and published by the Danish Energy Regulatory Authority. Methods for price setting must be published and approved by the Danish Energy Regulatory Authority.

4.2.8. Biogas integration into the natural gas network (Article 16(7) and Article 16(9) and (10) of Directive 2009/28/EC)

With the initiatives taken by the Green Growth agreement, as described in Sections 1 and 4.6, biogas generation in Denmark is expected to increase significantly up to 2020.

Denmark emphasises that biogas should be integrated into the energy supply system in the most cost effective way, so that biogas generation can be given the best possible support. There is general agreement that the most cost effective method is to pipe biogas directly to the local co-generation plants when this is possible. Heating plants and decentralised co-generation plants are widespread throughout Denmark.

Experience also indicates that as biogas will ultimately be distributed by the natural gas network, the 'downgrading' of natural gas to biogas quality is a significantly cheaper strategy than upgrading biogas to natural gas quality. In areas which eventually will be dominated by biogas, it could well be that biogas will come to set the standard for gas in the network. If this is the case, upgrading biogas would, in the short term, seem to be a step in the wrong direction.

The Danish Gas Technology Centre has begun to look into the advantages, disadvantages and expense of converting the relevant parts of the natural gas network to a gas standard suitable for biogas. An answer to the technical and economic questions relating to this is expected to take a number of years.

The agreements on Green Growth open up the possibility for subsidy equality for the provision of biogas to co-generation plants and the natural gas network respectively.

a) How is it ensured that the charging of transmission and distribution tariffs does not discriminate against gas from renewable energy sources?

Section 20 of the Natural Gas Supply Act states that it is the transmission and distribution companies that set tariffs. Methods for price setting are published and approved by the Danish Energy Regulatory Authority, cf. Section 36 a, of the NGSA. Pursuant to Section 2(2) of the Act, the provisions also apply for biogas, gas from biomass and other types of gas, to the extent these gases can technically and safely be injected and transported through the natural gas system.

b) Has any assessment been carried out on the need to extend the gas network infrastructure to facilitate the integration of gas from renewable sources? What is the result? If not, will there be such an assessment?

With the direct use of biogas in the decentralised co-generation plants, there is s significant need for the establishment of biogas transmission connections from both existing and future biogas installations to the co-generation plants that currently use natural gas. It has been shown that the establishment of these connections is a task that the biogas producers have considerable difficult in carrying out alone. As yet, there has been no investigation into what possible solutions to this are available or can be implemented.

Furthermore, in the longer term, the need may arise for modifications to the natural gas network, if biogas is to be distributed increasingly by it as a result of plans to ensure subsidy equality for the supply of biogas to both co-generation plants and the network.

As part of Green Growth, in 2012 there will be an appraisal of the expansion of biogas installations. In connection with this, it will be assessed whether there is a need for further initiatives for achieving greater energy production from manure, including whether new initiatives for a more efficient introduction of biogas into the energy supply system will be necessary.

c) Are technical rules on network connection and connection tariffs for biogas published? Where are these rules published?

In pursuance of Section 20 of the NGSA, transmission and distribution companies must publish their tariffs and conditions for use by the transmission and distribution network. In pursuance of Section 2(2), the NGSA also applies to biogas, gas from biomass and other types of gas, to the extent that these gases can technically and safely be injected and transported through the natural gas system.

At present, the technical instructions for gas are determined by the Gas Regulations prepared by the Danish Safety Technology Authority which can be found on the Authority's website. When the time comes to integrate biogas into the natural gas network, it will be assessed whether this can take place in accordance with the provisions in the Gas Regulations. The Danish Gas technology Centre has informed the natural gas distribution companies of the technological requirements for the use of the natural gas network for biogas.

The economic conditions are under preparation. These relate both to subsidies the current legislation prepares for and the concrete sales conditions which biogas suppliers will be offered by the natural gas companies. The latter will only be registered when practical use of the natural gas network for biogas ultimately begins.

4.2.9. District heating and cooling infrastructure development (Article 16(11) of Directive 2009/28/EC)

a) Please provide an assessment of the need for new district heating and cooling infrastructure using renewable energy sources and contributing to the 2020 target. Based on this assessment, are there plans to promote such infrastructures in the future? What are the expected contributions of large biomass, solar and geothermal facilities in the district heating and cooling systems?

The spread of the district heating system

As described in Section 4.2.3, district heating is widespread in Denmark, The district heating sector supplies around 60 % of domestic housing with heat, corresponding to 45 % of the total heat requirement.

District heat is produced mostly by central co-generation plants, decentralised co-generation plants and district heating plants. It is also produced by a number of peak and reserve load installations as well as some private companies. In all, there are 50.000 km of district heating pipeline in use in Denmark.

A study commissioned by the Danish Energy Agency showed that there is both economic and environmental potential in replacing natural gas with district heat for heating. On the basis of this, the Climate and Energy Minister has encouraged local authorities to promote projects for the conversion of natural gas to district heating. This has also allowed for clearer regulations for the compensation of gas companies in the promotion of conversion projects from individual natural gas to district heat.

Local authorities must ensure that projects are prepared for the establishment of combined heat supply installations (generation and distribution). District Councils can also make connection to the combined heat supply obligatory in urban areas. In addition, in cooperation with the supply companies and other affected parties, the local authorities can formulate a plan for heat supply to a specific area.

The ‘scrappage scheme’ for oil fired central heating systems described in Sections 4.2.3 i) and 4.4 can contribute to increased connections to district heat, as it also offers subsidies for conversion to district heat.

Renewable energy for the generation of district heating

With an already extensive district heating system in Denmark, much of which is still based on fossil fuels, there is great potential for conversion to an increasing use of various forms of renewable energy sources. This will form part of the Danish expansion with renewable energy up to the 2020 target.

Almost half of Danish district heat is produced from biomass and organic waste. As shown in Table 11, a considerable contribution to the expansion with renewable energy is expected to come from district heat and cogenerated heat based on biomass. The biomass consumption for heating is expected to increase from 1759 ktoe in 2005 to 2643 ktoe in 2020 (74 PJ in 2005, 111 in 2020).

An extensive growth in biomass installations is expected in connection with the Green Growth political agreement, as described in Section 4.6.2 e). For a period of time, Green Growth also opens up for subsidies for biomass installations and subsidy equality for the sale of biogas to both co-generation plants and the natural gas network. The agreement focuses on breaking down the non-economic barriers for expansion in the biomass field. The Planning Act will be amended to allow local authorities to include the erection of biomass installations in their planning.

A smaller contribution is also expected from solar energy. Over the last few years, large solar installations for district heating have been established in a number of locations in Denmark, as this has been economically attractive. The contribution from solar energy is expected to be 16 ktoe by 2020 as opposed to 10 in 2005 (0.4 PJ in 2005, 0.7 in 2020).

Geothermal energy is another recognised technology although its spread is currently quite limited in Denmark. Currently there are smaller installations at Thisted and at Mariagerholm near Copenhagen. However, there is a growing interest in geothermal energy illustrated by the fact that the Energy Agency is currently dealing with a number of applications for licenses for the investigation and reclaiming of geothermal energy. A new installation is expected to come into operation in Sønderborg in 2011.

A number of conditions promote the use of renewable energy in district heat generation, among them the fact that biomass is non-taxable[40]. However, there are also regulations that ensure that a large proportion of district heat generation is based on co-generation. The possibility of being able to change to renewable energy for heat generation without simultaneously producing electricity is limited to a certain extent by the provisions on choice of fuel as noted in the provisions of Executive Order No. 1295 of 13 December 2005 on the authorisation of projects for combined heat supply installations (project order). According to the Order, District Councils can approve natural gas, biomass, biogas and waste for the generation of cogenerated heat. With separate heat generation, it is not possible to exchange taxable fuels for non-taxable fuels, i.e. biomass. Expansion with biomass can therefore only take place if biomass is used in cogenerated heat. The incitement to convert from natural gas to biogas is driven to a great extent by the taxation rules, as natural gas is taxable, whilst energy taxation does not apply to biogas. The regulations are intended to ensure that a large part of district heat generation is via co-generation. One result of the change from natural gas-based co-generation to heat generation from biomass could lead to an increase in gross energy consumption and an increased consumption of coal. In addition, an increase in heat generation could be a barrier to expansion with biomass-based co-generation plants. Or put another way, there may be competition between renewable energy sources for the same heating market.

According to the 2010 Green Growth agreement 2.0, the use of biomass in energy generation is to be strengthened and therefore the support of the parties involved in the energy arbitration group is being sought to help disseminate the free choice of fuel to co-generation plants up to 2 MW by withdrawing the prohibition of non-taxable fuel for heat generation.

As well as the introduction of more renewable energy generated district heat over the coming years, more adaptations to the district heat system are expected with the introduction of more renewable energy, especially from wind power, into the electricity supply. District heat supply can held to ensure the regulation of the combined energy system using large heat pumps and heating elements. This is why, as part of the political agreement on the better integration of wind power in October 2009, it was decided to make the heating element scheme permanent. This means that co-generation and district heating plants that supply co-generation areas are able to use electricity for heat using heating elements with a lower tax.

[40] This applies especially to pure biomass, e.g. energy crops and biomass waste noted in Annex 1 of the Executive Order on biomass waste (Executive Order No. 1637 of 13 December 2006).

District cooling

Due to the climate in Denmark, cooling in buildings is only used to limited extent. District cooling can be relevant in areas with a great concentration of commercial premises. The expansion of the infrastructure for district cooling will only be necessary to the extent where there is a real need and if it is more efficient than energy saving initiatives.

The Municipal District Cooling Act, passed in 2008, allows local authorities that own district heating companies to establish and operate district cooling activities. Currently, there is one district cooling project in Copenhagen run by Energy Copenhagen. This will also use a small amount of sea water for district cooling.

4.2.10. Biofuels and bioliquids – sustainability criteria and verification of compliance (Articles 17 to 21 of Directive 2009/28/EC

a) How will the sustainability criteria for biofuels and bioliquids be implemented at national level? (*Is there legislation planned for implementation? What will be the institutional setup?*)

Criteria for sustainability were implemented in Executive Order No. 1403 of 15 December 2009, which came into force on 1 January 2010. The Order was issued in accordance with the Act on Sustainable Biofuels which was approved by parliament on 29 May 2009.

Under the terms of the Act, the Climate and Energy Minister oversees compliance, including ensuring that the companies concerned comply with the sustainability criteria.

b) How will it be ensured that biofuels and bioliquids that are counted towards the national renewable target, towards national renewable energy obligations and/or are eligible for financial support comply with the sustainability criteria set down in Article 17(2) to (5) of Directive 2009/28/EC? (*Will there be a national institution/body responsible for monitoring/verifying compliance with the criteria?*)

The Climate and Energy Minister is responsible for compliance with the criteria. Monitoring is undertaken by the Danish Energy Regulatory Authority, which is part of the Ministry for Climate and Energy.

According to the Act on Sustainable Biofuels and Executive Order No. 1403, the relevant companies must send a report to the Energy Agency by 1 April documenting their compliance with the Act and also that they are complying with the sustainability criteria for biofuels.

The company must furthermore document that an independent monitor has been engaged that will ensure an appropriate standard for the monitoring of the information presented to the Energy Agency. The company must also make available to the Energy Agency all data used for collecting the information.

c) If a national authority/body will monitor the fulfilment of the criteria, does such a national authority/body already exist? If so, please specify. If not, when is it envisaged to be established?

As responsibility lies with the Energy Agency, which is part of the Ministry for Climate and Energy, there would not seem to be any need to establish such an organisation.

d) Please provide information on the existence of national law on land zoning and national land register for verifying compliance with Article 17(3) to (5) of Directive 2009/28/EC. How economic operators can access to this information? (*Please provide information on the existence of rules and distinction between different land statuses, like biodiversity area, protected area etc; and on the competent national authority who will monitor this land register and changes in land status*.)

Much of Danish woodland is covered by a conservation obligation in which the framework for land use is stated in the Forestry Act. Protected woods are noted on the land register. Certain areas of especial natural value are left in their natural state, without any intervention by forestry.

Information on private forests left in their natural state are registered in the land zone registry relating to the specific property, while information on state forest left in its natural state can be obtained from the Danish Forest and Nature Agency, or in state forestry operational plans.

Private oak scrubland in Jutland is protected with a contractual agreement between the owners and the Forest and Nature Agency. State oak scrubland is part of the state forestry operational plans. There is a requirement to preserve areas of oak scrubland and there is a ban on spraying, fertilizing and deep earth working.

Certain forests are protected under the provisions of the Nature Protection Act. Information on this can be obtained from the Nature Protection Register.

The Habitats Directive types of forest in Natura 2000 areas, which comprise around 20.000 ha, have operational limitations, with a ban on spraying and fertilizing. Furthermore, types of forest with characteristic types of tree must be maintained as they are. There are also restrictions in relation to the use of other land types in Natura 2000 areas.

If this type of nature individually or together is greater than 2500 m^2, Section 3 of the Nature Protection Act contains a general protection of lakes over 100 m2, specific water courses, moorland, bogs, salt marshes, meadow and common land. If an area fulfils the definition these types of nature under the terms of the Act, it will be protected in accordance with Section 3. Protection is immediate and is not conditional on the areas being either registered, or that the owner has been informed. Changes must not be made to the protected area without prior permission. The provision does not preclude the continuing legal use of the protected areas. The areas are registered on the Danish Nature and Environment Portal.

There are a number of limitations in regard to planting energy crops such as energy willow on open countryside, especially adjacent to protected natural areas. The local authority is the usual authority with open countryside. The responsible authority for forests and protected coastal/dune areas is, however, the Ministry of the Environment.

