REPAP 2020

Renewable Energy Policy Action Paving the Way towards 2020

BEE

Bundesverband Erneuerbare Energie e.V.

National Renewable Energy Industry Roadmap

Germany

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I. CURRENT SITUATION

- Brief explanation of the structure and function of the RES market
- Current overall share (based on latest Eurostat data) and progress since RES-E and Biofuels directive (source: Commission's progress report).
- Existing legislative framework - Summary of current support policies for E/H&C/ T & current obstacles

By the end of 2007, renewables accounted for 9.8%[1] of final energy consumption in Germany according to official statistics (8.9% according to Eurostat). This represents more than a threefold increase since 1997. In 2008, according to provisional AGEE-Stat figures (Working Group on Renewable Energy), the share had dropped to 9.5% because of the increase in final energy consumption.

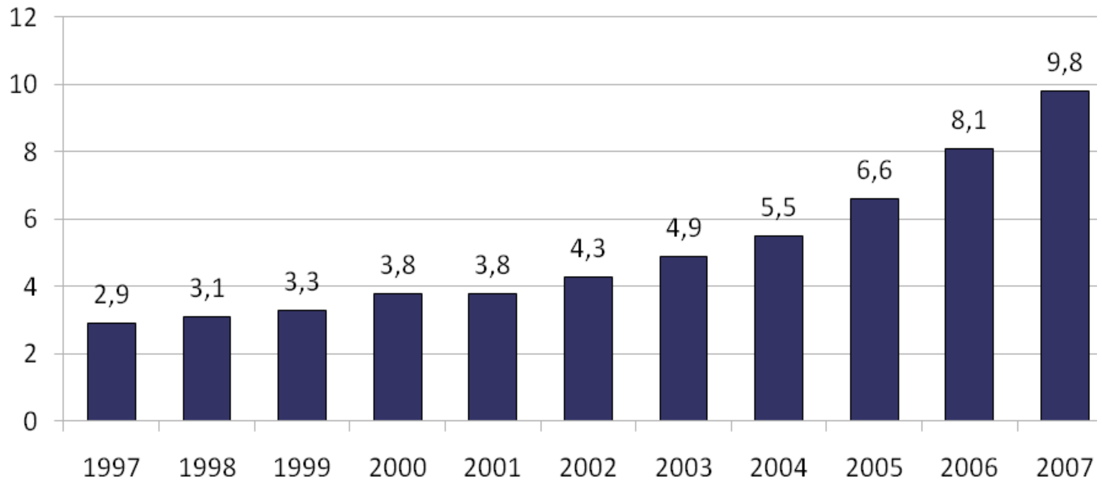

Figure 1: Total share of RES in final energy consumption %

This growth was generated predominantly by medium-sized companies benefiting from reliable and stable conditions created by the EEG (Renewable Energy Sources Act), the market incentive pro-

[1] The figures quoted here were calculated by AGEE-Stat/ the Federal Environment Ministry and are shared by BEE. According to the directive on the promotion of energy from renewable sources, in 2005 Germany was only achieving a share of 5.8% according to Eurostat data. More recent Eurostat data show the various values still remaining slightly below our figures, as depicted in the following table, but nevertheless show a figure of 6.3% for 2005, which is more than the 5.6% quoted in the directive.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total share of RES in final energy consumption %	2,8	3,0	3,2	3,7	3,8	4,3	4,7	5,4	6,3	7,4	8,9

As a general principle, it is important to note that the precise calculation of 'gross final energy consumption' within the meaning of the directive is very complex to achieve and, as both BEE and AGEE-Stat agree, the result tallies neither with previous Eurostat figures nor with the data used by AGEE-Stat. We are aware of the fact that adopting the definitions of the directive might result in – mostly slight – downward discrepancies from the figures we have used. Unless otherwise stated in this text, all of the statistics and forecasts it contains have been calculated by the methods generally employed by AGEE-Stat.

gramme and the tax exemption for biofuels, which granted them access to a market which had hitherto been largely dominated by oligopolies.

The electricity sector was responsible for the largest share in the growth of renewables, with the proportion of renewable energies rising from 4.4% in 1997 to 14.2% in 2007 despite an increase in overall consumption. This resulted from the introduction of highly-efficient support instruments: from 1991 to 2000 the Electricity Feed-In Act, and thereafter the Renewable Energy Sources Act (EEG). The proportion increased again to 15.1% by the end of 2008. This means that Germany has long since reached the indicative target of 12.5% for 2010 set by the EU electricity directive.

In the heating sector on the other hand, the share of renewables has only a little more than doubled, from 3.5% to 7.6%, despite the reduction in consumption. This was because the most important promotional instrument, the market incentive programme, was insufficiently effective particularly in respect of the building stock, because of the unreliable way in which it was organised over the course of several years. There does not appear to have been any significant increase in 2008.

No notable increase in the share of biofuels in the transport sector was apparent until 2005, when the tax exemption for pure biodiesel began to take effect, allowing the growing popularity of biodiesel in particular to increase the share of biofuels to 6.4% by 2007. This figure fell significantly in 2008 after the promotional instrument was changed from tax exemption to a blending quota. Nevertheless, these figures mean that the target of 5.75% by 2010 under the biofuels directive has been met.

I.1 Electricity sector

Following a slight decline in the preceding years, gross final energy consumption in the electricity sector rose continuously from 1997, from 546 TWh in that year to 613 TWh in 2007. The first signs of a notable increase in the generation of power from renewables also date from this time. The production of electricity from renewable energies rose from 24.5 TWh to 87.6 TWh between 1997 and 2007.

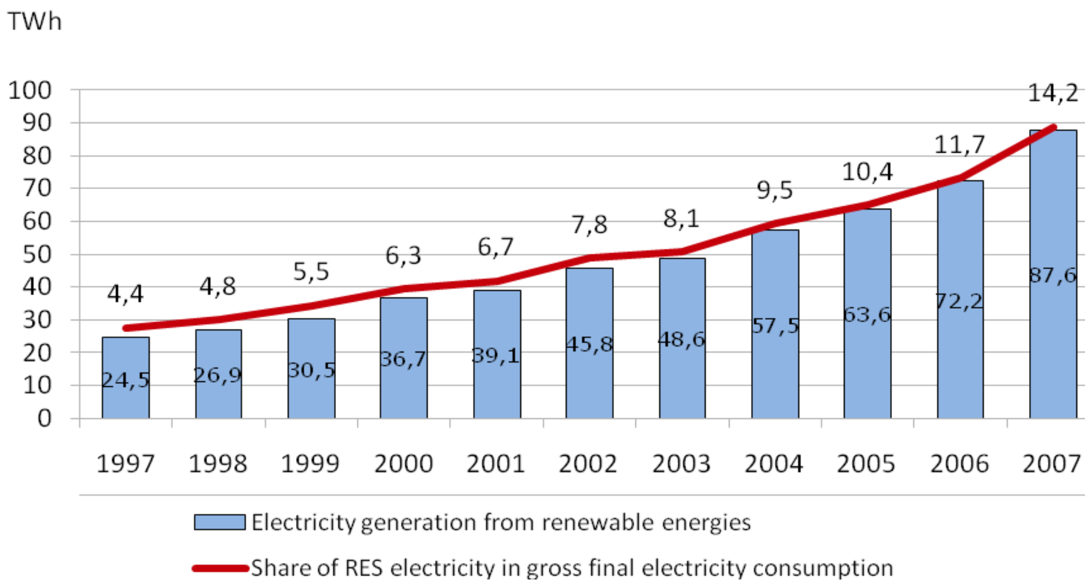

Figure 2: Electricity generation from RES

The EEG creates a stable legal and economic framework for sustainable growth of renewables in the electricity sector. It guarantees connection to the electricity grid for all those producing electricity from renewable energies, as well as allowing them to feed in and sell the electricity they generate for a period of 20 years at minimum rates specified in the Act. These tariffs vary depending on the technology used and the size of installation. In the wind sector, location is also taken into account. A supplementary bonus is paid in the bioenergy sector for the use of particular raw materials and technologies. The Act reduces the level of remuneration for new installations every year, depending on the technology used. This degression is generally 1%. For photovoltaics it is 10% since the most recent amendment and an additional percentage point if a corridor of growth is exceeded[2].

The EEG provides a reliable and stable legal framework for the different sources and technologies. Whilst hydroelectric power has consistently met more than 3% of German gross total energy needs in the past few years, wind energy in particular (to date exclusively onshore) has seen dramatic increases since the EEG came into force in 2000. It already accounts for nearly 7% of energy consumption today, with more than 25 GW installed capacity. The EEG has been responsible for a rise to almost 4.5% of the share of electricity generated by the various technologies for bioenergy utilisation. Photovoltaics have also seen considerable expansion to far more than 5 GW installed capacity, especially since the amendment of the EEG in 2004, when the terms of the Act were revised.

Due to the EEG, there is a stable and reliable legal framework for the different sources and technologies. Whereas Hydropower has constantly covered about 3% of Germany's gross electricity consumption, since 2000, there have been considerable increases particularly in wind power (as of today only onshore). With more than 25 GW of installed capacity, windpower is already contributing nearly 7% to the electricity consumption. Due to the EEG, the share of the diverse technologies for using bioenergy has risen to nearly 4.5%. Photovoltaics showed considerable growth with more than 5 GW of installed capacity, particularly since the framework was optimized in the amendment of 2004.

I.2 Heating

Gross final energy consumption was in more or less continuous decline from 1990 to2000, falling from 1,503 TWh to 1,289 TWh. According to the latest figures from the Federal Office of Statistics, heat consumption has since declined (temperature adjusted) by a further 5%. The heat production from renewable sources rose from 38 TWh in 1990 to 102 TWh in 2007.

Up until 2008, the most important promotional instrument was the market incentive programme for renewable energies, which was intended to encourage the use of various technologies to generate hot water and space heating from renewable energies through the granting of subsidies and reduced-interest loans. Between 2000 and 2007, roughly Euro 1 billion in subsidies and loans generated some Euro 8.2 billion in investment. In 2008, the programme was topped up to Euro 350 million per annum. Since the beginning of 2009, the Renewable Energies Heating Act has specified a minimum level of renewable energies required in new buildings. In addition, up to Euro 500 million per annum is now available to fund measures exceeding the legal requirements[3]. However, the financial framework defined by the Act has not yet been completely realised. Thus the programme received

[2] Details of the tariffs and degression rates can be downloaded from the BMU homepage at: http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eeg_verguetungsregelungen.pdf

[3] Details of the funding can be downloaded from the BMJ homepage at http://www.erneuerbare-energien.de/inhalt/41238/41238/.

Euro 468 million in funding in 2009, and the draft budget for the coming year also sets aside Euro 468 million.

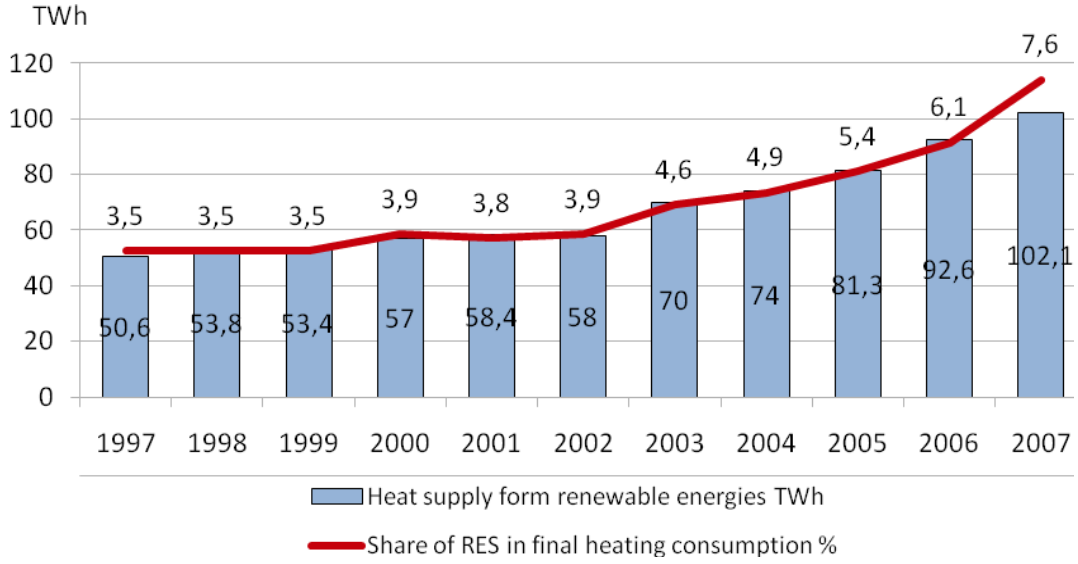

Figure 3: Heat supply from renewable energies

The market incentive programme thus continues to be dependent on annual budgetary approval, which restricts its effectiveness as a durable stable instrument. Nonetheless, in past years it has been responsible for growth as described above, although not on the same level as that seen in the electricity sector. More than 90% of the renewable energies used in the heating sector are various forms of bioenergy. Nevertheless, solar thermal installations as well as heat pumps and grid-connected geothermal installations have undergone considerable expansion. The energy generated by solar thermal installations has increased nearly fivefold since 1997, from 790 GWh to 3,663 GWh in 2007. Heat pumps generated nearly four times as much heat in 2007 (3,720 GWh, including aerothermal heat production) as in 1999. Grid-connected geothermal energy contributed nearly twice as much to heat provision in 2007 (202 GWh) as in 1997.

I.3 Transport

After rising to 67,103 ktoe[4] in 1999, final energy consumption in the transport sector began a slow decline in 2000 (66,188 ktoe), and had fallen to 62,385 ktoe by 2007. The share of biofuels first reached a statistically relevant level in 1992, when it reached 4 ktoe. By 2004, it was accounting for 1.5% of fuel consumption, i.e. 975 ktoe. However, these figures only began to improve dramatically in 2004, when tax exemption for pure biodiesel was introduced, and by 2007 they had reached 3,994 ktoe or 7.3 % (6.4% if one includes air transport[5]). However, a change in conditions has since led to a downslide.

[4] ktoe = kilotonnes of oil equivalent
[5] As specified in the directive, air transport is taken into account only in the denominator and not in the numerator.

Tax exemption for pure biogenic fuels was introduced in 2004, but this ruling was gradually reversed from 2006 and replaced by a binding utilisation and blending quota, which was reduced again in 2009.

Biodiesel is the most widely used biofuel in Germany by a considerable margin (more than 75% in 2008), although bioethanol and vegetable oils did make visible progress, particularly in the period from 2005 to 2007. The use of biodiesel and vegetable oil declined sharply in 2008, and is now below the level of 2006 once again. Only bioethanol was able to exhibit a slight improvement in 2008.

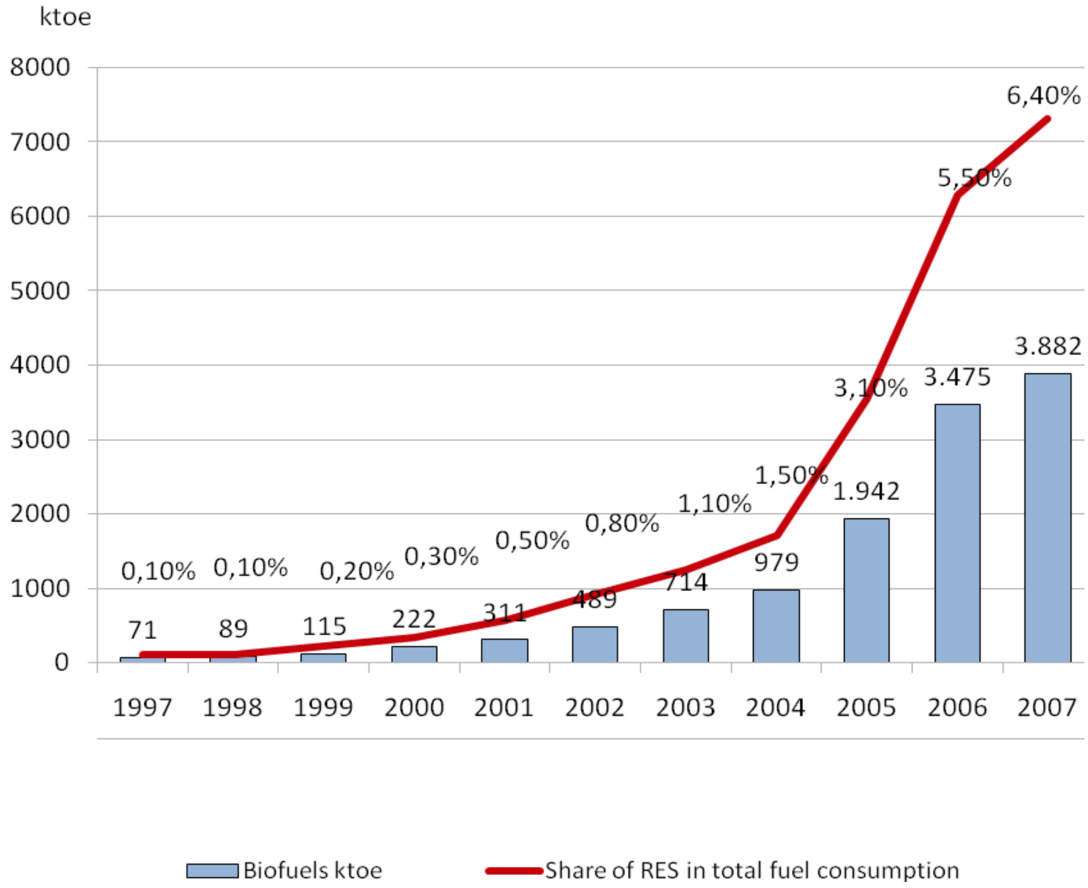

Figure 4: Biofuel consumption

II. TARGETS AND TRAJECTORIES

II.1 OVERALL RENEWABLE ENERGY TARGETS AND TRAJECTORIES

2005	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020
5,8%	13,78%	16,26%	19,14%	23,19%	28,77%

Table 1: Overall share of renewable energy in final energy consumption in 2005, indicative trajectory & binding 2020 target (in % of final energy consumption)

In the past, we have witnessed time and again how forecasts and scenarios have lacked ambition. Consequently, this roadmap depicts a realistic and challenging trajectory for growth in renewable energies, assuming that suitable framework conditions continue to exist and/or are developed further. The following tables show how growth is apportioned between the three sectors. We have described elsewhere[6] the areas in which the necessary conditions are basically in place and no more than targeted adjustments are required (the electricity sector), where some new measures must be introduced (the heating sector, particularly for the building stock), and where a political change of course is required and suitable instruments are needed if wide-ranging expansion is to be set in motion (transport sector).

II.2 SECTORAL TARGETS AND TRAJECTORIES

Ktoe/%	2005	Average 2011 - 2012	Average 2013 - 2014	Average 2015 - 2016	Average 2017 - 2018	2020 Targets
Expected Gross Final energy consumption[7]	205.520,9	203.623,7	200.025,4	196.490,6	193.018,3	185.426,5
Gross Final Consumption of electricity from RES[8]	5.514,3	11.624,9	14.117,9	16.800,3	19.771,5	23.941,9
Share of RES electricity in gross final electricity consumption[9]	10%	21,95%	26,86%	32,22%	38,23%	46,84%
Gross final energy consumption from RES in heating and cooling[10]	7.422,1	11.149,1	12.453,4	14.061,9	17.151,0	19.038,3

6 For the recent 2020 BEE total scenario, visit: http://www.bee-ev.de/3:329/Meldungen/2009/BEE-legt-energiepolitisches-Gesamtkonzept-vor.html

7 As defined in article 2.f of the RES directive: "gross final consumption of energy" means the energy commodities delivered for energy purposes to industry, transport , households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission".

8 as defined in Article 5(1)a .

9 Gross final consumption of electricity from renewable sources for electricity (as defined in Article 5(1)a) divided by total gross final consumption of electricity.

10 Excluding heat produced using RES-E. Because of the rising share of renewable energies in the electricity sector, the quantity of RES-E used for heat generation is becoming increasingly significant, and must therefore be taken into account. By 2020, the amount of heat generated from RES-E is to grow from 2150 ktoe in 2007 to 5761 ktoe. This means that the entire volume of heat generated from renewable energies will rise to 25,614 ktoe in 2020.

Share of RES heating and cooling in final heating and cooling consumption[11]	7,02%	12,56%	14,33%	16,35%	18,65%	25,09%
Final energy from renewable sources consumed in transport [12]	2.092,59	5.717,66	6.469,04	7.426,66	8.711,69	10.931,90
Share of RES in transport[13]	3,38%	9,08%	10,41%	12,17%	14,53%	18,81%
Total share of RES in final energy consumption[14]	7,2%	13,89%	16,35%	19,22%	23,24%	28,34%

Table 2: Targets for 2020 and indicative trajectory for the share of energy from renewable sources in the electricity, heating and cooling and transport sectors

Assumptions concerning the development of energy needs up to 2020

Electricity sector

According to the growth forecast of renewable energy industry, gross power consumption is to drop slightly by about 4 % from 617.5 TWh to 595 TWh in 2020. This is considerably less than in the scenarios calculated by EWI/Prognos for the energy summit, which anticipate a decline in power consumption of 10 to 11 percent by 2020[15].

Heating sector

According to the industry forecast, the demand for space heating and hot water will decline by 18% by 2020, and process heat consumption by 11 %. These assumptions are based on the research report, 'Political scenarios for climate protection IV - scenarios up to 2030' by the Federal Environment Agency (UBA) and the report 'Energy scenarios for the 2007 Energy Summit' by EWI and Prognos[16]. The 2009 lead scenario of the Federal Environment Ministry is based on the same trends. If consumption is to be reduced, extensive efficiency measures are required: in the case of space heating, for instance, the more widespread and rapid introduction of the latest and most efficient heating technologies, and bringing greater urgency to heat insulation in old and new buildings.

Transport sector

Like in the Renewbility climate protection scenario[17] , it is assumed that it will be possible to reduce consumption by some 13 percent by 2020 if the following measures are implemented: further improvements in the efficiency of car and lorry engines, an expansion of public transport options, the optimisation of freight haulage logistics, increased transportation of goods by rail and inland waterways and the use of electric vehicles.

[11] incl. heat produced from RES-E.
[12] As defined in Article 5(1)c
[13] Share of final energy consumption in the transport sector, incl. air, rail and shipping traffic. According to Directive 2009/28/EC, renewable energies will account for 21.5% of the total in the transport sector in 2020.
[14] Total Expected RES consumption divided by gross final energy consumption
[15] EWI/Prognos 2007: 'Energy scenarios for the 2007 Energy Summit.' http://www.bmwi.de/BMWi/Navigation/Service/publikationen,did=211908.html
[16] UBA 2007: UBA research report: 'Political scenarios for climate protection IV - scenarios up to 2030.' http://www.umweltbundesamt.de/uba-info-medien/mysql_medien.php?anfrage=Kennummer&Suchwort=3361
[17] Öko-Institut e.V. et al 2009: Renewbility: material flow analysis for sustainable mobility in the context of renewable energy until 2030. Draft results brochure – design of the scenarios, results, summary. Berlin, May 2009. http://www.renewbility.de/

II.3 CONTRIBUTION OF RENEWABLES TO ELECTRICITY CONSUMPTION

Contribution expected of each technology to meet the binding 2020 target and the indicative trajectory for the share of RES in electricity (in terms of installed capacity and gross electricity generation)