Information on protected nature is available on the Danish Nature and Environment Portal (www.miljoeportalen.dk). This information is updated regularly and also applies to registered protected natural areas (Section 3 of the Nature Protection Act) and Natura 2000 areas.

The information can also be verified by the respective authorities.

The Ministry of the Environment is responsible for the Danish Land Zone Register.

With the Green Growth political agreement, it has been decided to relax the restrictions and allow the planting of energy crops such as willow alongside water courses. However, this must not affect the biodiversity of protected nature and species in Natura 2000 areas.

e) As far as protected areas are concerned, please provide information under which national, European or international protection regime they are classified.

The Habitats Directive types of woodland have been identified in accordance with the EU Habitats Directive. Other forest areas discussed in Section 4.2.10 d) are protected in accordance with national regulations.

The other types of nature and species in Natura 2000 areas are similarly protected, in accordance with EU nature directives and national legislation. The national authority is the Agency for Spatial and Environmental Planning. There are also special regulations in relation to generally protected Annex 4 species outside Natura 2000 areas, cf. Section 4.2.1 a).

The generally protected types of nature are covered by the Nature Protection Act, which is the national legislation. Protection contributes considerably toe the implementation of EU nature protection directives (the Habitats and Bird Directives).

f) What is the procedure for changing the status of land? Who monitors and reports at national level on land status changes? How often are the land zone registers updated (monthly, annually, bi-annually etc.)?

The forest protection obligation is a permanent reservation of areas for forestry. The forest protection obligation can be repealed in certain instances, the rules for which are stipulated by the Forestry Act.

Private areas left for natural forest are, alongside oak scrubland, contractual and permanent. State areas left for natural forest and state oak scrub are included in the state forestry operational plans and administratively protected.

Under certain circumstances, protection can be withdrawn. Rules on this can be found in the Nature Protection Act.

The status for types of forest identified in pursuance of the Habitats Directive can not be actively changed, although certain types of forest can grow themselves out of protection unless there is active care to ensure that type of forest.

The Ministry of the Environment has responsibility for the Land Zone Register, which is updated regularly.

The local authorities have responsibility for Section 3 protection of the generally protected types of nature. They monitor protection and regularly update the registration of protected areas in the area information pages on the Danish Nature and Environment Portal.

g) How is compliance with good agro-environmental practices and other cross-compliance requirements (required by Article 17(6) of Directive 2009/28/EC) ensured and verified at national level?

The Danish Food Industry Agency is part of the Ministry of Food, Agriculture and Fisheries and is responsible for the Danish regulations for the implementation of EU area schemes and cross compliance requirements, as well as grants and subsidies. The DFIA is thus the organisation that can take decisions on the withdrawal of agricultural subsidies.

The Danish Plant Directorate is part of the Ministry of Food Agriculture and Fisheries. The DPD monitors EU area schemes and also ensures that cross compliance requirements for good agricultural and environmental conditions are complied with.

The DPD also monitors cross-compliance requirements for the protection of nests and endangered plant species for the Forest and Nature Agency, as well as certain Natura 2000 areas.

In addition, the DPD are the monitoring body for a number of other cross-compliance requirements including the prevention of the propagation of wild oat grass.

h) Does Denmark intend to develop optional 'certification' scheme(s) for biofuel and bioliquid sustainability as described in the second subparagraph of Article 18(4) of Directive 2009/28/EC? If so, how?

Denmark is open to the possibility but at present no decision has been reached.

4.3. Support schemes to promote the use of energy from renewable resources in electricity applied by the Member State or a group of Member States

Statutory provisions

a) What is the legal basis for this obligation/target?

b) Are there any technology-specific targets?

c) What are the concrete obligations/targets per year (per technology)?

d) Who has to fulfil the obligation?

e) What is the consequence of non-fulfilment?

f) Is there any mechanism to supervise fulfilment?

g) Is there any mechanism to modify obligations/targets?

Combined answer: There are no statutory targets or obligations for the promotion of renewable energy for the generation of electricity.

Financial Support

Financial support for electricity generation based on renewable energy is stated in Act No. 1392 of December 2008 on the promotion of renewable energy (RE Act). Support is given in the form of a price subsidy for:

A. Wind turbines (Sections 36-43)

B. Biogas etc. (Section 44)

C. Biomass (Sections 45-46)

D. Other RE installations (Section 47-48)

For any scheme you use, please give a detailed description answering the following questions?

a) What is the name and a short description of the scheme?

b) Is it an optional or obligatory scheme?

c) Who manages the scheme? (*Implementing body, monitoring authority*)

d) What are the measures taken to ensure availability of necessary budget/funding to achieve the national target?

e) How is long-term security and reliability addressed by the scheme?

f) Is the scheme periodically revised? What kind of feed-back or adjustment mechanism exists? How has the scheme been optimised so far?

g) Does support differ according to technology?

h) What are the expected impacts in terms of energy generation?

i) Is support conditional on meeting energy efficiency criteria?

j) Is it an existing measure? Could you please indicate national legislation regulating it?

k) Is this a planned scheme? When would it be operational?

l) What start and end dates (duration) are set for the whole scheme?

m) Are there maximum or minimum sizes of system which are eligible?

n) Is it possible for the same project to be supported by more than one support measure? Which measures can be cumulated?

o) Are there regional/local schemes? If so, please detail using the same criteria.

A. Price subsidies for wind turbines

Generally, apart from offshore wind turbines according to tender and domestic turbines.

There is a subsidy of 25 øre per kWh for electricity generation that corresponds to generation during the first 22,000 hours of the installed effect (full load hours) after connection to the grid.

There is 2.3 øre per kWh compensation for balancing costs for wind turbine electricity.

Extra subsidy on presentation of scrappage certificate

There is a subsidy for electricity produced by a wind turbine with grid connection from January 1 2005 up to and including December 2011 on condition that the owner uses the scrappage certificates issued on the dismantling of a wind turbine with an effect of 450 kWh or less, from 15 December 2004, up to and including the 15 December 2011. The scrappage certificate can, however, also be used for offshore wind turbines or domestic wind turbines under 25 kW that are connected to their own consumption installation. Scrappage certificates can be issued from a pool that corresponds with the combined effect of dismantled wind turbines of 175 MW.

With wind turbines connected from 21 February 2008 or later, the price subsidy is 8 øre per kWh for electricity generation corresponding to 12,000 full load hours for twice the installed effect of the dismantled windmills.

Tendered offshore wind turbines:

A subsidy that, compared with the market price, ensures a price quote for a given generation.

Domestic wind turbines:

A subsidy is awarded for electricity supplied to the electricity network by wind turbines with an installed effect of 25 kW or less which are connected to their own consumption installation. The subsidy is awarded irrespective of the connection point and is set so that the combined subsidy and market price make up 60 øre per kWh.

The scheme is optional for all types of subsidy for wind turbines. It is administrated by the network companies that measure electricity generation and Energinet.dk pays out the subsidy. The price subsidies are charged to the consumer via the PSO tariff. A project may not take advantage of more than one scheme. There are no requirements for compliance with energy efficiency criteria.

The support scheme is based on broad energy policy agreements and can be adjusted in accordance with new agreements. The subsidy was most recently amended by the RE Act which came in to force in January 2009.

The expected impact of the support scheme will be an increased expansion with wind power. There is no fixed end date for the scheme.

B. Price subsidies for biogas

There is a subsidy for electricity produced by installations that use biogas, gassificated gas produced from biomass, Stirling motors and other special electricity generation installations which use biomass as a source of energy. This is set so that it, in combination with the market price makes up 74.5 øre per kWh.

With electricity produced using biogas, gasification gas produced from biomass, Stirling motors or other special electricity producing installations using biomass as a source of energy in combination with other forms of fuel, a price subsidy of 40.5 kWh is given for that part of the electricity produced using biogas.

The sum of the price subsidies and the market price and price subsidies are index regulated every year from 2009 on the basis of 60 % of the increase in the net price index for the previous year in relation to 2007.

The scheme is optional and is administrated by the network companies that measure electricity generation and Energinet.dk pays out the subsidy.

The support scheme is based on broad energy policy agreements and can be adjusted in accordance with new agreements. The subsidy was most recently amended by the RE Act which came in to force in January 2009.

The expected impact of the support scheme will be an increased expansion with wind power. There is no fixed end date for the scheme.

There are no requirements for compliance with energy efficiency criteria and there is no set minimum or maximum size for the systems that are eligible for support.

C. Price subsidies for biomass

With electricity produced by the burning of biomass, there is a price subsidy of 15 øre per kWh, irrespectively of whether the electricity is produced by installations that solely use biomass, or installations that use a combination of biomass and other types of fuel.

The scheme is optional and is administrated by the network companies that measure electricity generation and Energinet.dk pays out the subsidy.

The support scheme is based on broad energy policy agreements and can be adjusted in accordance with new agreements. The subsidy was most recently amended by the RE Act which came in to force in January 2009.

The expected impact of the support scheme will be an increased use of biomass for electricity generation. There is no fixed end date for the scheme.

There are no requirements for compliance with energy efficiency criteria and there is no set minimum or maximum size for the systems that are eligible for support. A project may not take of advantage of more than one scheme.

D. Price subsidies for other types of renewable energy installation

There are subsidies for electricity produced by installations that solely use solar energy, wave or water power or other renewable energy sources apart from biogas and biomass.

The price subsidy is set so that combined with the market price it makes up 60 øre per kWh for 10 years after network connection and 40 øre the following 10 years.

With electricity produced from energy sources other than those mentioned, there is a price subsidy of 10 øre per kWh for 20 years from network connection.

With electricity produced by installations in which the named energy renewable energy sources are combined with other energy sources, there is a price subsidy of 26 øre per kWh for 10 years and 6 øre the following 10 years.

The scheme is optional and is administrated by the network companies that measure electricity generation and Energinet.dk pays out the subsidy.

The support scheme is based on broad energy policy agreements and can be adjusted in accordance with new agreements. The subsidy was most recently amended by the RE Act which came in to force in January 2009.

The expected impact of the support scheme will be an increased expansion with other types of renewable energy installation. There is no fixed end date for the scheme.

There are no requirements for compliance with energy efficiency criteria and there is no set minimum or maximum size for the systems that are eligible for support. A project may take of advantage of both the price subsidy and subsidies from the funding for small RE technologies, as described below.

Specific questions for financial support for investment:

a) What is granted by the scheme? (subsidies, capital grants, low interest loans, tax exemption or reduction, tax refunds).

b) Who can benefit from this scheme? Is it specified for certain technology (technologies)?

c) Are applications continuously received and granted or are there periodical calls? If periodical, could you please describe the frequency and conditions?

There is no financial support for investments in electricity producing renewable energy installations apart from small RE technologies. In Green Growth, the agreement states that subsidies can be awarded for investment in biogas generation installations.

The Energy Technology Development and Demonstration Programme (ETDDP)

The Energy Technology Development and Demonstration Programme was established with Act No. 555 of 5 June 2007.

The aim of the ETDDP is to support the aims of the energy policy through the promotion of the development of new energy technologies. The ETDDP will

- Provide support for *development and/or demonstration programmes*.
- Provide support for *research projects* in connection with this
- Provide support for the establishment of partnerships and international cooperation
- Create commercial successes for new energy technology and work closely with energy sector actors to put together strong project consortiums for ambitious and realisable projects.

The aims of the ETDDP are broader than merely promoting the use of renewable energy for electricity generation.

The Act came into force on 11 January 2008. There is no set end date, but a continuation of the scheme to any significant extent after 2010 will require a decision on new funding.

The ETDDP also provides support for projects for the use or wind power, biomass, solar energy and wave energy and contributes via these to the increase in the use of renewable energy.

There are no specific technological aims in the ETDDP Act. Resources will be tendered in connection with the application process. Apart from the fact that some of the resources were, for political reasons, allocated for the development of methods for the generation of 2 generation bioethanol, resources will not be allocated to specific technologies beforehand. The final decision on allocation of funds to projects will be made by an independent committee appointed by the minister. Allocation of funds will be made on the basis of precise project descriptions, budgets and business plans. The ETDDP administration will follow up the implementation of the projects on an ongoing basis. Amendments to project descriptions and budgets etc., can be made following approval by the administration.

Funding for small RE technologies

Funding will be allocated for the promotion of the spread of smaller capacity electricity producing installations, comprising solar cells, wave power and biogas installations that use technologies that have significance for the future propagation of the use of electricity from renewable sources.

Support is provided from a fund comprising DKK 25 million per year for four years, from 2008-2011.

Support, is provided to promote the introduction of installations onto the market including to a lesser extent, support for pilot projects. Support is conditional on the installation being network connected.

Support can also be provided for the establishment of installations, the operation of installations for a given period, or information on the energy properties of installations etc. Support for establishment and operation can be given together with the price subsidy for other renewable energy installations.

The support fund is administered by Energinet.dk, who make a call for applications one a year.

Support for the generation and sale of biogas

A series of initiatives have been planned in connection with the Green Growth agreement for the promotion of biogas. These include an implementation fund of DKK 85 million per year from 2010-2012, for the establishment of new combined biogas installations and operational investments in relation to connection to the combined installation. As part of this scheme, an installation subsidy of 60 % has been allocated for investments. In addition, the remaining finance will comprise a local authority loan guarantee and 20 % own finance.

An implementation fund of DKK 15 million per year during the period 2010-2012 will also be established for organic biogas installations. With this scheme, an installation subsidy of 20 % of the investment can be allocated. An assessment of the scheme will be undertaken following the first application call.