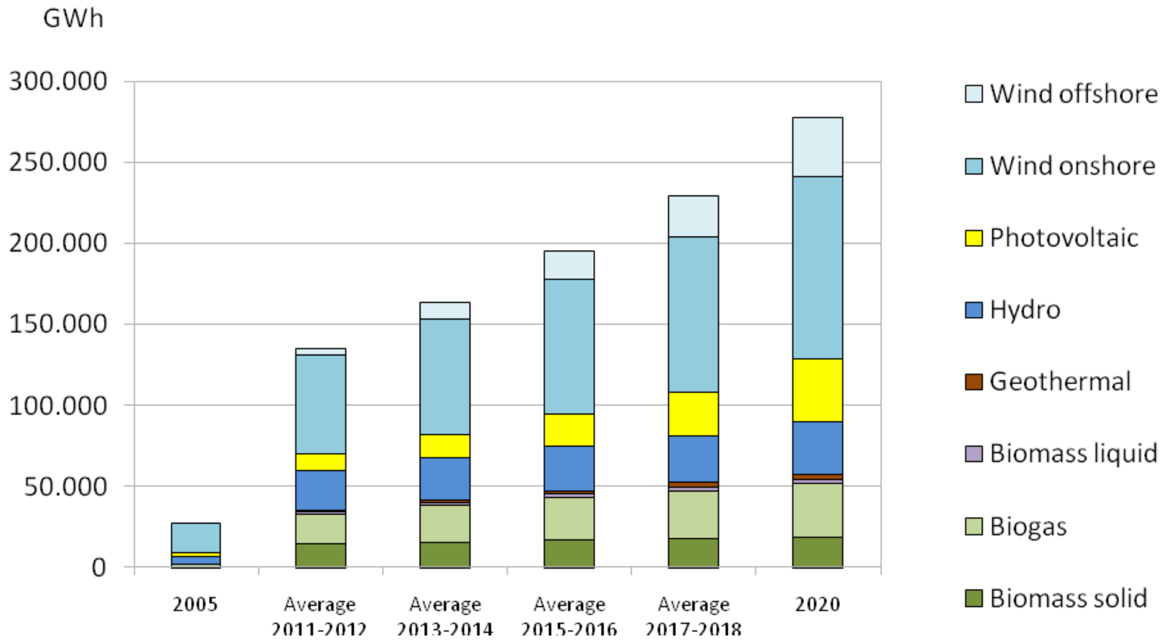

Figure 5: Electricity generation from RES until 2020

Development of the different branches

Bioenergy
By the year 2020, the amount of electricity generated using bioenergy will double in comparison with 2007 to a good 54 billion kilowatt-hours. Biogas will then make the largest contribution to bioenergy electricity (almost 60%), with solid biomass accounting for more than a quarter of total electricity production from biomass. The area required for the cultivation of energy crops for biogas production will increase to a million hectares by 2020. Roughly a third of the potential cultivation area for energy crops will then be used for the production of biogas. The proportion of waste materials (slurry, harvest residues, organic domestic refuse, green waste, etc.) in the substrate mix of biogas installations will increase steadily.

Geothermal energy
Given the positive framework conditions which exist, the expansion of deep geothermal energy for the generation of power and heat is set to boom in the next few years. Installed capacity will increase in leaps and bounds in the near future to more than 600 MW by the year 2020.

Hydro power
In the past, only about 20 percent of the theoretical potential of hydro power in Germany has been

exploited. There is also a considerable need to modernise, and thus to achieve increased output at existing installations. Consequently, the renewable energy industry expects an increase in hydroelectric power from 20.7 TWh in 2007 to 31.9 TWh in 2020 (solely with the use of run-of-river and pump storage power stations).

	2005		Average 2011-2012		Average 2013-2014		Average 2015-2016		Average 2017-2018		2020	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Biomass												
Solid	1.448	7.686	2.803	14.776	3.083	16.066	3.363	17.244	3.643	18.114	3.963	18.752
biogas	957	4.770	2.553	18.019	3.158	22.256	3.748	26.201	4.338	29.486	5.075	33.263
liquid	152	1.600	300	2.269	300	2.306	300	2.231	300	2.156	300	2.280
Geothermal	0	0	62	640	125	1.340	218	2.115	375	2.915	625	3.750
Hydro	4.680	21.542	5.150	24.720	5.450	26.160	5.750	27.600	6.050	29.040	6.500	31.850
Photovoltaic	1.881	1.300	11.300	9.666	15.750	13.943	21.000	19.220	28.000	26.466	39.500	39.500
Wind on-shore	18.428	27.233	30.347	61.172	33.947	71.820	37.547	83.757	41.147	96.512	45.000	112.050
Wind off-shore			1.400	3.938	2.850	10.300	4.600	17.020	6.825	25.253	10.000	37.000
Gross Final Consump-tion of electricity from RES[18]		64.131		135.198		164.192		195.388		229.943		278.445

Table 3: Electricity generation from RES until 2020

Photovoltaics

The contribution of photovoltaics (PV) to power generation will increase more than tenfold, from 3 TWh in 2007 to 39.5 TWh by 2020. The industry anticipates that installed photovoltaic capacity will increase from 3.8 GW in 2007 to 39.5 GW in the year 2020. It expects to receive an additional stimulus from the middle of the next decade, when so-called grid parity will be reached. In other words, generating electricity using one's own rooftop solar installation will be cheaper than buying electricity from an energy supplier.

Wind power

Onshore wind power installations are expected to generate 112 TWh of electricity with installed capacity of 45,000 MW by 2020. Offshore wind energy will contribute a further 37 TWh with installed capacity of 10,000 MW. During the period in question, the number of full load hours (onshore) is expected to rise from an average of 1,750 h/a today to 2,490 h/a in years of normal wind conditions. Depending on the location, hub height and wind park losses, values will fluctuate between about 2,000 h/a in weak-wind regions and approximately 4,000 h/a in coastal areas and on exposed high ground. Industry forecasts suggest an average value of 3,700 full-load hours per annum at sea. The greater number of full-load hours and thus more efficient power production will result from technical progress and, in particular, greater hub heights and adapted rotor diameters for the installed machinery. In addition to entering the offshore wind energy sector and designating new areas for on-

[18] as defined in Article 5(1)a .

shore wind power installations, it is repowering – the replacement of old machines by new, more efficient equipment, which will make a decisive contribution to the growth of the wind energy sector. According to the rule of thumb for onshore repowering, it should be possible to double installed capacity and triple power generation with half as many wind turbines. However, this presupposes that the most efficient technology, using hub heights of more than 100 m, can be deployed.

II.4 CONTRIBUTION OF RENEWABLES TO HEATING &COOLING

Contribution expected of each technology to meet the binding 2020 target and the indicative trajectory for the share of RES in heating and cooling (in terms of installed capacity and final heating& cooling consumption)

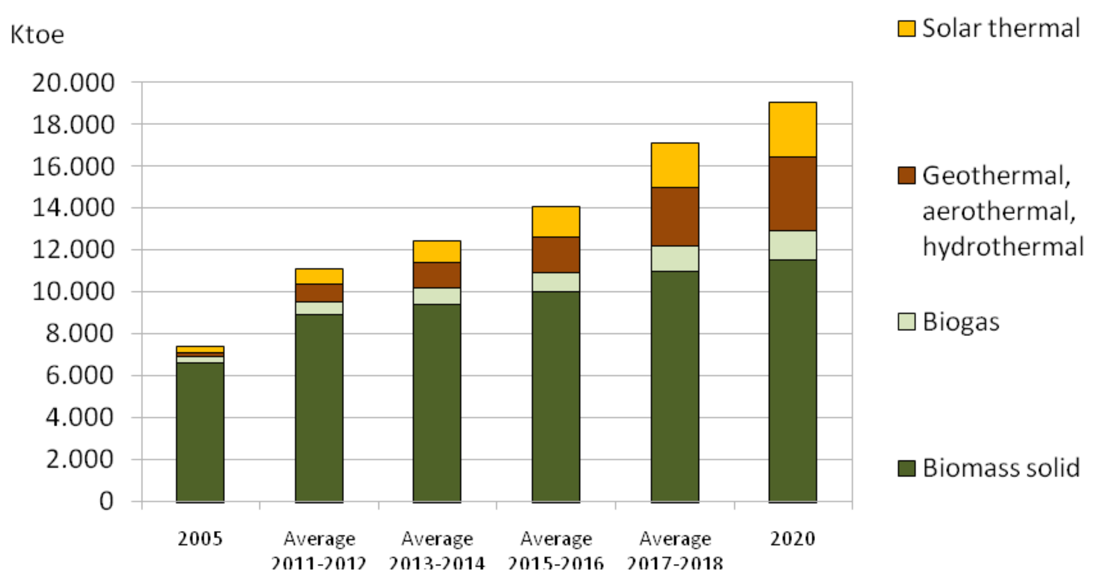

Figure 6: Heat generation from renewable energies until 2020

Development of the different branches

Bioenergy

In 2020, bioenergy will be continuing to make the largest contribution to total heat supply from renewable energies. From 2008 to 2020, heat provision from bioenergy will increase by 70 percent. This will continue the dynamic trend we have witnessed in recent years. The use of solid fuel and of heat from cogeneration plants will increase considerably. Solid biogenic fuels will dominate bioenergy heat production as a whole. The rapid rise in pellet heating systems will make an ever larger contribution in our homes. According to the forecast, the use of wood pellets for heat production will increase eightfold.

Geothermal energy and heat pumps

The forecast assumes a five-fold increase in heat generation from geothermal energy and heat pumps in the next ten years. Heat pump technology will still play the most important role within the entire segment of geothermal energy and heat pumps in the year 2020. By 2020 annual installations will exceed 200,000 systems, more than a threefold increase over todays market sizeIn 2020 heat pumps will use 12.17 TWh (1,046 ktoe) from geothermal and hydrothermal and 14.61 TWh (1,254 ktoe) from aerothermal sources. The direct utilisation of deep geothermal energy and of combined heat and power derived from geothermal sources will also continue to expand. Although these technologies only deliver less than 0.2 TWh at present, their contribution to renewable heat supply will increase to more than 14 TWh (1,225 ktoe) by 2020. The expansion of local heating networks will play a key role here.

Solar thermal heating

The area of solar collectors installed in Germany has doubled in the last five years. In 2008 alone, more than two million square metres were newly installed. The BEE forecast anticipates that the area of collectors installed annually will grow to more than 6 million square metres by 2020, three times what is currently being achieved. This means that the accumulated area of collectors would rise to more than 60 million square metres by 2020. These systems would be supplying 30 TWh of heat by 2020, compared to 4.4 TWh today.

Type of Energy	2005		**Average** 2011-2012		**Average** 2013-2014		**Average** 2015-2016		**Average** 2017-2018		2020	
	MWth	Ktoe	MWth	Ktoe	MWth	Ktoe	MWth	Ktoe	MWth	Ktoe	MWth	Ktoe
Biomass												
Solid		6.624		8.922		9.452		10.033		11.012		11.556
Biogas		286,7		612,8		739,9		893,3		1.185,2		1.363,7
Geothermal , aerothermal, hydrothermal		234,2		828,4		1.210,2		1.716,0		2.787,6		3.527,5 [19]
Solar thermal		277,7		786,0		1.051,1		1.420,0		2.165,8		2.591,5
Gross final energy consumption from RES in heating and cooling[20]		7.422		11.149,1		12.453,4		14.061,9		17.151,0		19.038,8

Table 4: Heat generation from renewable energies until 2020

[19] The share of shallow geothermal energy is to be 1,046 ktoe and the share of aerothermal energy 1,254 ktoe by 2020; 2,300 ktoe are to be produced using heat pumps, with the remaining 1,225 ktoe coming from deep geothermal resources.