Furthermore, with Green Growth, there is political agreement for increasing support for the introduction of biogas into the natural gas network, so that the support is the same as current support for the burning of biogas in the decentralised co-generation plants.

Four new schemes for the promotion of onshore wind power.

Four new schemes have been introduced in the RE Act for promoting expansion with wind turbines. The schemes are administered by Energinet.dk.

Value loss scheme

A constructor of a wind turbine must compensate for value loss to a property as a result of the erection of a wind turbine. The value loss is estimated by an assessment agency.

If a property loses more than 1 % of its value as a result of the erection of a new wind turbine, the owner will be fully insured against the loss. The property owner must make a claim to Energinet.dk for coverage of the loss of value. The either the property owner and the owner of the wind turbine can enter into an agreement for compensation for the loss of value, or else an independent assessment agency can evaluate the worth of the property and set the size of the compensation.

The claim by the owner of an affected property must be made before the wind turbine is erected. The wind turbine owner must therefore make a visual presentation of the project, prepare other materials and inform the affected citizens at a public meeting at least four weeks before the end of the local authority planning process. Claims after this period will only be assessed in exceptional cases.

Purchasing rights scheme

The constructor of a wind turbine is obliged to offer at least 20 % of shares in the turbine to the group of persons with purchasing rights. All citizens over the age of 18 living up to 4.5 km from new wind turbines can buy into local wind turbine projects. Shares not purchased by citizens living within the 4.5 km limit may be offered to permanent citizens in the rest of the municipal area. The constructor of the turbine must, at a minimum, advertise the project in the local newspaper and the amount of shares must at a minimum amount to 20 % of the cost price of the turbine. One share corresponds to 1000 kWh, which at the present is between DKK 3000-4000. Shareholders share costs, income, risk and influence equally with the constructor of the wind turbine.

Both the purchasing scheme and the loss of value scheme apply in general for wind turbines connected to the grid after January 1 2009. Exceptions are wind turbine projects which are already operative, i.e. onshore turbines for which the local authority has published the local plan supplement with accompanying EIA, before 1 March 2009, or has publicly announced that the wind turbine does not require an EIA. The exception is offshore wind turbines for which the constructor has received authorisation for preliminary investigations before1 March. Finally, wind turbines must be connected to the network before 1 September 2010 in order to be exempted from the loss of value or right of purchase schemes.

The green scheme

With the green scheme, local authorities can apply for support from Energynet.dk for projects that benefit the landscape and the recreational opportunities in the local area and for cultural and information activities. These can, for example be support for the establishment of a new nature path, or educational material for teaching about climate and energy.

The amounts made available to local authorities will depend on how many and how large the wind turbines actually erected are and depending on size, will generally be around DKK 200.000 per turbine.

The regulations of the green scheme in the RE Act came into force from 1 July 2009, simultaneously with the Executive Order on the administration of the green scheme.

The guarantee scheme

The guarantee scheme was established to support the financing of preliminary investigations etc., by local wind turbine committees prior to the erection of wind turbines. Decisions on the issuing of guarantees are the responsibility of Energinet.dk.

The guarantee scheme was established to provide more security for groups of citizens, wind turbine committees and others who may require a more secure decision basis before committing themselves to the erection of a wind turbine. This could be, for example, preliminary studies of the area, inconvenience to neighbours, economy, etc. Guarantees are made of DKK 500.000 per project. The guarantee will be taken up if the project is not completed and the loan cannot be repaid.

Specific questions for tradable certificates:

a) Is there an obliged share of electricity produced from renewable sources in the total supply?

b) Who has the obligation?

c) Are there technology-specific bands?

d) Which technologies are covered by the scheme?

e) Is international trade in certificates allowed? What are the conditions?

f) Is there a floor bottom price?

g) Is there a penalty for non-fulfilment? What is the average price for certificates?

h) Is it made public? Where?

i) What is the trading scheme for certificates?

j) How long can a plant participate in the scheme?

Combined answer: There is no support in the form of tradable certificates.

Specific questions for feed-in fixed tariffs:

a) What are the conditions to get the fixed tariff?

b) Is there a cap on the total volume of electricity produced per year or of installed capacity that is entitled to the tariff?

c) Is it a technology specific scheme? What are the tariff levels for each?

d) Are there other criteria differentiating tariffs?

e) For how long is the fixed tariff guaranteed?

f) Is there any tariff adjustment foreseen in the scheme?

Combined answer: Subsidies are awarded which, in combination with electricity market prices, ensure a constant premium for certain wind turbines, biogas installations and other renewable energy installations as described previously.

Specific questions for feed-in premium:

a) What are the conditions to get the premium?

b) Is there a cap on the total volume of electricity produced per year or of installed capacity that is entitled to the premium?

c) Is it an alternative to fixed tariff?

d) Is it a technology specific scheme? What are the premium levels for each?

e) Is there a floor and/or a cap for the premium? Please specify.

f) For how long is the premium price guaranteed?

g) Is there any tariff adjustment foreseen in the scheme?

Combined answer: Subsidies are awarded which, in combination with electricity market prices, ensure a constant premium for certain wind turbines, biogas installations and other renewable energy installations as described previously.

Specific questions for tendering:

a) What is the frequency and size of the tenders?

Tenders are announced for the erection of offshore wind turbines in accordance with political agreements. The last tender was for an offshore wind farm of 400 MW off Anholt.

A new subsidy was introduced in 2008 for the tendering of onshore areas wind turbines. In connection with this, a screening of state owned areas was undertaken to find suitable sites. These areas were introduced into local authority wind turbine plans. To the extent that local authorities, after closer examination, find that they are suitable for wind turbines, tenders will be announced for the erection of wind turbines. An additional screening of state owned areas has been undertaken to find further suitable sites.

b) Which technologies are specified?

The tender is used for politically agreed wind farms.

c) Is it integrated with grid development?

4.4. Support schemes to promote the use of energy from renewable resources in heating and cooling applied by a Member State or group of Member States

Financial support is only granted to promote the use of renewable energy for heating and cooling. The relevant questions from 4.3 are answered for each support scheme in the following.

Tax relief

The use of fossil fuels for heating and cooling attracts a considerable energy tax (about DKK 50 per GJ). Heat produced by the burning of waste (with the exception of biomass waste, included in Annex 1 of the Executive Order on biomass waste and the fibre fraction of gassified manure) has a corresponding tax. Duties were increased by 15 % in Spring Package 2.0 and will be index regulated in the future. On the other hand, energy tax was not levied on either the use of pure biomass (e.g. energy crops, which are not categorised as a waste product) or biomass waste included in Annex 1 of the Executive Order on biomass waste.

Scrappage scheme for oil-fired boilers

To ensure a reduction in CO_2 emissions from domestic housing, DKK 400 million has been earmarked for subsidies for the replacement of inefficient oil-fired boilers with more energy efficient heating systems. In areas with district heating, the subsidies are only granted for the installation of district heating. Outside of district heating areas, there are three possibilities for subsidy: 1) efficient air to water heat pumps, 2) efficient liquid to water heat pumps or 3) solar installations.

Via this scrappage scheme, subsidies can be given for purchasing and installing approved heating systems to replace scrapped oil-fired boilers. The scheme covers all types of year-round domestic property: owner occupied houses and flats, housing association properties, rented property and holiday homes that have year-round status.

The requirements for subsidy are that the oil-fired boiler is replaced either by a heat pump (geothermal or air to water), solar heating in combination with, for example, a new oil/natural gas/wood pellet boiler or a connection to district heat. In designated district heating areas, the scheme only gives subsidy for district heating.

The size of subsidy depends on the heating system which is installed to replace the oil-fired boiler. A subsidy is given for single unit houses, for the establishment of geothermal heating: DKK 20.000 for liquid-water heat pumps, DKK 15,000 for air-water heat pumps, DKK 10.000 for district heating units and 25 % of investment costs for solar installations.

Subsidy funds are limited and applications are considered on a 'first come, first served' basis as long as funds are available.

Ongoing reception of applications.

a) How are the support schemes for electricity from renewable energy sources adapted to encourage the use of CHP from renewable energy sources?

There are no specific support schemes as the general schemes for price subsidies for electricity generation and tax exemption for heat generation as described previously all promote the use of renewable energy.

b) What support schemes are in place to encourage the use of district heating and cooling using renewable energy sources?

There are no specific support schemes as the general schemes for price subsidies apply to all, irrespective of size of installation or sector.

c) What support schemes are in place to encourage the use of small-scale district heating and cooling from renewable energy sources?

See answers a) and b)

d) What support schemes are in place to encourage the use of industrial scale district heating and cooling from renewable energy sources?

See answers a) and b)

4.5. Support schemes to promote the use of energy from renewable resources in transport applied by the Member State or a group of Member States

a) What are the concrete obligations/targets per year (per fuel or technology)?

In accordance with the Act on Biofuels, an importer or manufacturer of petrol or diesel has an obligation to ensure that biofuels make up at least 5.75 % of the company's total annual sale of fuel to land transport, measured according to energy content. This target will be phased in over a three year period: 0.75 % in 2010, 3.35 % in 2011 and 5.75 % in 2012.

The government must, and will ensure that in accordance with the RE Act, at least 10 % renewable energy is reached in the transport sector by 2020. The government will ensure the fulfilment of this target through the increased use of biofuels in the transport sector and by promoting electric vehicles.

The Green Growth agreement states that there is a political consensus in Denmark for the investigation of the possibilities for and economic consequences of, reinforcing the production of especially, second generation biofuels, as well as investigating the technical possibilities for increasing the mix requirements.

b) Is there differentiation of the support according to fuel types or technologies? Is there any specific support to biofuels which meet the criteria of Article 21(2) of the Directive?

On evaluation of a company's obligation in relation to mixing biofuels with fuel for land transport, the contribution of second generation biofuels was estimated to be twice as large as the contribution from other biofuels.

From 2007-2010, as a part of the efforts to achieve the future targets for the use of renewable energy, the Energy Technology Development and Demonstration Programme (ETDDP) have contributed a total of DKK 200 million for the development and demonstration of second generation biofuels. The ETDDP have also supported other projects in relation to the transport sector, including low temperature fuel cells, batteries and the use of hydrogen.

The ETDDP Act came into force on 11 January 2008. There is no set and date for the scheme. The current mandate runs to 2010 and a continuation to any significant extent beyond 2010 is therefore dependent on a new grant.

A research scheme for electric vehicles has been set up with a framework of DKK 53 million for the period 2008-2012.

DKK 180 million has been earmarked for research and demonstration projects for energy efficient transport solutions, including electric vehicles and second generation biofuels, as part of the "Green transport policy" transport agreement.

Biofuels are exempt from the CO_2 tax levied on mineral petrol and diesel. Electric cars will be tax exempt up to and including 2015, in accordance with the government paper "Denmark 2020".

The following are answers to the same questions as in Section 4.3 in regard to the statutory and financial support schemes below:

A. Requirements for the mixing of biofuels with other fuels for land transport

B. Exemption from tax and vehicle taxation

C. Test scheme for electric vehicles

D. Test scheme for energy efficient transport solutions

A. Requirements for the mixing of biofuels in other fuels for land transport

According to Act No, 468 of 12 June 2009 on sustainable biofuels and Executive Order, companies that sell fuels for land transport have an obligation to ensure that biofuels make up at least 5.75 % of the company's total annual sale. This target will be phased in over a three year period: 0.75 % in 2010, 3.35 % in 2011 and 5.75 % in 2012. Biofuels must comply with the requirements on sustainability in the RE Act.

The Climate and Energy Minister ensures compliance with the Act. A system will be established to control the mixture percentage and compliance with the sustainability criteria. Failure to comply with the requirements is punishable by fine.

The Climate and Energy Minister can reduce the mixture requirements in the event of a crisis or of the lack of sustainable biofuels.

B. Exemption from tax and vehicle taxation

As previously mentioned, electric vehicles are exempt from both vehicle tax and fuel consumption charges. Biofuels are also exempt from the CO_2 tax levied on mineral petrol and diesel.

These tax exemption schemes are aimed at increasing the use of electric vehicles and biofuels and are administered by the Ministry of Taxation.

The provisions are stated in the Act on Vehicle Taxation, the Act on fuel consumption charges for certain types of motor vehicle and the Act on CO_2 charges on certain energy products.

The government has decided to extend tax exemption for electric cars up to and including 2015. After this, electric vehicles will be taxed favourably in relation to their environmental and climatic advantages. The tax will be phased in gradually over a shorter number of years.

Furthermore, the government are currently preparing a proposal for the restructuring of vehicle taxation so that it is transferred from ownership of a vehicle to its use, The proposal will make it more attractive to buy an energy-economical vehicle, irrespective of technology. If such a restructuring is approved, it could probably be implemented after 2017.

C. Test scheme for electric cars

The test scheme for electric vehicles is a financial support scheme and provides finance for projects which aimed at the undertaking of tests and research on the operation of a fleet of electric vehicles. The support can be given towards costs incurred by authorities, companies or institutions on the purchase of electric instead of conventional vehicles.

The scheme is intended to give experience with the technical, economic, organisational and environmental advantages of electric vehicles and pave the way for the phasing in of electric vehicles in Denmark. When electric vehicles are introduced into the Danish market in great numbers it will have enormous impact on electricity generation. As this is to a large extent based on wind power, electric vehicles allow for the introduction of wind power into electricity system in a cost effective way.

The further provisions in the support scheme can be found in Executive Order No. 1142 of 28 November 2008 on state subsidies for trial schemes with electric vehicles.

DKK 35 million was earmarked for the project which began in 2008 runs until 2012. It is an optional scheme and is administered by the Danish Energy Agency. A midway evaluation of the results of the scheme and the experiences that have been collected will be undertaken in 2010. The final evaluation of the scheme will be in 2012.