[20] excl. heat generated from RES-E: cf. footnote 6

II.5 CONTRIBUTION OF RENEWABLES TO TRANSPORT FUEL CONSUMPTION

Contribution expected of each technology to meet the binding 2020 target and the indicative interim trajectory for the share of energy from RES in the transport sector

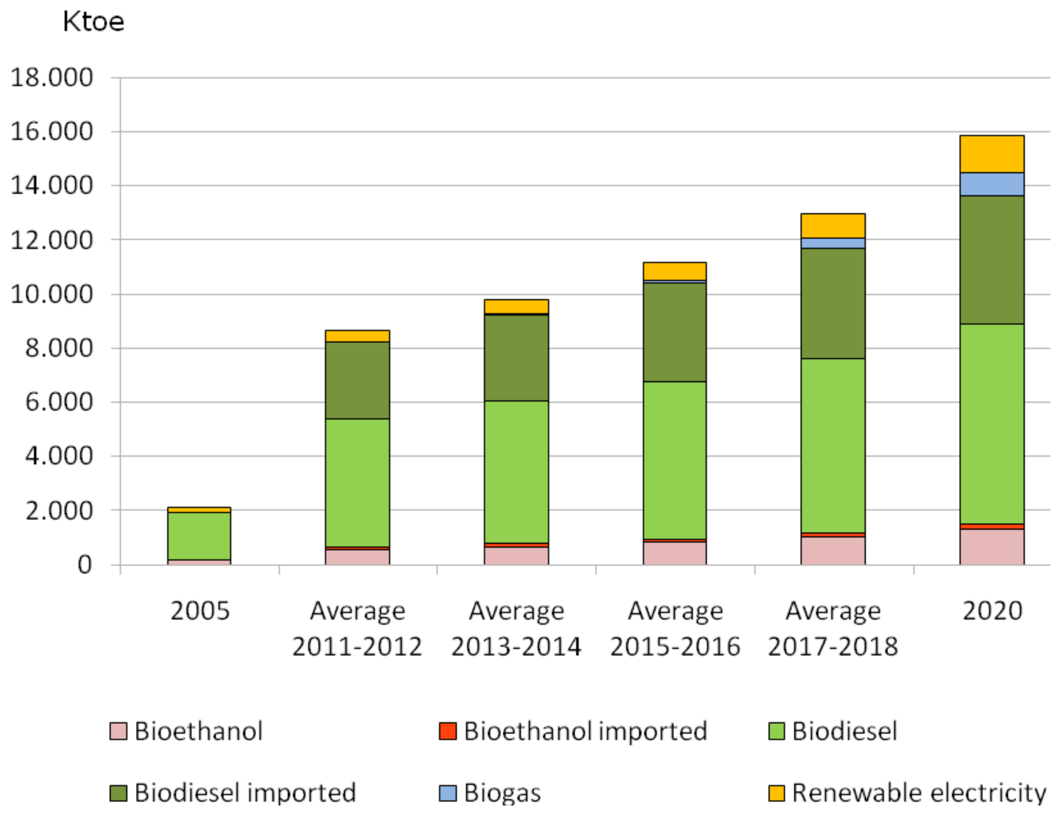

Figure 7: Final energy from RES in Transport until 2020

According to the BEE forecast, renewable energies will account for more than 18 percent of total energy consumption in the transport sector by 2020. Biofuels will make the largest contribution to this rise, accounting for 21 percent of fuel consumption by road transport. The importance of electricity from renewable sources in the transport sector will increase just as drastically. Firstly, the forecast anticipates a rise in the importance of rail transport and the use of electric vehicles. Secondly, the share of renewable energies in the electricity mix will increase during the period concerned to 47%, according to the industry forecast for the power sector. The BEE forecast suggests that biofuel production will increase from 4.5 million tonnes in 2007 to about 10 million tonnes in 2020. In percentage terms, bioethanol production will increase most, quadrupling to 2 million tonnes by 2020. Biodiesel production will also rise considerably to 7.6 million tonnes, whilst the use of pure vegetable oil will remain constant up to 2020. Biogas will play a much more important role in fuel consumption in the transport sector in 2020, accounting for more than 0.8 million tonnes. These trends reflect the part which biofuels will technically be able to play in overall fuel consumption by 2020. In the automobile sector, a 10% admixture of biodiesel will be blended with conventional diesel; a corresponding standard is already being drafted at EU level. Commercial vehicles will have a

30% admixture of biodiesel blended with conventional diesel. In addition, pure biodiesel and pure vegetable oil will be used for niche applications, such as in agriculture and forestry. In the case of bioethanol, an across-the-board admixture of 10% ethanol to petrol and an increase in the use of 85% ethanol fuel (E85) is anticipated.

Consumption in Ktoe	2005	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020
Bioethanol	168,9	543,1	668,1	821,9	1.011,1	1.308,2
of which imported	-	96,6	112,7	131,5	153,4	185,9
Biodiesel	1.775,6	4.734,1	5.244,3	5.817,9	6.462,7	7.379,7
of which imported	-	2.827,4	3.193,4	3.606,8	4.073,7	4.741,1
Biogas		10,3	34,2	111,8	365,4	880,3
Renewable electricity	148,1	430,1	522,4	675,1	872,4	1.363,7
Final energy from renewable sources consumed in transport [21]	2.092,6	5.717,7	6.469,0	7.426,7	8.711,7	10.931,9

TABLE 5: FINAL ENERGY FORM RES IN TRANSPORT UNTIL 2020

[21] As defined in Article 5(1)c

III. MEASURES FOR ACHIEVING THE TARGETS

III.1 Policy Measures

1. Measures on administrative procedures, regulations and codes [22]

Who are the administrative bodies responsible for authorization, certification and licensing procedures on national/or regional and local level? How should the competences be best defined and coordinated?

Biogas plants of up to 500 kWel are treated as privileged agricultural facilities under building law and licensed by district building authorities (up to 1 MW thermal input, corresponding to ca. 380 kWel), even on undeveloped land. Larger installations are licensed by commercial regulatory authorities, pursuant to the Federal Immission Control Act. Land utilisation and development plans must be drawn up for plants above 500 kWel, which necessitates the involvement of the local municipality or town and the participation of public interest groups. This decentralised structure with short decision-making processes and closed-loop materials cycles generally leads to a high level of acceptance within the population.

Problems do, however, arise in particular with regard to the 500 kW limit when technical progress enables the plant to increase output without the need for additional building work, e.g. because of improved utilisation of the substrate, improvements in fermentation biology, or increased efficiency. A flexibility framework should be introduced here to prevent plants which have undergone improvements from suddenly losing their licence.

Biomass plants: An abundance of different licences from many different authorities (district governments, state environmental agencies, building control authorities, etc.) must be obtained before erecting or operating a biomass (combined heat and) power station; these vary from one federal state to another. Licensing can take two years to complete, especially if environmental impact assessments are required. Added to this is the fact that the authorities may be insufficiently informed, especially in the case of new technologies (e.g. wood gasification systems), which can lead to negative or inappropriate decisions being made.

The lower building control authority is generally responsible for licensing **PV and solar thermal systems** on rooftops. It will check the building application, involve other authorities and forward the application in a one-stop-shop system. No significant barriers are raised by the procedure. Licences are not generally required for small solar systems attached to or on top of buildings, but there are a number of exceptions which might prevent the installation of such systems. It would be preferable if the federal states could harmonise their different building codes (LBOs), and introduce standard regulations and deadlines for decisions on solar system building applications.

Large **freestanding PV installations** require a licence. This means drawing up a development plan or a land utilisation plan, or amending regional planning regulations. There is no obligation to provide remuneration except under specific conditions. The EEG has provision for feed-in remuneration for freestanding installations on impervious surfaces, commercial or military land suitable for redevel-

[22] The questions listed below are included in the template issued by the EU Commission, which each Member State must complete for its National Renewable Energy Action Plan.

opment or green spaces used during the three preceding years as arable farmland. The principle of the one-stop-shop system is not yet a reality as far as freestanding PV installations are concerned. This means that various entities are involved in decisions on whether or not to license installations, such as municipalities, authorities and the local population, with the result that the licensing process can be a long, drawn-out affair. Since, as things stand, local communities do not always profit from the erection of freestanding PV installations due to a lack of financial (tax) incentives, they do not necessarily have an interest in granting approval for such plants. Changing the rules on trade tax in favour of the local municipality – as has been possible, for instance, with regard to the installation of wind farms – would be of assistance in this respect (Art. 29 Para. 1 Trade Tax Act). Efforts should also be made to further streamline the licensing process in the case of freestanding PV installations, and to review the rules on remuneration relating to surface-type.

Local lower water authorities are responsible for licensing vertical geothermal probes and groundwater **heat pumps**. This results in varying conditions being imposed, some of which cannot realistically be accepted. A nationally agreed licensing practice informed by state-of-the-art technology, and a simplified procedure for small installations would be advantageous.

The local lower water authority is also responsible for licensing new hydroelectric power stations or extensions to these. Different specifications have to be met, depending on the state concerned and the regional authority, some of which jeopardise the economic feasibility of the installation. This means that in some cases, financially viable ecological improvements are blocked. It is a basic tenet of EEG 2009 that an operator receives a higher tariff if he carries out ecological improvements to his installation and/or the water quality. This is certified by the lower water authority or an environmental verifier. The option of commissioning an environmental verifier has proved particularly successful in the current year.

The Federal Immission Control Act requires onshore **wind energy installations** (from 50 m high) to be licensed. In principle, this follows a simplified procedure (without public involvement). An environmental impact assessment, and with it a formal licensing procedure with public involvement, is mandatory for windfarms with more than 20 turbines. Those to be consulted include the building authority (unless it is also the licensing authority), the town or municipality, the military district administrative office, the regional government, the air traffic authority (for turbines whose total height is in excess of 100 m), the landscape authority, possibly the water authority, the environmental agency (unless it is also the licensing authority), the industrial safety agency, the state roadbuilding agency (for sites near motorways), and the roadbuilding authority (for sites near other roads).

Wind power installations in undeveloped areas are privileged projects pursuant to Art. 35 of the Building Code. This privileged status is unrestricted provided there is no control under regional or land utilisation planning. Other public concerns are to be taken into consideration only if there is a conflicting interest. The federal government has, to date, made no use of the opportunity to draw up clear regulations and to provide guidance, for instance on the ever-recurring issue of whether and to what extent interference to radar can or should be regarded as such a conflicting concern. Similar concerns exist in relation to height restrictions and regulations on distances from other sites, and to issues concerning the protection of species and of historic monuments. Some matters could of course be settled at local state level, but standardised national regulations would create greater clarity.

Where there is spatial and land utilisation planning, wind power installations are permitted only in designated zones within and outside regional plans, in areas subject to urban development plans, as secondary structures in privileged areas, and within business parks and industrial estates. Here they must meet often arbitrary regional and urban development regulations in terms of their distance from single houses, cultural monuments, nature reserves or gas pipelines/roads/overhead cables. Another inherent condition for their approval is their compliance with various limits in terms of noise emissions, shadow casting and turbulence.

A serious impediment to the expansion of onshore wind energy is often to be found in arbitrary height restrictions and restrictive regulations governing distances from other sites. In the majority of cases, the use of state-of-the-art equipment on high towers is scuppered by local height restrictions, which often prohibit structures more than 100 metres tall in total. This prevents the viable construction of large multi-megawatt class installations, both at new sites and as part of repowering initiatives. Rigid, arbitrary and bureaucratic distance regulations must be replaced by flexible, objective national statutory immission regulations (noise, shadow-casting, etc.). That said, certain provisions of the Federal Immission Control Act (e.g. the need to certify the completeness of documents before time-limits can begin to run) are also sometimes interpreted arbitrarily to the detriment of wind energy.

The 2009 annual Tax Act reviewed the breakdown of trade tax revenue for onshore wind power installations. In future, trade tax revenue will be split so that 70 percent is based on tangible fixed assets (incl. the value of the installation) and only 30 percent on a company's wage bill. This will mean that the local municipalities, where – in the case of wind power – the jobs may not necessary be located – will in future receive a higher share of the trade tax. This would make the siting of wind power installations much more acceptable without incurring any additional expense. This successful regulation should also be extended to other areas of renewable energy. Additional measures aimed at making wind parks more acceptable, such as the introduction of need-based illumination combined with the deployment of modern radar systems, would also be beneficial.

Offshore wind energy projects are licensed by the relevant authority. Within the 12 nautical mile zone, coastal states are responsible for licensing. In the Exclusive Economic Zone, licences are granted at national level. The authority responsible in this case is the Federal Maritime and Hydrographic Agency (BSH) in Hamburg. Decisions are made on the basis of the Offshore Installations Regulations.

The Regulation of the Federal Ministry of Transport, Building and Urban Development on spatial planning in the German Exclusive Economic Zone (EEZ) in the North Sea has been in force since autumn 2009. This regulation defines for the first time the legal planning basis for the various usages and functions of the German EEZ in the North Sea. It regulates the interests of the offshore wind energy industry, the traditional marine industries (fishing, shipping, raw materials extraction, laying of submarine cables and pipes, aquaculture), scientific research and marine environmental protection. The aim is to give improved planning security to projects to exploit offshore wind energy and reduce the potential for conflict between the various utilisation and protection interests at sea.