Support is given only to pure electric cars that can be charged from the grid. These are extremely energy efficient in relation to conventional cars.

The projects are undertaken according to the regulations for de minimis support. There is a maximum of DKK 750.000 per project, which is granted in the form of subsidies.

Support can also be applied for from other support schemes in both Denmark and the EU on the condition that EU regulations for state support are complied with.

Receipt of applications and awarding of support takes place periodically, 1-2 times a year. Companies and authorities may apply.

D. Test scheme for energy efficient transport solutions

Support may be given via the test scheme for the testing of more energy efficient transport solutions for public and private companies. The aim of the scheme is to reduce CO_2 emissions from the road transport sector.

The scheme is optional and is administered by the Centre for Green Transport, a part of the Danish Transport Authority. The scheme, planned as part of the "Green Transport Policy" agreement of January 2009, was confirmed by the Finance Act of 2010 and runs from 1 January 2010 to 31 December 2013.

The first call for applications was announced on 26 March 2010. Experiences from previous calls will be included in the preparation of subsequent calls.

In general, support is given for all schemes to reduce CO_2 emissions from road transport. In order to receive support, the project must result in a change in energy efficiency and/or a reduction in the consumption of fossil fuels.

Public authorities, companies and institutions, as well as private companies, organisations and institutions are eligible for support. The support is restricted to specific technologies.

Receipt of applications and awarding of support takes place periodically. Tendering for funding takes place 1-2 times a year. Calls are made on the Transport Authority's website and in the press. The application material includes a number of criteria which will be decisive for awarding support, including specific requirements for the reduction of CO_2 emissions and/or the reduction in the consumption of fossil fuels.

There are no minimum and maximum sizes of systems eligible for support. Support can also be applied for from other support schemes in both Denmark and the EU on the condition that EU regulations for state support are complied with.

Support for private applicants and public authorities that are economically active in a market will be awarded support in accordance with the de minimis regulations or according to the group exemption scheme.

4.6. Specific measures for the promotion of the use of energy from biomass

4.6.1 Biomass supply: both domestic and trade

Table 7: Biomass supply in 2006 (ktoe/år)

Sector of origin		Amount of domestic resource[41]	Imported		Exported	Net amount	Primary energy generation (ktoe)
			EU	Third countries	EU/third countries		
A) Biomass From forestry[42] :	*Of which*						
	1. Direct supply of wood biomass from forests and other wooded land for energy generation	666	376	32			1074
	Optional — if information is available you can further detail the amount of feedstock belonging to this category a) fellings b) residues from fellings (tops, branches, bark, stumps) c) landscape management residues (woody biomass from parks, gardens, tree rows, bushes) d) other (please define)						
	2. Indirect supply of wood biomass for energy generation	172					172
	Optional — if information is available you can further detail: a) residues from sawmilling, woodworking, furniture industry (bark, sawdust) b) by products of the pulp and paper industry (black liquor, tall oil) c) processed wood-fuel d) post-consumer recycled wood (recycled wood for energy generation, household waste wood) e) other (please define)						
B) Biomass	*Of which:*						

41 Amount of the resource in m 3 (if possible, otherwise in appropriate alternative units) for category A and its subcategories and in tonnes for categories B and C and their subcategories.

42 Biomass from forestry should also include biomass from forest-based industries. Under the category of biomass from forestry processed solid fuels, such as chips, pellets and briquettes should be included in the corresponding subcategories of origin.

From agriculture and fisheries:	**1. Agricultural crops and fisheries products directly provided for energy generation**	Unknown					Unknown
	Optional — if information is available you can further detail: a) arable crops (cereals, oilseeds, sugar beet, silage maize) b) plantations c) short rotation trees d) other energy crops (grasses) e) algae f) other (please define)						
	2. Agricultural by-products/processed residues and fisheries by-products for energy generation	515					515
	Optional — if information is available you can further detail: a) straw b) manure c) animal fat d) meat and bonemeal e) cake by-products (incl. oil seed and olive oil cake for energy) f) fruit biomass (including shell, kernel) g) fisheries byproducts h) clippings from vines, olives, fruit trees i) other (please define)						
C) Biomass from waste:	*Of which:*						
	1. Biodegradable fraction of municipal solid waste including biowaste (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) **and landfill gas**	540					540
	2. Biodegradable fraction of industrial waste (including paper, cardboard, pallets)						0
	3. Sewage sludge	21					21

Source: The Danish Energy Agency Statistics.

Table 7: Biomass supply in 2006 (TJ/year)

Sector of origin		Production	Imported		Export	Net amount	Consumption
			EU	Third countries	EU/third countries		
A) Biomass from forestry	*Of which:*						
	1. Direct supply of wood biomass from forests and other wooded land for energy generation	27.900	15.755	1327			44.982
	Optional — if information is available you can further detail the amount of feedstock belonging to this category a) fellings b) residues from fellings (tops, branches, bark, stumps) c) landscape management residues (woody biomass from parks, gardens, tree rows, bushes) d) other (please define)						
	2. Indirect supply of wood biomass for energy generation	7192					7192
	Optional — if information is available you can further detail: a) residues from sawmilling woodworking, furniture industry (bark, sawdust) b) by products of the pulp and paper industry (black liquor, tall oil) c) processed wood fuel d) post-consumer recycled wood (recycled wood for energy generation, household waste wood) e) other (please define)						
B) Biomass from agriculture and fisheries:	*Of which:*						
	1. Agricultural crops and fisheries products directly provided for energy generation	Not known					Not known
	Optional — if information is available you can further detail: a) Arable crops (cereals, oilseeds, sugar beet, silage maize) b) Plantations c) Short rotation trees d) Other energy crops (grasses) e) Algae f) Other (please define)						

	2. Agricultural by-products/processed residues and fisheries by-products for energy generation	21578					21578
	Optional — if information is available you can further detail: a) straw b) manure c) animal fat d) meat and bonemeal e) cake by-products (incl. oil seed and olive oil cake for energy) f) fruit biomass (including shell, kernel) g) fisheries by-products h) clippings from vines, olives, fruit trees i) other (please define)						
C) Biomass from waste	*Of which:*						
	1. Biodegradable fraction of municipal solid waste including biowaste (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) **and landfill gas**	22.594					22.594
	2. Biodegradable fraction of industrial waste (including paper, cardboard, pallets)						0
	3. Sewage sludge	879					879

Source: Energy Agency Statistics.

The amounts of biomass supplies in Table 7 are included in the Danish Energy Agency Statistics for 2008, for which the 2006 figures are shown in the table on page 5.

The Energy Agency Statistics are not presented in quite the same way as Table 7 and for this reason, the subcategories are not filled out. The following groupings relate to Table 7:

A1+A2: Wood chips (6780 TJ), firewood (19017 TJ), wood pellets (2343 TJ) and wood residue (6952) are roughly divided in category A1+A2.

B2: Straw (18538 TJ) plus biogas from manure and other agricultural by-products and fisheries (3919 TJ) minus biogas from sludge (879 TJ). Biogas from landfill sites is included under B2.

C1: Biodegradable waste for burning

C3: Biogas from sludge.

The table below shows the calorific values used to determine the amount of energy for the various types of biomass.

Fuel	**Unit**	**Calorific value**
Straw	GJ/ton	14.50
Wood chips	GJ/m^3	2.80
Wood chips	GJ/ton	9.30
Firewood, deciduous	GJ/m^3	10.40
Firewood, conifer	GJ/m^3	7.60
Wood pellets	GJ/ton	17.50
Wood residue	GJ/ton	14.70
Wood residue	GJ/m^3	3.20
Biogas	GJ/1000 m^3	23.00
Waste	GJ/ton	10.50
Bioethanol	GJ/ton	26.70
Biodiesel	GJ/ton	37.60

In energy and CO_2 emission statistics, waste is divided into two components: biodegradable waste and non-biodegradable waste. In accordance with international conventions, including the definitions in Article 2 of the RE Act, the biodegradable part is regarded as renewable energy. In Danish energy statistics it was assumed that up to and including 2007, 77.7% of waste would be biodegradable. Following research work undertaken by the National Energy Research Institute (NERI), a part of the Ministry of the Environment, the statistics for 2008 presuppose a lower share of 58.8 %. This has now been back-calculated in all figures and consequently also in Table 7. The 58.8 % share is furthermore carried into calculations of the share of renewable energy in the action plan up to 2020.

The expected development tendencies for the generation and consumption of biomass as the basis for Table 7a are described below.

As an annex to the Action Plan, an assessment of all the significant renewable resources in Denmark compared with the current consumption of renewable energy (in 2008) is included. Key figures for biomass are also given.

Potential evaluations, biomass	Generation 2008 (PJ)	Unexploited potential (PJ)	Conditions for potential evaluation
Straw	15	40	Current area use
Wood	41	10	Current generation and forested areas
Energy crops[43]	4	65	10 % of the land area corresponding to around 15 % of the cultivated area
Biodiesel/bioethanol	5	20	Non-exploited straw resources of 40 PJ with an efficiency of 50 %.
Biogas	4	35	Current generation suitable for biogas
Biomass from the sea	0	?	
Total biomass	*64*	*125*	
Waste etc.	24	5	Estimated amount of waste in 2020

The table shows a biomass potential calculated on the basis of a number assumptions on area use and based on recognised technology.

The first row shows national biomass generation for energy in 2008. The second row shows further possible biomass generation from, for example, a more intensive utilisation of agricultural waste products etc., from the cultivation of energy crops, increased tree planting and the establishment of solar installations on ground areas that would otherwise be used for foodstuffs production. Resource calculations thus overlap. For example, straw resources of 40 PJ are assumed to produce bioethanol for the potential evaluation of bioethanol and therefore cannot be used in co-generation.

It can be seen that significant un-utilised biomass potential exists in all areas (straw, wood, energy crops, biodiesel/bioethanol and biogas). With the right market conditions, the biogas potential of these can be harnessed.

The development potential of biomass production for energy is discussed later in this section, which indicates that there is a good argument for the generation of 'energy wood' increasing over the coming years as a result of market forces and the price relationship between timber and energy wood. For the other types of biomass such as waste, straw and manure, it expected that changes in consumption and generation will run parallel, which is reflected in Table 7a. It is estimated that the share of manure in biogas generation is 50 %, as the remainder comes from organic waste such as abattoir by-products.

The estimated assumption is that 20 % of the un-utilised wood potential of 10 PJ will be exploited by 2020.

[43] There is no differentiation between annual and perennial energy crops.

Table 7a: Estimated biomass domestic supply in 2015 and 2020 (ktoe/year)

Sector of origin		2015		2020	
		Expected amount of domestic resource	Primary energy generation	Expected amount of domestic resource	Primary energy generation
A) Biomass from forestry	**1. Direct supply of wood biomass from forests and other wooded land for energy generation**	750	1457	834	1839
	2. Indirect supply of wood biomass for energy generation	172	172	172	172
B) Biomass from agriculture and fisheries	**1. Agricultural crops and fishery products directly provided for energy generation**				
	2. Agricultural by-products/processed residues and fishery by-products for energy generation	621	621	705	705
C) Biomass from waste	**1. Biodegradable fraction of municipal solid waste including biowaste** (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) **and landfill gas**	611	611	683	683
	2. Biodegradable fraction of industrial waste (including paper, cardboard, pallets)		0		0
	3. Sewage sludge	21	21	21	21

Table 7a: Estimated biomass supply in 2015 and 2020 (TJ/year)

Sector of origin		2015		2020	
		Expected amount of domestic resource	Primary energy generation (ktoe)	Expected amount of domestic resource	Primary energy generation (ktoe)
A) Biomass from forestry:	**1. Direct supply of wood biomass from forests and other wooded land for energy generation**	27.900 Wood chips: +1000 Multiannual energy crops: +2500 Total: 31400	44.982 +16.000 Total: 61.000	27.900 +2000 Multiannual energy crops: +5000 Total: 34900	44.982 +32.000 Total: 77000
	2. Indirect supply of wood biomass for energy generation	7192	7192	7192	7192
B) Biomass from agriculture and fisheries	**1. Agricultural crops and fisheries products directly provided for energy generation**				
	2. Agricultural by-products/processed residues and fisheries by-products for energy generation	22.457 Straw: +500 Manure: +3000 Total: 26000	22.457 Straw: +500 Manure: +3000 Total: 26000	22.457 Straw: +1000 Manure: +6000 Total: 29500	22.457 Straw: +1000 Manure: +6000 Total: 29500
C) Biomass from waste:	**1. Biodegradable fraction of municipal solid waste including biowaste** (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) **and landfill gas lossepladsgas**	22.594 Waste: +3000 Total: 25600	22.594 Waste: +3000 Total: 25600	22.594 Waste:+6000 Total: 28600	22.594 Waste: +6000 Total: 28600
	2. Biodegradable fraction of industrial waste (including paper, cardboard, pallets)		0		0
	3. Sewage sludge	879	879	879	879

The growth of wood of about 32 PJ is largely expected to be covered by imported wood pellets which will be used in the central co-generation plants. The import share of wood pellets is about 90 %. Two PJ out of the 32 is estimated to be produced in Denmark via increased wood chip generation.

One result of the Green Growth agreement is expected to be the increased subsidised planting of perennial energy crops. Table 7a assumes the planting of 15,000 ha perennial energy crops in 2015 and 30.000 ha in 2020. Dry matter content is set at 10 tons dry matter/ha.

Further growth in biomass generation (straw, biogas, biodegradable waste) is expected to be domestic, with developments in generation and consumption running parallel.