Priority areas have been established for offshore wind energy, with wind parks planned for these areas being given priority over other interests. Some 8,000 MW of wind energy can be installed (using 5 MW class turbines) in the priority areas designated thus far. Offshore wind parks outside the priority areas which have already been approved are not affected by spatial plans: they can go ahead as scheduled. To satisfy the German government's scale-up target for offshore wind energy (approx. 25,000MW by the year 2030), offshore wind energy projects may also be approved outside the priority areas, in the so-called white areas of the spatial plan, in addition to the wind energy parks within the priority areas. However, no satisfactory solution has yet been found to the issue of legal planning in the future. The ministry responsible proposes that a new concession model to ascertain future areas for wind parks be applied in an amendment to the Offshore Installations Regulations. This change of system would, however, render obsolete licensing procedures which are already underway in the white areas. It is therefore of fundamental importance in this respect that as well as adequate remuneration and unequivocal regulations on mandatory grid connection and the designated time-limits, a standard licensing practice should be introduced. To this end, the responsible licensing authority (the BSH) must be sufficiently well staffed to be able to handle application processes speedily. Practicable time-limits should also be applied for the period of validity of licences.

Is comprehensive information on the processing of authorization, certification and licensing applications for RES installations available?

In general, it is project developers and installers who tend to be entrusted with handling the administrative requirements relating to the installation of renewable energy systems. But since there is still scope for simplification at the relevant agencies, and also because Germany is often regarded to some extent as a role model, European projects such as ‘Windbarriers’ and ‘PV LEGAL’ have set themselves the objective of learning more about the bureaucratic requirements governing the licensing of installations in Europe and, where possible, sweeping these away.

Should authorization procedure take into account the specificities of different renewable energy technologies? If yes, how?

Clear regulations which take into account the specificities of the different technologies are vital.

Should the renewable energy potential be taken into account in spatial planning?

In general, renewable energy installations should be given priority over competing utilisations when it comes to regional planning. This would be particularly beneficial for wind energy, because it would enable the argument that new areas for onshore wind farms have become scarce or even non-existent in Germany to be refuted. It is precisely those federal states in which wind energy use is already very far advanced (e.g. Schleswig-Holstein or Brandenburg) which are planning to increase their share of designated zones significantly.

The potential of onshore wind energy is far from having been exhausted. States the size of Bavaria and Baden-Württemberg have not even begun to make extensive economic and ecological use of sites suitable for wind energy development. Pioneers in the field such as Schleswig-Holstein are gradually replacing installations dating from the infancy of wind energy utilisation in Germany.

Should timetables for processing applications be communicated in advance?

In some areas, it is already customary to provide an indication of how long the licensing process is expected to take. Introducing this more generally and harmonising procedures would be an important benefit, particularly as it would create greater certainty for smaller and decentralised installations in terms of planning.

How many steps should be needed to obtain the final authorization? Should there be a one-stop shop for coordinating all the steps?

The fewer steps are needed, the more simple and transparent the licensing process can be. In the field of solar energy, the one-stop shop is already to some extent a reality for rooftop installations. However, even in the field of solar energy there is room for improvement, particularly in the licensing of freestanding installations, which is still far from being a one-stop shop. Similar shortcuts and simplifications would also speed up licensing for other technologies.

For which small scale projects, should there be simplified and less burdensome authorization procedures?

There seems to be a particular need for this with respect to ground-source heat pumps of up to 20 kW, as well as small-scale hydroelectric plants of up to 100 kW.

2. Measures concerning Buildings

What measures should be introduced into the building codes to ensure the share of renewable energy used in the building sector will increase?
How should an obligation for minimum levels of renewable energy in new and newly refurbished buildings be drafted to best ensure renewable energy integration in buildings? At what levels should it be set?

There is a nationwide obligation under the Renewable Energy Heating Act to use renewable energies in new buildings constructed after 1/1/2009. This is an important step on the way towards a modern renewable heating standard. The share of renewable energy varies depending on the technology concerned. Alternatively, insulation work may be carried out. If a photovoltaic system has already been installed, or the installation of a solar thermal system is not possible for other reasons, the obligation is waived. It is the owner who is responsible for meeting the obligation. Failure to do so may result in the imposition of a fine. In this context it is, however, important to prevent underenforcement by ensuring that the law is adequately put into practice and harmonised by the federal states.

A state law introduced in Baden-Württemberg also requires the owners of existing building stock to commit to meeting 10 percent of their annual heating requirement from renewables when changing their heating systems from 1/1/2010. A minimum standard for renewable heat should also be established at national level covering the upgrading of heating systems in existing buildings.

In order to exploit the opportunity to use renewable energies in existing building stock, a national obligation should be introduced – preferably by federal law – at the very least to include renewable energies when fundamental renovation work is being carried out. But in addition to imposing regulations, it is just as essential to create reliable, budget independ incentives. In addition, other obstacles to the modernisation of heating systems, such as those found in tenancy laws should be eliminated.

Since legislators forbore from imposing a national building obligation vis-à-vis the building stock in the Renewable Energy Heating Act, it now lies with the federal states to introduce building stock regulations at state level without delay. The states must now be required by the federal government to enact legislation immediately and, above all, to appoint the relevant authorities which will then be responsible for ensuring compliance with such 'state heating laws'. Standard national legislation would, however, be preferable.

In order to solve the user/investor dilemma, it should be possible in future to shift some of the burden of investing in renewable energies onto the level of gross rent charged, and/or to charge for the heat produced. If the building is not very energy efficient, the right to charge for heating costs should be restricted and/or the tenant should be entitled to a rent reduction.

What is the projected increase of renewable energy use in the building sector until 2020?

Only 12 percent of heating systems in Germany can be considered state-of-the-art. It is therefore imperative that the annual modernisation rate in existing building stock be doubled from somewhere around a mere three percent today to at least six percent. The share of renewables in the heating sector can undoubtedly be increased to at least 25 percent if the policy proposals listed here are put into practice.

What measures should be taken to ensure that public buildings fulfill an exemplary role by 2012?

Every project to renovate energy systems in public buildings should be used as an opportunity to switch over the building's energy supply completely to renewable energies.

3. Measures on Information

How should specific information be targeted at different groups, as end consumers, builders, property managers, property agents, installers, architects, farmers, suppliers of equipment using renewable energy sources, public administration?

In addition to the existing information structures via associations and manufacturers, a wide-ranging public information campaign should receive political support.

Especially in federal states which have not yet seen any large-scale introduction of what have since become fully-developed renewable energy technologies such as wind energy, the licensing authorities must be kept fully informed of which sites it would be expedient to earmark, so as to avoid delays lasting years caused by an inappropriate choice of site. The authorities – but also political decision-makers – of such states often falsely assume that no relevant potential exists.

How will you ensure that certification schemes or equivalent qualification schemes become or are available by 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps?

Certification already exists for installers of heat pumps (EUCERT). However, this should be given greater political support – by providing information to installers and consumers, but also by supplying financial support and incentives (for instance, larger grants if a certified installer is employed).

Since the spring of 2009, installers of PV systems have been able to issue "PV Passports" to their customers (www.Photovoltaik-Anlagenpass.de) to certify the quality of the installation. The passport was developed by the German Solar Industry Association (BSW-Solar) and the Central Association of

Electrical and Installation Trades with support from the Technical Inspection Agency of the Rhineland, in order to create a minimum standard for the installation of PV systems in Germany.

The PV Passport is designed to standardise the installation process and provide customers with an assurance that that all the important technical specifications have been met, and the system is functioning correctly. The passport is provided by installers on a voluntary basis, and is intended to serve both customers and installers as a guide to ensuring a high standard of system functionality. It also backs up the documentation process, and ensures transparency in the case of disputes between the parties concerned.

How should guidance for planners and architects be provided to help them consider the optimal combination of renewable energy sources, high efficiency technologies and district heating and cooling when planning, designing, building and renovating industrial or residential areas?

Suitable retraining programmes should be developed and taken up – possibly with public funding.

What should be the role of regional and local actors in the design and management of programmes for information, awareness raising and training programmes for citizens on the benefits and practicalities of renewable energy sources?

One example of this is the action weeks for individual technologies – e.g. 'Week of the Sun' or the 'Heat pump action weeks', which demonstrate that addressing end consumers at local level can be highly successful. During the heat pump action weeks, the activities of partners and association members are organised locally, with a central, national umbrella campaign merely providing support. It would be feasible – and desirable in the medium term – to develop these action weeks for individual technologies further, enabling concerted information to be provided on heat from renewable sources. Regional political support is a valuable asset in this regard.

Name recognition among the public of local companies which manufacture renewable energy systems is important in helping to broaden the acceptance and recognise the potential of renewable energy. Once people familiarise themselves with regional companies and their workplaces, they can identify much more closely with the regional success of systems manufactured locally. Suppliers which deliver only certain components, for instance, often fail to be recognised at all as renewables companies. Regional industry days or open days organised by companies hoping to attract local people and decision-makers, can ensure that a better quality of information is available.

Most federal states have codes of practice for the construction of ground-source heat pumps. This is another important information strategem, although it would be preferable if the association were more closely involved on occasion.

4. Measures on certification of installers

Responsible body/(ies) for setting up and authorising certification / qualification schemes by 2012 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps

It would be beneficial for Chambers of Trade, professional associations and divisional associations to team up with accredited training-providers and centres and become actively involved, if they have not already done so. Individual training-providers are also obtaining certification from the relevant accredited institutes (e.g. the Technical Inspection Agency). The Federal Ministry of Education and Research can play an important role here, by organising activities which promote and support education, including, for instance, as part of the 'Qualification Initiative'. Alongside this, individual divisional associations (e.g. the German Heat Pump Association) are themselves playing an active role in the area of qualifications – in collaboration with recognised training centres.

Are such certification schemes / qualifications already available? Please, describe them.

In the solar energy sector, qualifications are provided mainly by the manufacturers, who also issue a 'certificate' (manufacturer --> certified skilled installer); there are also schools for solar energy specialists. The latter are trained installers (electricians, gas fitters or plumbers), who can provide customers with the best solution for obtaining energy from renewable sources, tailored to their individual needs. After completing their vocational training, they earn a further qualification and obtain certification as specialists in renewable energies at a certified European school for solar energy specialists.

The European Heat Pump Organisation (EHPA) has developed the syllabus and certification requirements of a training programme for heat pump installers as part of an EU project. These already comply with every single specification of Article 14 of the renewable energies directive. In order to be certified, the specialists must attend a 40-hour course and pass an examination; they are also tested on their installation of a reference system, and are subject to continuous quality control. Political support would be beneficial; it would increase take-up more rapidly than in the past, and create more incentives for craftsmen to obtain certification.

Are there specific trainings for case handlers in the different authorisation bodies?

As far as we are aware, this is not the case at present, although it would certainly be beneficial for the various technologies.

Is information publicly available on these schemes? Are lists of certified or qualified installers published? If yes, where? Are other schemes accepted as equivalent to the national/ regional scheme?

Information on the solar energy industry is available from manufacturers and at the schools for solar energy specialists. For example, end customers can find details of qualified installers on the internet at www.solarfoerderung.de. Certified installers for heat pumps and information on certification can be found, for instance, at www.waermepumpe.de.

5. Measures on electricity infrastructure development

How should transmission and distribution grids be developed to integrate renewable electricity while maintaining the secure operation of the electricity system? How is this requirement included in the transmission and distribution operators' periodical network planning?
How will the development of intelligent networks and storage facilities be ensured?