It should be noted that there are various forms of conversion (burning, biogassification etc.,) within the same category.

Table 8: Current agricultural land use for generation of crops dedicated to energy in (2006)

Agricultural land use for generation of dedicated energy crops	Areal (ha)
1) Land used for short rotation trees (willows, poplars)	2006: Ca. 1000 ha 2010: Ca. 4000 ha.
2) Land used for other energy crops such as grasses (reed canary grass, switch grass, Miscanthus), sorghum	Max. 50 ha

In addition, oil rich products such as rapeseed are produced on around 70.000 ha.

4.6.2 Measures to increase biomass availability, taking into account other biomass users (agriculture and forest-based sectors)

Mobilisation of new biomass sources

a) Please specify how much land is degraded.

Not known

b) Please specify how much unused arable land there is.

Not known

c) Are any measures planned to encourage unused arable land, degraded land, etc., to be used for energy purposes?

The Ministry of Food, Agriculture and Fisheries has earmarked three amounts of DKK 32 million (96 million) between 2010-2013, for the establishment of perennial energy crops in areas where there is a documented effect of nitrogen emissions (V1 and V2 areas in accordance with the Water Policy Framework Directive)

From a taxation point of view, the planting of willow and other perennial energy crops is now considered an operational cost and is therefore tax deductable.

The plan also opens up the possibility of being able to plant perennial energy crops without pesticides or manure alongside water courses and lakes.

d) Is energy use of certain already available primary material (such as animal manure) planned?

There are plans to use up to 50 % of manure for energy by 2020.

In 1993, there was a broad political consensus for the use of biomass in energy supplies for industrial purposes (the biomass agreement). The basis of the agreement was that there are many good arguments for the use of biomass such as straw, woodchips, biogas etc., for energy from a broad societal point of view.

Considerations in relation to energy policy, the environment, resources, support for agriculture and forestry, support for the local economy and employment are all good reasons for using biofuels in the energy supply and for industrial usage".

There was a supplementary amendment to the agreement in 1997 which remains applicable. The main theme of the biomass agreement was that power stations should have the capacity to burn at least one million tons of straw and at least 0.2 million tons of wood chips. In addition, electricity plants would be able to combine the use of wood and straw although they would only be able to burn 19.5 PJ/year.

When coal was allowed in Block 2 at the Avedøre plant in February 2009, the condition was that DONG Energy, one of the largest energy producers, must use at least 22.7 PJ biomass annually at the plant. Excess biomass use can be saved for the coming years. If the requirements are not complied with, the coal license will be revoked. The license is applicable from 2010, or from the point when the EIA is completed.

As the biomass agreement only states requirements for minimum capacity and not for biomass utilisation, this has created a more secure basis for an annual minimum use of biomass in the Danish electricity and heating system.

e) Is there any specific policy promoting the generation and use of biogas? What type of uses are promoted (local, district heating, biogas grid, natural gas grid integration)?

The Green Growth political agreement of 16 July 2009 sets ambitious targets: "*One aim is that by 2020, 50 % of manure will be used for green energy*". The current work of integrating biogas into the natural gas network is further described in 4.2.8.

The political priorities and the economic conditions have changed markedly in recent years. The political agreement of 21 February 2008 has established new improved billing conditions for biomass and biogas. This has been followed up by the Green Growth agreement which opens up for subsidies for biogas installations for a period of time and subsidy equality for the transport of biogas directly to co-generation plants or the natural gas network, respectively.

The Green Growth agreement also focuses on breaking down the non-economic barriers for expansion in the biogas field. The Planning Act has been amended so that local authorities must include the erection of biogas installations in their planning. During the coming years, a 'flying squad' appointed by the state will advise the local authorities on this. In addition, a road-map for the efficient introduction of biogas into the energy system will be prepared, as well as a coordiation plan for ensuring the best possible use of biogas installations in relation to manure production in the agricultural sector.

Biogas is intended primarily to replace natural gas, as this will make the greatest contribution to increased security of supply and good economy whilst at the same time giving biogas companies the best price for their gas. In the first years, biogas is planned to replace natural gas in the decentralised co-generation plants. In the longer term, the natural gas network is expected to be used for the transmission and utilisation of biogas, especially If costs can be brought down for the treatment of the biogas before it is pumped into the network.

An increase from the current figure for manure in biogas installations from about 5 % to 50 %, assumes a breakthrough for biogas installations that are economically balanced on animal manure/slurry and other biomass such as energy crops, although without dependence on an injection of organic waste - which is already an almost fully exploited resource. If this breakthrough can be achieved, it will open up the possibility that after 2020, it will be possible to assimilate all types of manure into the energy supply. However, energy exploitation such as this will depend on how the manure resources can be utilised.

In order to promote this development, the Ministry of Food, Agriculture and Fisheries have earmarked DKK 300 million for the establishment of new biogas installations. This is spread over three years and will mean three yearly amounts of DKK 85 million three of DKK 15 million for biogas installations on organic farms.

f) What measures are planned to improve forest management techniques in order to maximise the extraction of biomass from the forest in a sustainable way?[44] How will forest management be improved in order to increase future growth? What measures are planned to maximise the extraction of existing biomass that can already be put into practice?

Felling in Danish forests has been on the increase over the last 10 years. During this period, the felling of conifers has almost doubled, while the felling of deciduous trees has remained more or less constant. In particular, the felling of trees for energy generation (firewood and wood chips) has increased dramatically and today comprises almost half of the total fellings.

It is to be expected that the transfer to more nature-based forestry in both state owned and private forests, as well as the implementation of Natura 2000 plans will, in the medium term, reduce biomass generation in the existing forests. However, this will probably be more than balanced out in the medium to long term by the Danish parliament decision to double the forested area over a generation (80 - 100 years).

There are currently no plans to improve forestry management in order to encourage more growth or the recovery of as much biomass as possible from forests. If demand for biomass increases, the recovery of biomass from forests will increase.

Figures for volume of wood, felling and growth indicate that there is considerable potential in wood (½ - 1 million m^3) that is not designated for felling. Out of consideration for biodiversity in forests, it must be ensured that utilisation must be sustainable, which includes leaving a considerable amount of dead wood and large old trees after felling.

[44] In a report from July 2008, the Standing Forestry Committee ad hoc Working Group II have prepared a series of recommendations on mobilisation and efficient use of wood and wood residues for energy generation. The report can be seen at http://ec.europa.eu/agriculture/fore/publi/sfc_wgii_final_report_072008_en.pdf.

Impact on other sectors:

a) How will the impact of energy use of biomass on other sectors based on agriculture and forestry be monitored? What are these impacts? (If possible, please provide information also on quantitative effects). Is the monitoring of these impacts planned in the future?

If the use of straw in energy supply increases, this will have an impact on agricultural production that uses straw. This could mean higher prices and with them, increasing costs for animal producers that use straw for spreading etc. With chopped straw, however, it is possible to buy alternatives.

Within the forestry sector, an increased demand for energy wood can mean that a larger proportion of timber will be used for energy instead of for generation, e.g., for building, furniture etc. It is the poorer qualities of timber in particular that will be used for energy generation. An increased demand can also mean that there will be more wood needed from the forests, which will be to the advantage of the forestry sector.

Annual reports of felling and use are compiled and included in Danish forestry statistics.

In a previous report in connection with the conversion of Herningværket (a Danish power station in the town of Herning), the energy Authority concluded that the increased use of wood chips did not in general have an influence on the timber industry in Denmark. A global increase in the use of wood chips, with the inevitable rise in prices for wood chips would naturally have an impact on costs and competition in the timber industry, which would ultimately also seem to be an international problem. This constitutes an important focus point for the timber industry.

b) What kind of development is expected in other sectors based on agriculture and forest that could have an impact on the energy use? (e.g. could improved efficiency/productivity increase or decrease the amount of by-products available for energy use?)

The Danish timber industry today exports much of its residue as wood chips for the production of cellulose. With competitive pricing, this could be used for domestic energy generation. This comprises 50 % of the raw material for sawmills.

It is also thought that in the future, fewer animals will be slaughtered in Denmark, which will mean less animal fat and bonemeal by-products. Abattoir and dairy residues are very important raw materials in biogas generation as they considerably increase production. For this reason, it is important to find alternatives in which energy crops such as maize, lucerne, clover, rapeseed etc, can replace abattoir residue for biogas generation.

4.7. Planned use of statistical transfers between Member States and planned participation in joint projects with other Member States and third countries

On the basis of this document, the Danish government expects to be able to fulfil its obligations for expansion with renewable energy up to 2020 with domestic initiatives.

Conversely, as the expected total share of Danish renewable energy is expected to exceed the indicative trajectory, the Danish government is also prepared to make any excess renewable energy available to other countries in the years up to 2020.

As far as participation in joint projects is concerned, Denmark has begun a clarification of procedural aspects and agreements within the framework of the Nordic energy partnership including how the various types of national support schemes can be included in joint projects. This has resulted in a two-year research project entitled “Nordic Testing Ground”. There is also a three-year EU development initiative entitled “Concerted Action – Renewable Energy”, in which Denmark is an active partner.

The Danish government is awaiting confirmation of the above trans-national project, so answers to 4.7.1 and 4.7.3 are thus expected to be included in the coming progress report to the Commission.

4.7.1. Procedural aspects

a) Describe the national procedures (step by step) established or to be established, for arranging a statistical transfer or joint project (including responsible bodies and contact points).

b) Describe the means by which private entities can propose and take part in joint projects either with Member States or third countries.

c) Give the criteria for determining when statistical transfers or joint projects shall be used.

d) What is going to be the mechanism to involve other interested Member States in a joint project?

e) Is Denmark willing to participate in joint projects in other Member States? How much installed capacity/electricity or heat produced per year are you planning to support? How do you plan to provide support schemes for such projects?

4.7.2. Estimated excess generation of renewable energy compared to the indicative trajectory which could be transferred to other Member States

See Table 9.

4.7.3. Estimated potential for joint projects

a) In which sectors can you offer renewable energy use development in your territory for the purpose of joint projects?

b) Has the technology to be developed been specified? How much installed capacity/electricity or heat produced per year?

c) How will sites for joint projects be identified? (For example, can local and regional authorities or promoters recommend sites? Or can any project participate regardless of its location?)

d) Are you aware of the potential for joint projects in other Member States or in third countries? (In which sector? How much capacity? What is the planned support? For which technologies?)

e) Do you have any preference to support certain technologies? If so, which?

4.7.4. Expected demand for energy from renewable sources to be met by means other than domestic generation

See Table 9.

Table 9: Estimated excess and/or deficit generation of renewable energy compared to the indicative trajectory which could be transferred to/from other Member States in Denmark (ktoe)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Estimated excess in forecast document	-	613	809	769	784	473	657	333	366	-	0
Estimated excess in National Renewable Energy Action Plan	-	694	834	1.123	1.106	833	928	552	619	-	63
Estimated deficit in forecast document	0	0	0	0	0	0	0	0	0	-	337
Estimated deficit in National Renewable Energy Action Plan	-	0	0	0	0	0	0	0	0	-	0

Table 9: Estimated excess and/or deficit generation of renewable energy compared to the indicative trajectory which could be transferred to/from other Member States in Denmark (PJ)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Estimated excess in forecast document	-	26	34	32	33	20	28	14	15	-	0
Estimated excess in National Renewable Energy Action Plan	-	29	35	47	46	35	39	23	26	-	3
Estimated deficit in forecast document	-	0	0	0	0	0	0	0	0	-	14
Estimated deficit in National Renewable Energy Action Plan	-	0	0	0	0	0	0	0	0	-	0

5. ASSESSMENTS

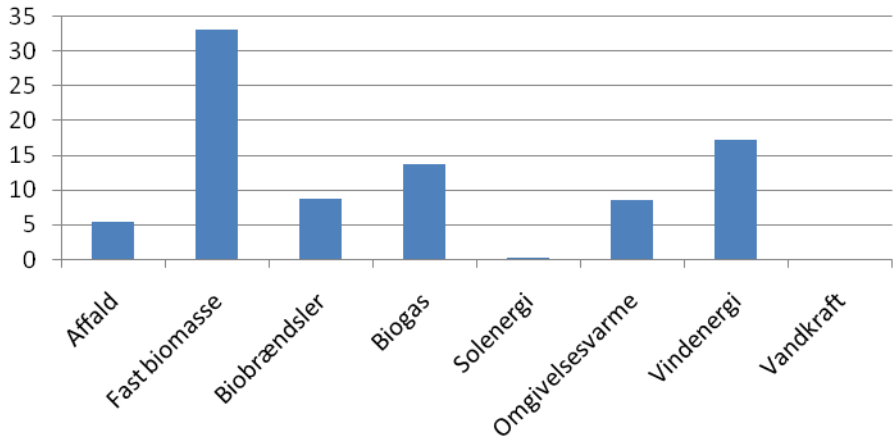
5.1. Total contribution expected from energy efficiency and energy saving measures to meet the binding 2020 targets and the indicative interim trajectory for shares of energy from renewable resources in electricity, heating and cooling and transport

As a general comment to the tables in the Section, it must be emphasised that the separation into technologies, in accordance with the guidelines in the Commission template the action plan are, for the purposes of this calculation, estimated values. Fig. 4, which shows the expected growth in consumption of renewable energy in energy sources, must therefore be understood as estimated development.