In the past, the grid infrastructure has largely been designed for conventional, base load energy supply. Power station units were larger, and power stations were erected close to centres of consumption. Wind energy does not tend to be used so much close to consumption centres, but rather in areas with low population densities and less industrialisation (e.g. Schleswig-Holstein, parts of Lower Saxony, Mecklenburg-Western Pomerania, Brandenburg and Saxony-Anhalt). The growing share of wind energy in these states means that greater distances have to be bridged; it also creates shortages in the existing grid, primarily because the potential of wind energy is barely being exploited in the southern German states. The transportation problem would also be reduced significantly if there were a greater expansion in the use of wind energy. At the same time, increasing problems are arising concerning the connection of PV installations, especially in the case of small, low-voltage systems. This is only partly the fault of neglected grid optimisation and/or neglected grid expansion. In the low-voltage network in particular, there has been a lack of investment in network optimisation (key words: load-flow inversion, dumb transformers, etc.). Often, this is actually because network optimisation or expansion planning has either not yet begun, or is behind schedule. Sometimes network operators place enormous hurdles in the way of operators of small-scale systems. These are in contravention of EEG regulations, which require prompt and prioritised network connection.

Rapid optimisation and, in the medium term, optimised expansion of the networks, combined with the creation and development of intelligent networks (smart grids), is required if a growing volume of variable power supply is to be handled. Network operators tend to plan on the basis of forecasts of power station expansion and anticipated supply. A special study – dena grid study I – was prepared for the integration of wind energy, in which all the relevant entities were involved, to forecast the extent to which the grid had to expand and provide grid operators with an additional basis for planning. The follow-up study – Dena grid study II – should be completed by the end of 2010. This second study examines and discusses such issues as the optimisation of the existing network. Other studies are also investigating a second important point: the constraints of electricity markets and/or electricity trading as they relate to the integration of large, variable quantities of wind power. Issues include the organisation of electricity markets, how to keep transmission capacity available, trading periods and market expansion. It is a question of facilitating integration at the optimum possible cost.

In order to achieve our targets for the expansion of renewable energies, power station parks of the future will have to be much more flexible to control. Inflexible base-load power stations (coal and nuclear power) would delay the expansion of renewable energies quite considerably in the years ahead. Against this background, the recent decision by the German government to extend the life of nuclear power stations is highly problematic. From this point of view too, flexible power station units and storage technologies are particularly deserving of financial support, and will have to be extended further and developed in the coming years. If a demand-oriented integration of renewable energies is to be encouraged, combined generation and storage technologies will require additional support. This might be possible to arrange, for instance, through the aforementioned bonus scheme already discussed in Germany which promotes the stabilisation of feed-in, or its closer adaptation to the needs of the electrical system and to demand. Existing storage facilities must be used and extended in parallel with the development of new technologies.

But measures aimed at influencing the level of consumption should also be taken, such as introducing appropriate tariffs and intelligent meters.

The Electricity Grid Expansion Act has been a first step towards accelerated network expansion. In future, it will be possible to lay power lines underground providing that certain conditions are met, which will speed up licensing procedures. If onshore and offshore wind energy is to see a rapid expansion, the law should go further. As a matter of principle, progress should be expedited through the standard use of underground cables for high-voltage grids, with the costs for using such cables being shared. It should be possible for extra-high-voltage cables to be laid at least partly underground in sensitive areas. The use of underground cables meets with a much less negative public response, and prolonged licensing procedures resulting from objections to overhead lines could be shortened considerably.

In addition, the largest possible number of entities should be involved in network expansion. Pursuant to Art. 46 (German Energy Industry Act), it should be possible not only to rent networks, but also to buy them.

How should the interconnection capacity with neighbouring countries be reinforced?

The TRADE Wind Study identified a total of 42 interconnectors for wind energy use on land. Their expansion, which should be completed by 2020 or 2030 at the latest, would promote the internal European integration of the electricity markets in general, and compensate for the costs of expanding the network by virtue of the optimisation effects achieved in European network operation and electricity trading. As far as the growth of offshore wind energy is concerned, the study supports the expansion and development of a branched network system, which would enable wind power to be fed into the grids of a number of countries bordering the North Sea and Baltic.

It is generally true to say that the larger the area with existing wind capacity, the more successful and secure will be the availability of the predicted and anticipated capacity, and the more efficient the system as a whole.

The international exchange of information about predicted feed-in volumes must also be improved. The first positive steps have already been taken in this direction.

How should the grid infrastructure authorisation procedures be accelerated?

The expansion of power lines is governed by the Energy Transmission Expansion Act. This Act provides for the laying of new extra-high-voltage underground cables on four pilot routes. The network operators are able to pass on the additional costs generated by laying the cables underground in the form of increased electricity prices. This approach should also be made possible in the high voltage sector (110 kV), provided the cable laying and operational costs do not exceed 1.6 times those of traditional methods. The industry believes that the Act will create more prospects of success for the important use of underground cables. However, the regulations remain too restrictive as a whole. The ruling on 110 kV lines is to apply only to projects for which no planning processes or planning permission procedures have yet been initiated. As a result, its practical impact will remain very insignificant in the years to come.

It is proposed that 110 kV high-voltage lines should always be laid underground, and the costs passed on across the board.

The legal concepts underlying the connection of offshore wind parks, which has been enshrined in this Act since 2006, have not yet been specified in greater detail. In particular, no timetable has been set, and nor have the various preconditions for completion of the connection by the network operator been regulated.

How should coordination between grid infrastructure approval and administrative planning procedures be ensured?

Liberalisation of the electricity markets – in particular the unbundling of previously integrated companies – has led to a situation where there is no longer any coherent power station and network planning. At the same time, the network operators are obliged to comply with every request for connection, and to operate the network efficiently. However, it remains the responsibility of the companies to make commercial decisions on which power stations are actually to be built. A large number of elements of uncertainty (the rate of expansion in renewable energies, raw material costs, the price of CO_2 emissions allowances, etc.) as well as long planning and completion times have restricted the necessary planning security for network expansion, leading to delays and even the abandonment of expansion plans.

In order to avoid further such delays, it would be very helpful to plan network expansion at a number of levels (nationally, regionally and locally), and to take into account at least a few different scenarios for renewable energy expansion. To date, there have been only a few network strategies based on the expansion of renewable energies (the Dena grid study I and the Brandenburg and Mecklenburg-Western Pomerania grid studies). Their strategy of inviting all the various entities to the table should be implemented across the board.

Should there be priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources?

In this case, the EEG has been providing a solid foundation for years, which was expressed even more unequivocally and extended in the most recent amendment. As well as prioritising the supply of electricity from renewable sources, there is also a provision on providing immediate access to the network and a regulation committing network operators to expand the network if capacity is insufficient in areas where renewable energy capacity is to be connected.

How should the costs of connection and technical adaptation be shared between producers and transmission and distribution system operators? How should it be ensured that transmission and distribution system operators are able to recover these investment costs? Should any modification of these cost bearing rules be planned in the future?

The EEG rulings on network connection cost attribution have also proved effective (with the system operator bearing the costs up the next suitable grid connection point, and the network operator thereafter). This is also true of the duty to ensure cost transparency. However, these rules are not always observed by the network operators. This can place obstacles in the way of small systems in particular.

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

According to the EEG, the connection must be made ‘immediately’. For a long time, few complaints were made about delays or lack of transparency, but this seems to have been changing more recently. It remains to be seen whether this is an indication that network operators are increasingly circumventing the welcome statutory regulations on prioritised feed-in and immediate connectivity.

6. Priority/Guaranteed Access to the grid

Should priority or guaranteed access be ensured? Explain.

Priority grid access as governed by the EEG is an essential condition for the rapid expansion of renewable energies. It has enabled new entrants to the market in particular to supply and sell the power they have generated under clear-cut conditions and at foreseeable costs. Priority grid connection prevents the existing oligopolies from squeezing out renewable energy producers, especially in markets where networks and generation capacity are largely in the hands of similarly- sized companies.

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

Clear statutory regulations and consistent enforcement are required.

How should the transmission and distribution of electricity from renewable energy sources be guaranteed by the transmission and distribution system operators?
What grid and market related operational measures should be taken to minimise curtailment of electricity from renewable energy sources?

The transport capacity of the networks should be increased, in part using technical solutions such as temperature monitoring or high-temperature conductors. Initial experience in this field has been gained in localised areas of Germany. Such measures should be introduced across the country. They would mean that on cold days, for instance, considerably more electricity could be transported through the networks than on hot days; inflexibility unnecessarily reduces the capacity of the lines.

In addition, good forecasting systems for the supply of power from renewable energies could help prevent the necessity of switching off systems.

In order to improve the system integration of renewable energies, regenerative combined cycle power plants should receive support under the EEG, and incentives should be created to develop a wide range of energy storage facilities. The introduction of a bonus to ensure a stable supply and/or to coordinate supply more effectively with the needs of the electrical system and with demand would provide an important stimulus in this respect.

7. Biogas integration into the natural gas network

How should one ensure that charging of transmission and distribution tariffs is not discriminating against gas from renewable energy sources?

In theory, the statutory regulations regarding fees for the transmission and distribution of biogas in the natural gas network, most of which are contained in the Gas Network Access Ordinance and the

Ordinance on Gas Network Tariffs pursuant to the Energy Industry Act, are largely non-discriminatory. Yet in practice, access to the gas network by biogas systems which are not operated either wholly or partly by gas supply companies is not without its problems.

Supplying biogas is difficult for a number of reasons in the case of a 'normal' operator of a biogas system, e.g. one producing the equivalent of between 0.5 and 1.5 megawatts of electricity,:

a) It is very difficult for biogas system operators to locate cogeneration unit operators on the natural gas network who are prepared to convert their units to biogas. They are not privy to the same information about cogeneration unit locations and operators as is available to gas network operators.

b) Operators of cogeneration units need to be confident that biogas will always be available throughout the EEG remuneration period of up to 20 years. However, it is difficult for operators of biogas systems of the size quoted to supply the volumes of biogas required by a large cogeneration unit on their own. The relationship between biogas system operators and cogeneration unit operators is consequently characterised by imponderables as the law currently stands.

c) Because of these uncertainties and the remuneration under the CHP Act for cogeneration units operated by natural gas, there is little incentive for cogeneration unit operators to switch to biogas.

d) Despite the provisions of the new Gas Network Access Ordinance of April 2008, network connection is very difficult for biogas supply projects in which there is no involvement by the energy supply companies themselves or their subsidiaries. There are repeated problems and delays.

e) Because of the lack of a broad market for processing technology, economies of scale have been very small thus far, which has made the technology relatively expensive. This may change with the introduction of a Renewable Gas Feed Act (EGE).

These problems could be solved by introducing a Feed Act (EGE) for the gas network modelled on the Renewable Energy Sources Act, with duties to connect, purchase, transmit and remunerate.

Should any assessment be carried out at national or regional level on the need to extend gas network infrastructure to facilitate the integration of gas from renewable sources?

The gas network infrastructure in Germany is already very good. Simple measures could be taken to improve even further the reception capacity of the networks with low pressure stages for biogas and other renewable gases, for instance by feedback into higher pressure stages. A study into the reception and integration capacity of the natural gas networks for biogas and the possibilities of improving these would be very helpful. However, when commissioning such a study, strong guarantees would have to be in place to ensure that those conducting the study (the scientists) were strictly impartial, and could not be influenced by gas companies / gas network operators.

8. District heating and cooling infrastructure development

What are the needs for new district heating and cooling infrastructure using renewable energy sources and contributing to the 2020 target? How should these plans be promoted?

The commercial operation of (biomass) local heating networks depends absolutely on a minimum connection density and minimum heat consumption. Consequently, it might be beneficial to introduce a compulsory scheme whereby areas of newbuild would have to connect to a local heating network. However, in order to prevent inefficient or uneconomic projects from participating, resulting in poor investments, strict quality standards would have to be met before funding was granted. At the same time, incentives should be created to increase the share of renewable energies in existing distance heating networks.

The CHP bonus could also be optimised under the EEG to provide greater financial support for biomass CHP installations and thus provide a stimulus for local heating networks.

Measures begin with urban planning, and continue with extending the possibilities of heat contracting, etc.

In the area of geothermal energy, CHP plants in particular can contribute to grid-connected heat provision. In addition, 'cold local heating networks'[23] can supply entire residential districts from a single heat source, using the home's own heat pump.

What are the planned contributions of large biomass, solar and geothermal facilities in the district heating and cooling systems?

The combined cycle plants commonly used in the past for individual buildings, which are supplied by solar local heating, almost all use a short-term heat storage system, which enables up to 30% of the building's annual heating requirement to be met from solar energy.

If considerably more than 30% of the heat requirement – i.e. also a considerable proportion of the space heating requirement in winter – is to be met from solar energy, then a central component of the system should be the use of seasonal heat storage systems (long-term heat storage). This would mean that some of the heat generated during the summer period could be stored until the winter, enabling solar energy to account for 50% or more of total consumption. Designs suitable for new buildings, which meet almost 100% of household needs from solar thermal energy, are already available on the market.

It is generally assumed that the importance of combined heat and power (CHP) for bioenergy systems will continue to grow. The amount of heat supplied by cogeneration units will more than double from about 20 TWh today to 45 TWh in 2020. The industry assumes that by 2020, heat recovered from cogeneration units will be accounting for up to 60 percent of the total.

[23] Cold local heating networks tap low-temperature heat sources such as groundwater or surface water, the soil or waste heat centrally for a large number of buildings. Decentralised heat pumps raise the temperature in individual buildings to the required level. In summer, the networks can also be used with suitable heat pumps for extremely energy-efficient 'passive cooling'.

9. Compliance with sustainability criteria through biofuels and other bioliquids

How will the sustainability criteria for biofuels and bioliquids be implemented at national level? How should 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 of Article 17.2-5?

The Biofuel Sustainability Ordinance was adopted by the Federal Cabinet on 16 September and came into force on 2 November 2009. The ordinance on the sustainability of bioliquids for power generation is already in force. The two ordinances are similar in terms of their basic requirements and measures, and implement the directive in national law. The act governing amendments to financial support for biofuels creates a direct link between state support measures and evidence of sustainability.

The Sustainability Ordinance governs proofs of origin under the sustainability criteria contained in Directive 2009/28/EC. The origin of the biomass must be traceable from start to finish as part of a mass balance system. Consignments of biomass with differing sustainability characteristics may be mixed, provided the sustainable consignments are recorded in advance, and the amount of sustainable biomass extracted from the mixture is not greater than that which was added. A greenhouse gas balance may only be drawn up from a number of different biofuels if each share added represents a greenhouse gas emission saving at least 35%.

The ordinances also govern the way in which the criteria on guaranteeing sustainability are to be certified. The certification body monitors at least once a year whether the interface meets the conditions under which a certificate can be issued. It also verifies whether the biomass used in the production of biofuels is cultivated in compliance with the sustainability criteria.

The ordinance is to be applied only to biofuels placed on the market after 1/7/2010, within the scope of transitional provisions.

The German biofuels industry believes that the deadline set for the introduction of the sustainability ordinance is very tight. An administrative regulation is currently being drafted for practical implementation of the ordinance which, among other things, rules on important definitions for no-go areas, and sets demands vis-à-vis the mass balance system. This should be completed by November 2009. The sustainability ordinance will represent a major administrative burden for the companies concerned, as well as a not inconsiderable financial cost. The implementation of a comprehensive mass balance system must be regulated, interfaces must be certified, and certification systems and bodies approved. In addition, the development of independent certification systems has not yet been completed, so it remains unclear what burden these systems will place on the economy.

The industry believes that the target date of 1/7/2010 which has been set for implementation of these wide-ranging provisions is highly ambitious. The European Commission has not yet published guidelines on the implementation of Directive 2009/28/EC. Among other things, these govern the way in which sustainability criteria are translated into national law. The EU guidelines will therefore have to be adopted by the German sustainability ordinance retroactively. In addition, the requirements regarding proof of origin and the mass balance system will be specified in more detail, and more precise definitions will be provided for the sustainability criteria which are to be met. It may be necessary to adapt the German sustainability ordinance shortly after its implementation, so that it complies with European Commission guidelines.

If a level playing field is to be created, it will also be necessary to extend the sustainability criteria to biomass for use in the food and feed industry, but in particular to fossil raw materials.

As far as protected areas are concerned, under which national or international protection regime should they be classified?

If possible, no new definitions should be introduced. Conservation areas are already adequately defined in Germany.

What should be the procedure for changing the status of land? With what frequency should changes in land status be registered?

These matters have already been regulated for agriculture and forestry in Germany and in the EU. No new definitions should be introduced for energy; rather this should remain – as it is today – an AGRICULTURAL issue.

How should the national verification of compliance with good agro-environmental practices and other cross-compliance requirements (required by Article 17.6) be ensured?

Evidence of good professional practice and observance of cross-compliance requirements are in accordance with the provisions of Regulation (EC) No. 73/2009 of the European Council. Regular monitoring to ensure that companies meet requirements is also required by the German sustainability ordinance. New regulations would be unnecessary and should not be introduced.

Should there be a voluntary "certification" scheme(s) for biofuel and bioliquid sustainability as described in Article 18(4)?

Yes that would be very beneficial – provided the material requirements of the Directive are implemented on an equal footing – as it would enable the implementation of the sustainability criteria to be realised in practice.

III.2 FINANCIAL SUPPORT

1. Support schemes for renewable electricity

What further improvements could be implemented to ensure reaching the target in the electricity sector?

The EEG with its guaranteed but degressive feed-in tariffs and priority grid access is a central pillar of the success achieved in the electricity sector. Regular cautious readjustment of tariffs and degression rates, as in the example of the 'flexible ceiling' in the promotion of photovoltaics, for instance, can allow for fine-tuning and create the right balance of funding. Examples from countries such as Spain, where tariffs for individual technologies were set too high, demonstrate that it is only with appropriate and sustainable tariffs that the market can grow effectively. Incentives to combine electricity generation from a number of renewable sources with the development of storage facilities for energy would be other expediting elements.

Investment aid:

What investment aid should be granted by the scheme? (subsidies, capital grants, low interest loan, tax exemption or reduction, tax refund). Who could benefit from this scheme?

Grants under the market incentive programme and reduced-interest support schemes offered at national or state level or by the Bank for Reconstruction and Development (KfW) and other targeted incentives have proved helpful in the past. Such instruments should be extended in a purposeful manner so as to make it easier for innovative technologies to access the market.

Should applications be continuously received and granted or are there periodical calls? If it is periodical, what should be the frequency, conditions?

Continuous access to support instruments and continuous granting are essential if ups and downs in the market are to be avoided and investment security ensured. It is only in this way that the industry can operate economically and balance out fluctuations in demand in the long term.

Operational aid:

What should be the conditions to get the fixed tariff?

The generation of energy from renewable sources within the meaning of the EEG must remain the sole condition.

Should there be cap of the total volume of electricity produced per year or of installed capacity that is entitled to the tariff?

Capping of support will prevent investment security and further growth of the industry (cf. Spain). Flexible ceilings (corridors), on the other hand, may be acceptable in exceptional circumstances, because they allow the tariff to be adjusted flexibly depending on the volume of installed capacity.

Should this be a technology specific scheme? What would be the tariff levels for each?

Technology-specific support is indispensable if the various renewable energy technologies – and not just those which are most cost-effective at the time – are to be allowed to enter the market. It is only in this way that the industry can invest continuously and reduce costs through economies of scale.

Should there be other criteria differentiating the tariff?

The size, technology and possibly location of the system. A bonus for direct use, i.e. for decentralised consumption, is also considered beneficial.

How long should the fixed tariff be guaranteed?

Twenty years is generally considered to be an appropriate period.

Should there be any tariff adjustment foreseen in the scheme?

Yes, annual degression promotes innovation.

Should the scheme be periodically revised?

Yes. Regular revisions and adjustments are necessary, firstly to avoid over-funding, and secondly so that one can react to retarding factors. They must, however, observe certain minimum intervals (ideally every four years), to prevent procrastination and uncertainty on the part of potential investors.

Who should be managing the scheme?

The process of wide-ranging, scientifically-based progress reports and decision-making by the German Bundestag following widespread consultation with the industry has proved successful, because this enables the broad support for renewable energies within the population and indeed in all the parliamentary parties to be heard.

2. Support schemes for renewable heating and cooling

What measures could be best to ensure development of heating and cooling renewable energy sources?

By consistently pursuing a combined strategy of making demands and providing support, we can succeed in tapping the potential of solar energy, biomass and geothermal energy for security of supply, energy saving and climate protection, at the same time as providing a long-term reduction in energy costs for consumers with a sustainable renewable energies heating standard.

Consequently, the market incentive programme which currently Euro 500 million should be topped up to at least one billion Euro in the years ahead, the incentives to modernise which are anchored within it should be extended, there should be increased financial support for renovations in particular, and funding should continue to be developed as a budget-independent and needs-based instrument. The application process for funding should also be simplified.

In addition, there should be a significant extension to the mandatory use of renewable energies in the existing building stock, and an appropriate solution should be found to the user/investor dilemma. Tax incentives for investing in renewable energies would be beneficial.

What support schemes could best encourage the use of district heating and cooling using renewable energy sources?

In the case of CHP networks supplying heat from deep geothermal energy, there is already support for the development of heat sources. Similar support for cold local heating networks would be desirable, as the exploitation of shallow heat sources is expensive. In general, investment subsidies for networks in the Market Incentive Programme which are conditional upon quality standards being maintained would be useful. Also of benefit would be possible connection obligations for new construction sites, which could be specified in the development plans.

Higher tariffs for the heat portion in the CHP bonus pursuant to the EEG might provide a considerable boost to regenerative heat utilisation.

3. Support schemes for renewable resources in transport

What should be the concrete obligations / targets per year (per fuel or technology)?

The strategy to expand the use of renewable energies in the transport sector is based on two pillars: extending the use of sustainably produced biofuels, and increasing the use of electric vehicles. Whilst biofuels are currently the only alternative to fossil fuels in the transport sector which are available in any appreciable quantity, the use of electric vehicles has the potential to assume considerable importance.

The challenge facing policymakers in the coming years therefore lies in restoring the competitiveness of domestic sustainable biofuel production through a two-part support system. Firstly, the most recent reduction in overall biofuel quotas should be reversed, and a gradual increase to 8 percent be achieved by 2015, as was initially specified in the Biofuel Quota Act.

Secondly, tax differentiation could be used to recreate a market segment for pure biodiesel. Providing tax incentives for the use of particularly CO_2-efficient pure biofuels should provide an additional stimulus for the reduction of greenhouse gases.

As far as electric vehicles are concerned, the German government has already taken its first steps towards expanding their use with an action plan aimed at achieving a target figure of 1 million electric vehicles by 2020. Potentially, we should be aiming to increase the purchase of electric vehicles not only through incentive programmes, but also by using as incentives their further advantages (e.g. lower levels of noise, pollution and toxic emissions).

Should there be a differentiation of the support according to fuel types (biodiesel, bioethanol) and technologies (second generation biofuels, renewable electricity)?

It is fundamentally important to differentiate support according to fuel types, because their raw materials, production processes and possible uses, as well as their competitiveness and market penetration, are markedly different. Differentiation according to technologies would also appear reasonable, to take account of differing degrees of readiness for the market. This is also reflected in the national support instruments for biofuels and electric vehicles, and in Directive 2009/28/EC. R&D funding is required to nurture new technologies (i.e.essentially for the launch of the '2nd generation').

III.3 INCREASING BIOMASS AVAILABILITY

Biomass availability: domestic potential and import

Biomass availability in 2007

No separate statistical record is currently held of the volume of biomass imports and exports for energy use. Consequently, no quantitative data is available on the importation and exportation of biomass used as an energy source. Figures supplied by the German Biomass Research Centre (DBFZ) reveal that Germany is currently exporting more wood raw material for energy use than it is importing. According to provisional DBFZ data, the volume of raw wood imported for fuel in 2007 was

458,000 m^3 (out of a total of 4,417,000 m^3 of imported raw wood). In 2008, Germany produced some 1.5 million tonnes of pellets, of which ca. 600,000 t were exported and 900,000 t used domestically. Wood pellet imports cannot be quantified precisely in Germany, since the foreign trade statistics group them together with sawdust, wood waste, wood scrap and briquettes. Given the volume of domestic pellet production/capacity and pellet consumption, pellet importation is of no great significance.