Development in RE consumption (gross)

Fig. 4 below, shows how much the individual energy sources are expected to contribute to the general targets during the period from 2008 to 2020 (measured in growth in gross energy consumption). The greatest contribution comes from the increased use of wood in the central co-generation plants, as well as the established and confirmed offshore wind farms. Expansion with biogas as a result of the Energy Agreement and Green Growth, the integration of biofuels into the means of propulsion for the transport sector, ambient heat using individual heat pumps and the burning of biodegradable waste, are all expected to make considerable contributions to the expansion of renewable energy during this period.

Fig. 4. Expected growth in gross energy consumption of the individual RE sources 2008-2020 (PJ)



Key for the above graphic
(key text, bottom of graph, left to right)
Waste
Solid biomass
Biofuels
Biogas
Solar energy
Ambient heat
Wind power
Water power

Development in RE consumption (net)

Tables 10-12 show the calculated development of renewable energy consumption in the electricity, heating and transport sectors measured in growth in RE in the gross final energy consumption

The renewable energy in the electricity sector is almost exclusively from wind power (estimated at 70.3 % of the total consumption of renewable energy in 2010) and biomass, i.e. straw, wood, biodegradable waste and biogas (estimated at 30.3 % in 2010). Consumption of renewable energy in the electricity sector is estimated to increase by 65 %, from 12.4 TWh (Terawatt hours) in 2010 to 20.6 TWh in 2020.

Renewable energy in the heating sector is primarily from biomass, i.e. straw, wood, bio-oil and biodegradable waste (estimated at 90.5 % in 2010). The contribution of renewable energy in the district heating sector in 2010 is estimated at 40.4 % of the total consumption of renewable energy for heating. Consumption of renewable energy in the heating sector is estimated to increase from 103 PJ in 2010 to 127 PJ in 2020, in other words by 20 %.

The consumption of renewable energy in the transport sector is calculated as being 1.7 PJ in 2010, rising to 10.8 PJ in 2012 and 12.2 in 2020. Biofuels are thought to constitute the largest part of this, with 1.3 PJ in 2010, 10.2 in 2012 and 10.9 in 2020. Consumption of renewable energy by electric trains and vehicles make up the rest with 0.5 PJ in 2010 and 2012 (only electric trains) and 1.2 in 2020 (electric vehicles and trains). The consumption of renewable energy in the transport sector is thus estimated to increase from 1.7 PJ in 2010, to 12.2 PJ in 2020, which is more than seven times higher.

A significant expansion in both onshore and offshore wind power (frozen policy) is calculated into the Energy Agency's basis projection. To illustrate that a further expansion in both categories is planned and without knowing what the actual distribution will be, growth over and above the projection remains, for the purposes of this calculation, evenly distributed between offshore and onshore turbines.

Tables 10 a and b show the contribution from each electricity generating RE technology expressed in gross electricity generation and installed electricity capacity. The calculation for installed electricity capacity in the "solid biomass" category (straw, wood and waste) up to 2020 includes all electricity and co-generation installations that use biomass. The capacity will, however, not necessarily be used to burn biomass because the current utilisation will also be dependent on the price development of coal, biomass and CO_2 quotas.

Table 10.a: Estimation of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Denmark to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity 2010-2014

	2005		*2010*		*2011*		*2012*		*2013*		*2014*	
	MW	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*
Hydro:	10	23	10	31	10	31	10	31	10	31	10	31
<1MW	0	0	0	0	0	0	0	0	0	0	0	0
1MW–10MW	10	23	10	31	10	31	10	31	10	31	10	31
>10MW	0	0	0	0	0	0	0	0	0	0	0	0
Of which pumping	0	0	0	0	0	0	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0
Solar:	3	2	3	2	3	2	3	2	3	2	4	3
photovoltaic	3	2	3	2	3	2	3	2	3	2	4	3
Concentrated solar power	0	0	0	0	0	0	0	0	0	0	0	0
Tide, wave, ocean	0	0	0	0	0	0	0	0	0	0	0	0
Wind:	3.129	6.614	3.584	8.606	3.779	9.335	3.841	9.694	4.222	11.321	4.214	11.329
onshore	2.706	5.158	2.923	6.121	3.023	6.451	2.985	6.400	2.966	6.387	2.958	6.395
offshore	423	1.456	661	2.485	756	2.884	856	3.294	1.256	4.934	1.256	4.934
Biomass:	777	3.243	1.017	3.772	935	4.132	947	4.211	1.783	5.773	1.800	5.714
solid	740	2.960	991	3.578	879	3.903	884	3.926	1.707	5.390	1.707	5.196
biogas	37	283	26	194	30	229	38	284	50	382	67	518
bioliquids[45]	0	0	0	0	26	0	26	1	26	1	26	1
Total	3.919	9.881	4.614	12.412	4.727	13.500	4.801	13.938	6.017	17.127	6.028	17.078
Of which in CHP	777	3.243	1.017	3.772	909	4.132	921	4.210	1.757	5.772	1.774	5.714

45 This only takes into account those complying with the sustainability criteria (cf. Article 5(1) of Directive 2009/28/EC last subparagraph)

Table 10.b: Estimation of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Denmark to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity 2015-2020

	2015		*2016*		*2017*		*2018*		*2019*		*2020*	
	MW	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*	*MW*	*GWh*
Hydro:	10	31	10	31	10	31	10	31	10	31	10	31
<1MW	0	0	0	0	0	0	0	0	0	0	0	0
1MW–10MW	10	31	10	31	10	31	10	31	10	31	10	31
>10MW	0	0	0	0	0	0	0	0	0	0	0	0
Of which pumping	0	0	0	0	0	0	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0
Solar:	4	3	4	3	4	3	4	3	6	4	6	4
photovoltaic	4	3	4	3	4	3	4	3	6	4	6	4
Concentrated solar power	0	0	0	0	0	0	0	0	0	0	0	0
Tide, wave ocean	0	0	0	0	0	0	0	0	0	0	0	0
Wind:	4.180	11.242	4.316	11.667	4.313	11.837	4.213	11.832	4.109	11.787	3.960	11.713
onshore	2.929	6.322	3.040	6.660	3.011	6.728	2.886	6.617	2.756	6.471	2.621	6.391
offshore	1.251	4.920	1.277	5.007	1.302	5.109	1.328	5.215	1.353	5.316	1.339	5.322
Biomass:	1.837	6.035	2.177	6.278	2.231	6.763	2.342	7.348	2.706	8.412	2.779	8.846
solid	1.717	5.312	2.017	5.266	2.025	5.432	2.086	5.659	2.393	6.328	2.404	6.345
biogas	95	721	134	1.010	180	1.326	231	1.683	287	2.076	349	2.493
bioliquids	26	1	26	3	26	4	26	6	26	8	26	8
Total	6.031	17.312	6.508	17.979	6.558	18.634	6.570	19.214	6.831	20.235	6.754	20.595
Of which in CHP	1.811	6.033	2.151	6.275	2.205	6.759	2.316	7.342	2.680	8.404	2.753	8.838

Table 11: Estimation of total contribution (final energy consumption[46]) expected from each renewable energy technology in [Member State] to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in heating and cooling 2010-2020 (ktoe)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Geothermal (excluding low temperature geothermal heat in heat pump applications)	0	0	0	0	0	0	0	0	0	0	0	0
Solar	10	11	12	12	13	13	14	14	15	15	16	16
Biomass:	1.759	2.245	2.298	2.303	2.525	2.504	2.526	2.543	2.541	2.543	2.632	2.643
solid	*1.714*	*2.178*	*2.228*	*2.230*	*2.445*	*2.415*	*2.426*	*2.427*	*2.409*	*2.396*	*2.472*	*2.470*
biogas	*45*	*59*	*62*	*66*	*73*	*81*	*92*	*109*	*124*	*138*	*153*	*165*
bioliquid[47]	*0*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*	*8*
RE from heat pumps:	100	210	226	246	269	286	301	315	330	344	357	370
Of which aerothermal	*48*	*91*	*102*	*111*	*119*	*128*	*135*	*142*	*150*	*157*	*164*	*170*
of which geothermal	*52*	*119*	*123*	*135*	*150*	*159*	*166*	*173*	*180*	*187*	*193*	*199*
Of which hydrothermal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	1.869	2.466	2.535	2.561	2.807	2.803	2.841	2.873	2.886	2.902	3.004	3.028
of which DH[48]	*854*	*1.053*	*1.097*	*1.105*	*1.332*	*1.312*	*1.341*	*1.365*	*1.368*	*1.377*	*1.470*	*1.486*
Of which biomass in households[49]	*700*	*976*	*978*	*978*	*977*	*977*	*973*	*969*	*965*	*959*	*953*	*948*

46 Take into account only those complying with the sustainability criteria (cf.. Article 5(1) last subparagraph of Directive 2009/28/EC).

47 District heating and/or cooling from total renewable heating and cooling consumption (RES-DH).

48 From the total renewable heating and cooling consumption.

49 Direct use and district heat as defined in Article 5(4) of Directive 2009/28/EC.

Table 11: Estimation of total contribution (final energy consumption[50]) expected from each renewable energy technology in [Member State] to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in heating and cooling 2010-2020 (PJ)

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Geothermal (excluding low temperature geothermal heat in heat pump applications)	0	0	0	0	0	0	0	0	0	0	0	0
Solar	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Biomass:	74	94	96	96	106	105	106	106	106	106	110	111
solid	*72*	*91*	*93*	*93*	*102*	*101*	*102*	*102*	*101*	*100*	*103*	*103*
biogas	*2*	*2*	*3*	*3*	*3*	*3*	*4*	*5*	*5*	*6*	*6*	*7*
bioliquid[51]	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
RE from heat pumps:	4	*9*	*9*	10	11	12	13	13	14	14	15	15
Of which aerothermal	*2*	*4*	*4*	*5*	*5*	*5*	*6*	*6*	*6*	*7*	*7*	*7*
Of which geothermal	*2*	*5*	*5*	*6*	*6*	*7*	*7*	*7*	*8*	*8*	*8*	*8*
Of which hydrothermal	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	78	103	106	107	118	117	119	120	121	121	126	127
Of which DH[52]	*36*	*44*	*46*	*46*	*56*	*55*	*56*	*57*	*57*	*58*	*62*	*62*
of which biomass in households[53]	29	41	41	41	41	41	41	41	40	40	40	40

50 Take into account only those complying with the sustainability criteria (cf.. Article 5(1) last subparagraph of Directive 2009/28/EC).

51 District heating and/or cooling from total renewable heating and cooling consumption (RES-DH).

52 From the total renewable heating and cooling consumption.

53 Direct use and district heat as defined in Article 5(4) of Directive 2009/28/EC

Table 12: Estimation of total contribution expected from each renewable energy technology in Denmark to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in the transport sector 2010-2020 (ktoe)[54]

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bioethanol/bio-ETBE	0	13	57	98	96	95	95	95	95	95	95	94
Of which biofuels[55], cf. Article 21(2)	*0*	*13*	*57*	*98*	*96*	*95*	*95*	*95*	*95*	*95*	*95*	*94*
Of which imported[56]	*0*	*13*	*57*	*98*	*96*	*95*	*95*	*95*	*95*	*95*	*95*	*94*
Biodiesel	0	18	83	147	148	149	152	155	158	161	164	167
Of which biofuels[57], cf. Article 21(2)	*0*	*18*	*83*	*147*	*148*	*149*	*152*	*155*	*158*	*161*	*164*	*167*
Of which imported[58]	*0*	*18*	*83*	*147*	*148*	*149*	*152*	*155*	*158*	*161*	*164*	*167*
Hydrogen from renewables	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity	9	11	12	13	16	16	19	20	21	23	27	29
Of which road transport	*0*	*0*	*0*	*0*	*1*	*2*	*4*	*4*	*5*	*7*	*9*	*12*
Of which non-road transport	*9*	*11*	*12*	*12*	*15*	*15*	*15*	*15*	*16*	*16*	*17*	*17*
Others (as biogas, vegetable oils, etc.) - please specify	0	0	0	0	0	0	0	0	0	0	0	0
Of which biofuels[59], cf. Article 21(2)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	9	42	151	257	259	260	266	270	275	279	286	291

54 Only those biofuels and liquid biofuels that fulfil the sustainability criteria cf.. Article 5(1) last paragraph of Directive 2009/28/EC.

55 Biofuels that are included in Article 21(2) of Directive 2009/28/EC.

56 From the whole amount of bioethanol/bio-ETBE.

57 Biofuels corresponding to the definition in Article 21(2) of Directive 2009/28/EC.

58 From the whole amount of biodiesel.

59 Biofuels corresponding to the definition in Article 21(2) of Directive 2009/28/EC.

Table 12: Estimation of total contribution expected from each renewable energy technology in Denmark to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in the transport sector 2010-2020 (PJ)[60]

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Bioethanol/bio-ETBE	0.0	0.5	2.4	4.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.9
Of which, biofuels[61], Article 21(2)	*0.0*	*0.5*	*2.4*	*4.1*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*3.9*
Of which imported[62]	*0.0*	*0.5*	*2.4*	*4.1*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*4.0*	*3.9*
Biodiesel	0.0	0.8	3.5	6.1	6.2	6.2	6.4	6.5	6.6	6.7	6.9	7.0
Of which biofuels[63], Article 21(2)	*0.0*	*0.8*	*3.5*	*6.1*	*6.2*	*6.2*	*6.4*	*6.5*	*6.6*	*6.7*	*6.9*	*7.0*
Of which imported[64]	*0.0*	*0.8*	*3.5*	*6.1*	*6.2*	*6.2*	*6.4*	*6.5*	*6.6*	*6.7*	*6.9*	*7.0*
Hydrogen from renewable sources	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity from renewable sources	0.4	0.5	0.5	0.5	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.2
Of which road transport	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*	*0.4*	*0.5*
Of which, other forms or transport	*0.4*	*0.5*	*0.5*	*0.5*	*0.6*	*0.6*	*0.6*	*0.6*	*0.7*	*0.7*	*0.7*	*0.7*
Others (as biogas, vegetable oil etc.) – please specify	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Of which, biofuels[65] Article 21(2)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Total	0.4	1.7	6.3	10.8	10.9	10.9	11.1	11.3	11.5	11.7	12.0	12.2

60 Only those biofuels and liquid biofuels that fulfil the sustainability criteria cf. Article 5(1) last paragraph of Directive 2009/28/EC.

61 Biofuels that are included in Article 21(2) of Directive 2009/28/EC.

62 From the whole amount of bioethanol/bio-ETBE.

63 Biofuels corresponding to the definition in Article 21(2) of Directive 2009/28/EC.

64 From the whole amount of biodiesel.

65 Biofuels corresponding to the definition in Article 21(2) of Directive 2009/28/EC.

5.2. Total contribution expected from energy efficiency and energy saving measures to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in electricity, heating and cooling and transport.

The expected development in the final energy consumption can be found in Table 1 and described in Section 2.

5.3. Assessment of the impacts (Optional)

Table 13: Estimated costs and benefits of the renewable energy policy support measures

Measure	Expected renewable energy use (ktoe)	Expected cost (in EUR) - indicate time frame	Expected GHG reduction by gas (t/year)	Expected job creations

5.4. Preparation of the National Renewable Energy Action Plan and the follow-up of its implementation

a) How were regional and/or local authorities and/or cities involved in the preparation of this Action Plan? Were other stakeholders involved?

On 26 April 2010 the Danish Energy Authority held a meeting on the Danish Action Plan for Renewable Energy with the relevant stakeholders from trade and other interested organisations.

Local Government Denmark (LGC) participated in the meeting and subsequently, the Energy Agency has held another meeting with LGC in regard to the section in the Action plan which relates to local circumstances.

During the preparation of the Action Plan there has been ongoing contact with relevant actors, including trade and other interested organisations.

The Action Plan was prepared with the cooperation of the relevant Ministries, Agencies and other public authorities.

b) Are there plans to develop regional/local renewable energy strategies? If so, could you please explain? In case relevant competences are delegated to regional/local levels, what mechanism will ensure national target compliance?

There already are and will be many more local initiatives for the expansion of renewable energy and the reduction of greenhouse gases, e.g. Eco Cities, Climate Communities and Energy Islands, which are further described in Section 4.2.4.

There are, however, no specifically developed regional or local strategies for renewable energy in connection with the preparation of this Action Plan.

c) Please explain the public consultation carried out for the preparation of this Action Plan.

In connection with the meeting on the Action Plan at the Energy Agency on 26 April 2006, meeting participants were give the opportunity to submit written comments on the basis for the Action Plan.

d) Please indicate your national contact point/the national authority or body responsible for the follow-up of the Renewable Energy Action Plan?

The Climate and Energy Ministry and the Danish Energy Agency

e) Do you have a monitoring system, including indicators for individual measures and instruments, to follow-up the implementation of the Renewable Energy Action Plan? If so, could you please give more details on it?

As mentioned in Sections 2 and 3 of the Action Plan, development in the renewable energy share is uncertain and dependent on changes in the basis for calculations. It will therefore be important to follow the development up to 2020 closely. This is also a part of the RE Directive which includes the preparation of progress reports sent to the Commission every second year.

When the next progress report is sent in before the end of December 2011, it may be necessary to assess the need for possible new initiatives for reaching the targets set in the RE Directive.

As mentioned in Section 1, the partners behind the energy-political agreement will meet before the end of 2010 to discuss supplementary initiatives for the period after 2011. It is expected that by that time, updated guidelines will be available for how the expansion with renewable energy should be prioritised and organised thereafter. The first progress report is expected to confirm the current Action Plan for a number of different areas.

If the actual expansion with renewable energy within a particular area is less than calculated, this can be supported in two ways:

- New energy-political initiatives to ensure that expansion plans that are not implemented in relation to the targets in the Action Plan may still be fulfilled.
- Expansion with renewable energy can be increased in other areas.

For many years, the annually published national energy statistics have been an effective tool for evaluating the development in consumption of various renewable energy sources. The Energy Agency works continuously to improve the quality of the data in the energy statistics.

The Energy Agency updates it basis projection annually. The latest updated projection is another central tool for evaluating the need for supplementary initiatives and will be an important basis for the preparation of future progress reports.

Annex. RE resources in Denmark[66]

Danish renewable energy sources are non-fossil energy sources that exist either in the soil, sea or air around Denmark. It should be noted that geothermal energy is included even though it is actually not renewable and will ultimately become exhausted. However, its potential use is so modest that this will take many hundreds of years and it can thus be considered renewable.

Denmark has a land territory of around 43,000 km^2 and a sea area that includes territorial waters and the exclusive economic zone / fishing grounds of around 106,000 km^2. Basically, apart from geothermal energy, renewable energy sources are based on the incident solar radiation of the earth's surface.

The annual incident solar radiation on the surface of Denmark is illustrated in Fig. 1.1 and constitutes an average of around 1000 kWh, corresponding to 3.6 GJ/m^2. If the incident solar radiation were to be utilised properly, Denmark's current energy consumption of around 850 PJ could be supplied by the incident solar radiation of an area of about 230 km^2, corresponding to around 0.5 % of its land area, or less than the size of Langeland (a Danish island)

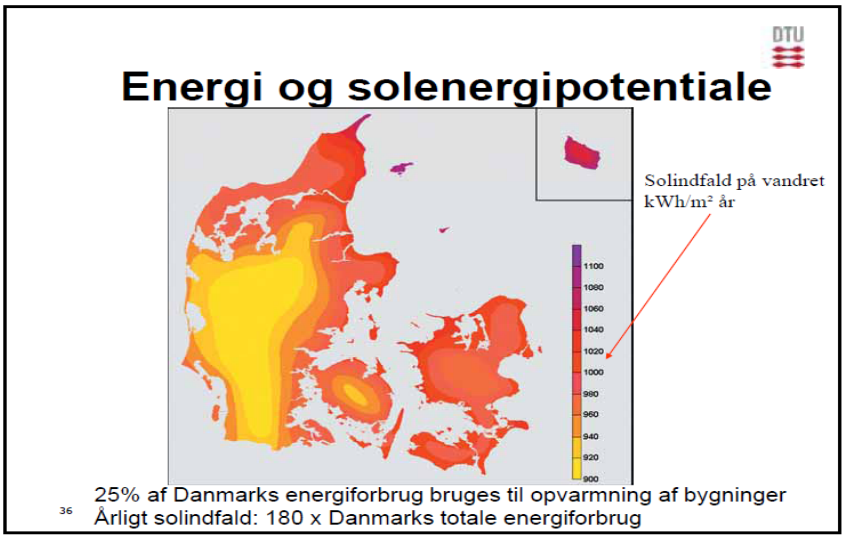


Fig. 1.1 Incident solar radiation

Key for the above graphic

Title text above map: Energy and solar energy potential Small text right of map: Incident solar radiation – horizontal axis kWh/m2 year

Text under map: 25 % of Danish energy consumption is used to heat buildings Annual incident solar radiation: 180 x total Danish energy consumption

66 The Annex is an extract of Annex 7 of Energy supply security in Denmark, the supplementary report from 2010.

Part of the incident solar radiation can be utilised for geothermal solar heating, for electricity generation and biomass generation. In addition, incident solar radiation is also the basis for the use of wind power.

Fig. 1.2 shows an overview of the wind resources as middle wind speeds over land, at a height of 100 m, over the course of a year. Offshore, this is reckoned to be a little higher at the coast. The figure shows that there is a great difference in coastal and inland areas. Thus, in the best sites along the west coast of Jutland, a generation corresponding to around 4000 full load hours at middle wind speeds of up to 9 m/s (red areas) can be expected, while inland, with a middle wind speed of around 7 m/s (dark blue areas), around 2800 full load hours can be expected from the same type of wind turbine. To ensure a high level of generation inland, it is therefore vital that wind turbines are situated where there is a lot of wind.

Table 1.1 Energy generation per km^2

	TJ/km^2	Conditions
Incident solar radiation	3600	
Solar heat	1440	Energy efficiency[1] 40pct.
Electric solar cells	360	Energy efficiency[1] 10pct.
Wind turbines	70	8 MW per km^2 and 2400 full load hours
Biomass	15	1.000 tons per km^2, calorific value 15 GJ/t
Bioethanol	5.5	0.25 l per kg biomass, calorific value 22 MJ/l

Note 1: In practice, solar panels and cells must be angled horizontally to catch a greater incident solar radiation and there must be a specific distance between them, otherwise this will result in lower energy efficiency.

In general, an energy generation per km^2 as shown in Table 1.1 can be achieved irrespective of the energy consumption involved in generation, e.g. of biomass (wheat) and bioethanol.

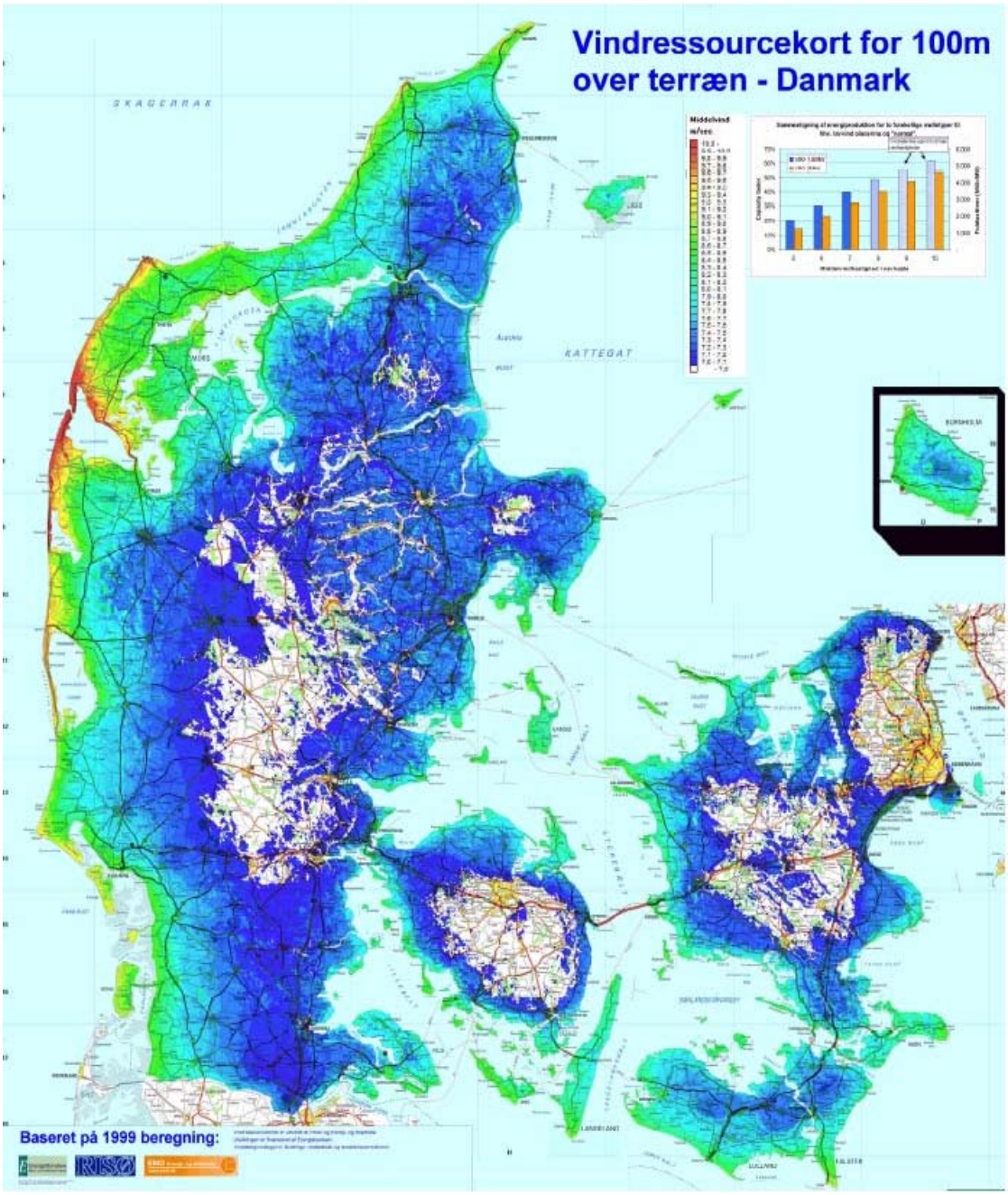


Fig. 1.2 Wind resource map

Key for the above graphic

Title text, right of map: Wind resource map. 100 Metres above land – Denmark
Bottom left corner text: Based on 1999 figures

If Danish gross energy consumption of 850 PJ/year is to be supplied by these energy forms, as a percentage of the total land area (43,000 km^2) this would require:

Table 1.2:

	pct.
Incident solar radiation	0.5
Solar heat	1.4
Solar electricity	5.5
Wind turbines	28
Biomass	132
Bioethanol	360

The "energy efficiency", i.e. the calorific value in relation to the incident solar radiation with the generation of biomass and bio ethanol is respectively around 0.4 % and 0.15 %. This is very low in relation to more direct use such as solar cells, which have around 10 %.

If the current electricity generation of around 130 PJ is to be provided by offshore wind power, this would usually require an area of around 1300 km^2, corresponding to 35 x 35 km square, or around 1.2 % of Danish sea area. As a comparison, around 10 % of Danish waters is a designated protected area.

Biomass from the sea

A number of types of algae occur naturally in Danish waters. It is quite possible to utilise this biomass production for energy generation. For example, experiments with sea lettuce in tanks have shown that with the addition of nutrients etc., it is possible to achieve a dry material yield per area unit that can be 3-4 times higher than traditional land biomass. It would seem that algae can be used as raw material, not only for the generation of ethanol or biogas, but also for fodder and other pharmaceutical products.

However, it is currently impossible to present an assessment of the combined potential for the use of sea algae biomass.

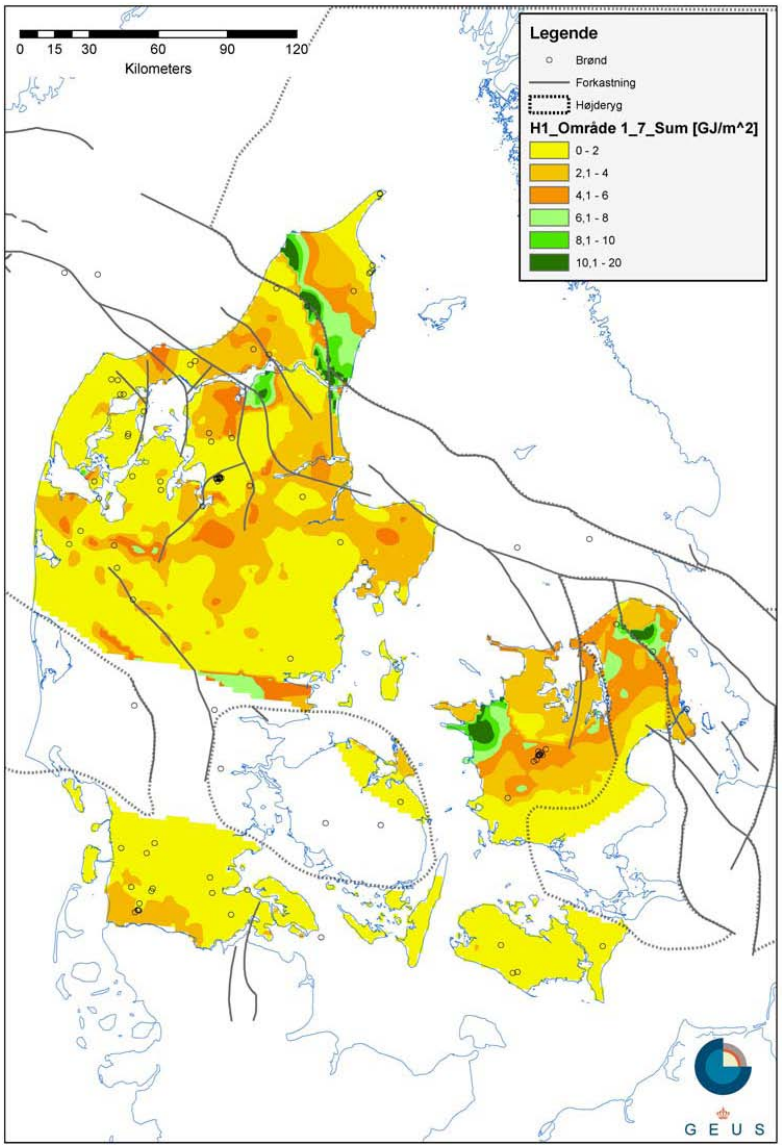
Wave power

Wave power can be converted to electricity using a wave power installation. Research is being conducted into many different types of wave power installation although as yet none of them have a commercial platform. The potential of wave power for large-scale energy generation in Denmark comes primarily from the North Sea, where an installation on a stretch of 20 km coastline has been estimated to be able to produce around 4000 kWh of power.

Geothermal energy

Inside the core of the earth, radioactive processes still occur that are similar to those in the sun. These processes produce a constant stream of heat from inside the earth which has a temperature of around 5000 °C. This heat streams up to the earth's crust where it can be utilised. There are huge amounts of geothermal energy in the underground everywhere on earth. However, in many places this is difficult to access, so the utilisation of geothermal energy can primarily take place in sub-surface areas with rock types such as sandstone or chalk. These types of rock have a suitable porosity as well as good water conducting ability (permeability), so sub-surface water can flow freely. These sub-surface areas are called geothermic reservoirs.

Fig. 1.3 The map shows the estimated resource in GJ/m^2 [67]



[67] Geothermics - heat from inside the earth. Danish Energy Agency, October 2009

In Denmark, geothermal energy is used for the generation of heat that can be used in district heating systems. The temperature and thus the energy content in the Danish underground increases with depth; around 25-30 °C per km. Between 800-3000 metres down into the underground, there are many places with aqueous sandstone layers with such water transmission abilities that it makes geothermal heat generation a possibility.

The total heat resource in potential sandstone reservoirs are seen as the available geothermic resource which can be utilised economically at a given point in the future. The combined resource can be calculated in GJ/m^2. The resource is calculated by its porosity, temperature, and net sand density as well as surface area. The resource is actually proportional to the potential cooling and the actual reservoir volume. It is assumed that the cooled water will be returned to the same reservoir; partly to keep the reservoir closed and partly to maintain pressure.

Fig. 1.3 shows the calculated geothermal resources. The map is divided into areas with a total heat resource from around 2 GJ/m^2 (yellow areas) to around 20 GJ/m^2 (dark green areas).

Geothermal energy can be used where large amounts of hot water are needed. In the most suitable geothermal reservoirs in the Danish underground the temperature is between 30 °C and 90 °C. However, the utilisation of geothermal energy often requires the use of heat pumps, as in many cases the temperature of district heating systems will require temperatures above this level.

In a local area of 10 km^2, and a combined resource of 15 GJ/m^2 (the dark green areas in Fig. 8), the combined geothermal resource for the area is calculated as follows: 10 km^2 x 15 GJ/m^2 = 150 PJ.

If it is assumed that the district heating of a town such as Kalundborg distributes around 2000 TJ/year to the local area and around half of this is geothermal energy, the length of time the resource will be available to cover the heating requirements of the town has been estimated to be 150 years.

In the geothermal report[68], 32 areas indicated with a total annual district heat consumption of around 75 PJ, have been indicated as being candidates for geothermal heat. On the assumption of around 50 % geothermal heat for 100 years and an average resource of around 4 GJ/m^2, it would require an area of around 1000 km^2 or 2 % of Danish land area.

1.1 Limitations of RE resources

Area

There are a number of limitations to be able to use land areas for the generation of renewable energy. Current utilisation can be estimated as follows:

[68] Geothermics - heat from inside the earth. Danish Energy Agency, October 2009

Table 1.3 Area Distribution

Usage	**%**
Agriculture	64
Nature	10
Forest	12
Habitation	14

How large a part of the total land area it will be possible to use can not be calculated very precisely. Taking into consideration neighbours, natural areas, forests etc., it has been estimated[69] that there is 'room' for around 4000 MW of wind turbines on land. Some of the limitations are political and can therefore be tightened or relaxed over time.

Wood resources

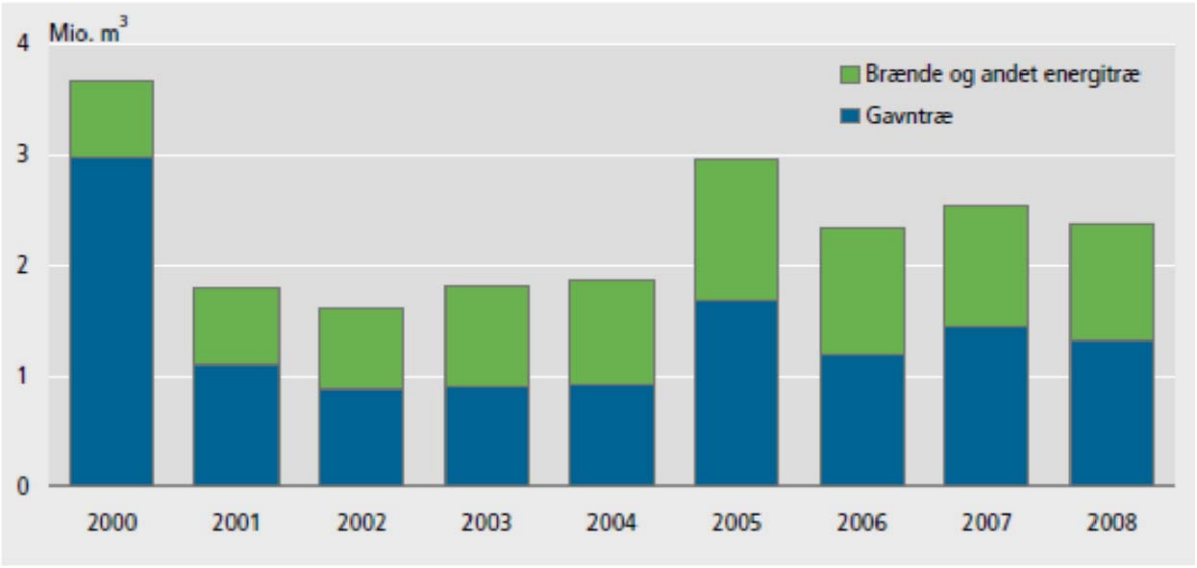
There are around 5000 km^2 of forested area in Denmark and the annual felling yield, as shown in Fig. 1.4, is something like 2.5 million m^3. Denmark can thus satisfy around 25 % of its own wood consumption[70].

In recent years, with both private and state planting, the forested area has been increased by around 2500 – 3000 ha annually. Denmark is still a relatively unforested country and in relation to the other Nordic countries, covers a small area. It has, however, great potential for valuable agricultural production.

69 Report from the government's planning committee for onshore wind turbines

70 The Danish National Forestry Programme. The Danish Forest and Nature Agency

Fig. 1.4 Felling is calculated in m^3 solid mass equivalent with dry content in coniferous timber[71].



Key for the above graphic

Overall title: The map shows the estimated resources in GJ/m

Kilometres

Key box, right top: Legende = Key
(small circle - brønd) = Well
(line – forkastning) = Fault
(shaded rectangle - højderyg) = Ridge
H1_area 1_7_Sum [GJ/m^2]
Note: decimal points in Danish are commas, e.g. 2,7. Replace with UK decimal points. e.g. 2.7.

[71] News from Statistics Denmark, No. 384.31. August 2009

Growth in the forests during this period is estimated at about 5 million m^3 annually[72], of which around half is registered as fellable. The energy content (calorific value) of this is estimated at 35-40 PJ or around 75 GJ per ha. Not all growth is for felling and not all of the felled wood mass is registered, but is left on the forest floor. Of this, an estimated 5 PJ is for private consumption in wood burning stoves etc[73].

Only about half of the felled wood is used directly for energy generation, while all of the timber which, following preparation is left as shavings, chippings and sawdust, can be sold as biofuel as of wood pellets, briquettes or other combustible products.

The overall assessment is that wood use for energy purposes from Danish forests is about 50 GJ/ha, or around 25 PJ/year. In addition, there is wood from private gardens, hedges etc, which has been estimated at around 10 PJ and 5 PJ wood residue, of which the total domestic generation for energy purposes is around 40 PJ.

Total RE potential

Table 1.4 shows one possible assessment of RE potential divided into electricity generating sources, heat generating sources and fuels, based on the known conditions of area use and on recognised technology.

The first column shows the domestic generation in 2008 which is equal to the actual annual consumption. The second column shows the possible generation with the establishment of wind turbines, solar panels and solar cells on roofs, more intensive use of by-products from agriculture etc. It should be noted that there are competing forms of supply, especially with regard to heating. It will, for example be unlikely to be able to use both geothermal and solar heat pumps for district heating to the given extent.

With the cultivation of energy crops, increased tree planting and the establishment of solar installations, areas can be utilised that would otherwise be used for activities such as food production.

In the Danish part of the North Sea, there is great potential for energy generation from wind turbines and wave power installations. The potential is stated without taking other interests into account. With this in mind,[74] for example, areas have been identified with space for around 4600 MW, assuming construction in low water and within a relatively short distance to land.

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72 The Danish National Forestry Programme. The Danish Forest and Nature Agency 2002

73 Anders Evald *Brændeforbrug i Danmark* (Firewood Generation in Denmark) Force Technology September 2006

74 Wind Turbine Erection in the Future – 2005. The Danish Energy Agency, April 2007

Table 1.4 (PJ)

	Generation 2008	Unused potential	Conditions for assessing potential
Electricity			
Onshore	20	16	4000 MW
wind	5	>1000	80,000 MW corresponding to 10,000 km^2 or about 10 % of the sea area
turbines	0	?	
Wave power Solar cells	0	8-100	10 m^2 per dwelling – 300 km^2 (1 % of land area)
Total electricity generation	*25*	*>1000*	
Heat			
Individual solar heating and heat pump installations	6	25	Half of dwellings with gas-oil and natural gas (2008)
District heating - solar heating and heat pump installations	1	60	Half of district heat generation
Geothermal energy	1	40	Around half of the potential
Total heat generation	*7*	*125*	
Biofuels			
Straw	15	40	Current area use
Wood	41	10	Current production and forested areas
Energy crops	4	65	10 % of land area corresponding to around 15 % of cultivated area
Biodiesel/bioethanol	5	20	Unused straw resources at 40 PJ with an efficiency of 50 %
Biogas	4	35	Current generation suitable for biogas
Biomass from the sea	0	?	
Total biofuels	*64*	*125*	
Waste	24	5	Estimated waste amount in 2020
Total energy generation	**126**	**>1300**	