Agricultural land use for dedicated energy production		Surface in ha
1) Land used for production of bio-liquid and vegetable oil	Of which:	
	1.1 for bioethanol (cerals, corn, sugar beets)	250.000
	1.2 for biodiesel (rape, sunflowers and others)	1.120.000
2) Land used for short rotation trees (willows, poplars)		
3) Land used for energy other energy crops such as grasses (red canary grass, switch grass, Miscanthus), sorghum		400.000 (for biogas production)

Table 6: Current land use for production of crops dedicated to energy in 2007

Sector of origin		Primary energy production (value in ktoe)	Final energy use (value in ktoe)
A) Biomass from forestry[24]	1. **direct supply of wood biomass from forests and other wooded land for energy generation**	4.538	3.857
	2. indirect supply of wood biomass for energy generation	1.314	1.117
B) Biomass from agriculture and fisheries:	*Of which:*		
	1. agricultural crops and fishery products directly provided for energy generation	10.368	7.870
	2. Agricultural by-products / processed residues and fishery by-products for energy generation	7.094	6.030
C) Biomass from waste:	**1. Biodegradable fraction of municipal solid waste**	1.003	642
	2. **2. Biodegradable fraction of industrial waste (including paper, cardboard, pellets)**	1.791	1.415
	3. Sewage sludge	908	581

Table 7: Biomass potential in 2020

[24]Biomass from forestry should also include biomass from the forest-based industries. Under the category of biomass form forestry processed solid fuels, like chips, pellets and briquettes should be included in the corresponding subcategories of origin.

Domestic biomass potential is sufficient to cover future requirements for heat and power generation. It is, however, anticipated that imports of bioenergy raw materials, e.g. in the wood pellet segment, will increase. Consequently, it is realistic to assume that by 2020 not all domestic potential will be being used.

In terms of biofuel production, the forecast assumes that about half of raw materials will be produced domestically in 2020, with the remainder being imported. The area of land required for biofuel production in German will increase as a result from 1.4 million hectares in 2007 to 2.4 million hectares in 2020.

- What measures could best encourage the use for energy purposes of unused arable land, degraded land, etc. planned?
- What measures could ensure a higher productivity of currently used lands or harvesting more than once on the same land per year – if applicable- planned?
- How should one encourage the energy use of certain primary material already available (like animal manure)?
- What measures could improve forest management techniques in order to maximise the extraction of biomass from the forest in a sustainable way?
- How could the impact of energy use of biomass on other sectors based on agriculture and forest be detected?
- What kind of development is expected in other sectors based on agriculture and forest that could have an impact to the energy use? (Are there possible positive impacts, like more efficiency might result in more biomass available for energy, or negative impacts, like more efficiency, might also result in fewer by-products available for energy?)

A secure supply of biomass (for energy production) without negative impact on the availability of foodstuff and taking due account of environmental and climate protection considerations is the most important building block for the further expansion of the use of biomass as an energy source.

Particular attention should be paid in this respect to the use of degraded land for the production of biomass. According to the FAO, roughly 3.5 billion ha of land is currently classified as degraded. Just a part of this land surface would be sufficient to meet a large proportion of global energy requirements from bioenergy. The cultivation of biomass on degraded land would also have other positive effects, such as a reduction in land erosion caused by wind and water, CO_2 storage in plants, etc.

In order to create incentives for increased use of degraded land, instruments must be developed which compensate for the lower yields and higher risks of such cultivation. Directive 2009/28/EC offers an incentive for liquid bioenergy (biofuels, bioliquids) through a greenhouse gas bonus for the use of degraded land. However, this will only prove economically efficient if an improvement in the greenhouse gas balance also benefits the market for biofuels. This is not yet the case, because biofuels only have to comply with the minimum level of a 35% reduction in greenhouse gas emissions to be included in the achievement of the target. An improved greenhouse gas balance does not at present offer any direct financial advantages.

New and improved cultivation methods, such as mixed cultivation, dual cultivation and intercropping, would appear to lend themselves to increasing the efficiency per hectare of biomass cultivation. It has also been shown in the past that agricultural yields can be improved considerably through breeding. The focus should be on the further development of high-yielding energy crops in order to enable the maximum possible increase in biomass to be achieved. Since there is still a great need for research in this area, the provision of R&D funding would be a priority in the first instance.

To encourage the cultivation of short rotation plantations (SRPs) and create an incentive for farmers, capacity-building measures must be adopted if the latter are to accept such cultivation in the first place. In addition, considerable effort must be devoted to researching suitable plant species, cultivation techniques and harvesting and processing techniques. Last but not least, legal clarification is required so that fields do not automatically acquire the status of 'woodland' when short rotation plantations are established on arable land, but remain agricultural land.

In order to utilise the biomass potential from forestry more effectively, it is particularly essential to create suitable utilisation structures for privately-owned woodland. Small and very small areas of woodland are often left unmanaged, with the result that considerable potential remains untapped. One possible way forward would be to encourage the establishment of woodland management groups, allowing several private woods to be managed together or possibly to have their management outsourced to an external service-provider, which would enable this untapped potential to be exploited. In order to simplify the processing and marketing of such biomass, one idea worth exploring is that of centralised biomass depots. To improve incentives for the widespread use of the wood potential, adjustments will have to be made to the EEG; for instance, higher tariffs will be required for smaller systems too, to enable forest wood to be transported over longer distances, thus creating a sound basis for a commercial operation. In addition, the exclusivity principle of the EEG should be eased, allowing mixtures of renewable and non-renewable biomass to be used. This would, for instance, permit the combustion of forest wood in power stations normally fired by waste wood, which would also allow forest wood to be used commercially in larger power stations. Furthermore, the mandatory connection of new development areas to the biomass local heating network could create a strong incentive to promote decentralised supply concepts with regional biomass – and consequently forest wood – to a greater extent.

If we are also to make full use of the existing biomass potential, incentives are required which create a legally binding and permanently secure framework for power generation from biomass. This includes further mobilisation of biogenic municipal waste and other organic waste which can be used in a particularly CO_2-efficient way for energy. In addition, we should push forward with the use of biomass from nature reserves, provided that this is not to the detriment of nature conservation.

III.4 FLEXIBILITY MECHANISMS/JOINT PROJECTS/EUROPEAN PERSPECTIVE

What procedures should be established for arranging a statistical transfer or joint project?

In order to be able to make active offers of statistical transfers, the German government should approach other governments requiring support as soon as it has calculated with a relatively high degree of certainty that it will exceed the requirements of the indicative trajectory and 2020 target. Negotiations on volume, timeframe, costs, etc. should be expedited. However, priority should be given to supporting the attainment of targets at home, before making statistical transfers.

The Federal Environment Ministry (or a subordinate authority) should be the focal point for joint projects, where both interested investors and governments interested in such projects can discuss the details and reach agreements. The German government must verify immediately – and not only when initial enquiries are made – which if any legal amendments would be required for joint projects in Germany with (partial) transfer of renewables production towards the target of another Member State.

How should private entities take part in joint projects with either Member States or third countries?

Private entities can and should be allowed to invest in projects. Agreement must be reached between the governments concerned (after first examining the legal framework) on the extent to which part of production can be transferred to meet the target of another Member State.

In which sectors can renewable energy be developed in your territory for the purpose of joint projects? With which technology? How much installed capacity / electricity or heat produced per year?

Generally speaking, no sector or technology can be excluded. Whether individual projects can be designed completely or partially for the benefit of meeting another Member State's targets must be decided on a case-by-case basis, depending on how much of the target has been met and after weighing the sharing of costs.

How should sites for joint projects be identified?

No differently from any other sites for renewable energy projects.

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?)

We do not feel the need to examine this issue in any depth, because we do not regard this as necessary for the fulfilment of our targets in Germany.

However, we do believe it would be interesting for future political discussion in the EU if early approaches were made to creating a common support system based on a minimum price (feed-in system). In this respect too, we urge the German government to examine soon which legal conditions would have to be met for this purpose, and to contact other Member States at an early date for the purpose of developing and potentially agreeing upon common rules.

	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020
Estimated excess (Million €)	9.738,963	10.989,845	13.590,033	16.756,320	20.747,438

Table 8: Estimated excess and deficit production of renewable energy compared to the indicative trajectory

As reference values, we have assumed a scenario which exactly meets the national overall target by 2020.

IV. Estimated costs & benefits of the renewable energy policy support measures

What is the estimated consumption of renewable energies (in ktoe)?

2005	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020
15.028,99	28.491,66	33.040,34	38.288,86	45.634,19	54.709,10

Tabel 9: Estimated consumption of renewable energies in ktoe

What are the expected costs (in euros) of achieving the 2020 target?

Two energy price variants were assumed for the cost calculations: *Price path A*: Dramatic increase in the price of energy: The price of crude oil rises to $\$_{2008}$200 /barrel by 2020. As a result, the market price for electricity rises to 15 ct_{2008}/kWh in 2020. **Price path B**: Moderate increase in the price of energy: The price of crude oil rises to $\$_{2008}$100 /barrel by 2020. As a result, the market price for electricity rises to 9 ct_{2008}/kWh in 2020. A linear rise up to 2020 is assumed for both price paths.

Electricity Sector

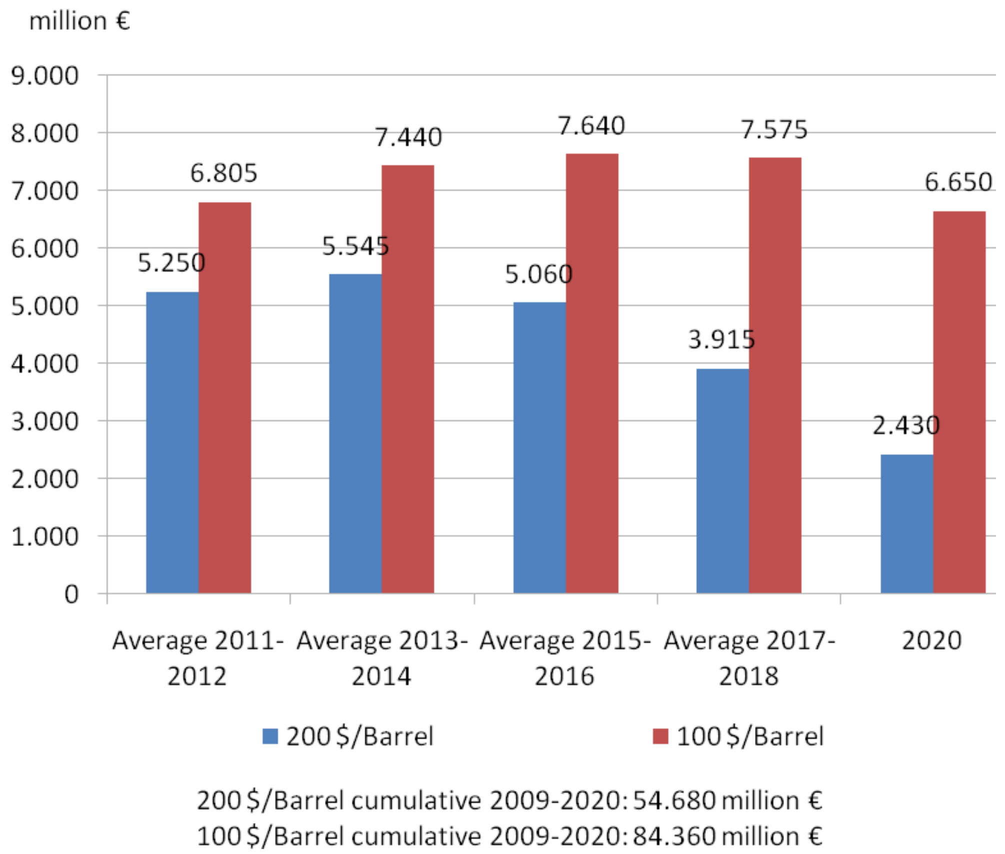

Figure 8: Cost of electricity generation from RES

Million €	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020	Total (2009-2020)
200 $2008/Barrel	5.250,00	5.545,00	5.060,00	3.915,00	2.430,00	54.680,00
100 $2008/Barrel	6.805,00	7.440,00	7.640,00	7.575,00	6.650,00	84.360,00

Table 10: Cost of electricity generation from RES

Heat Sector

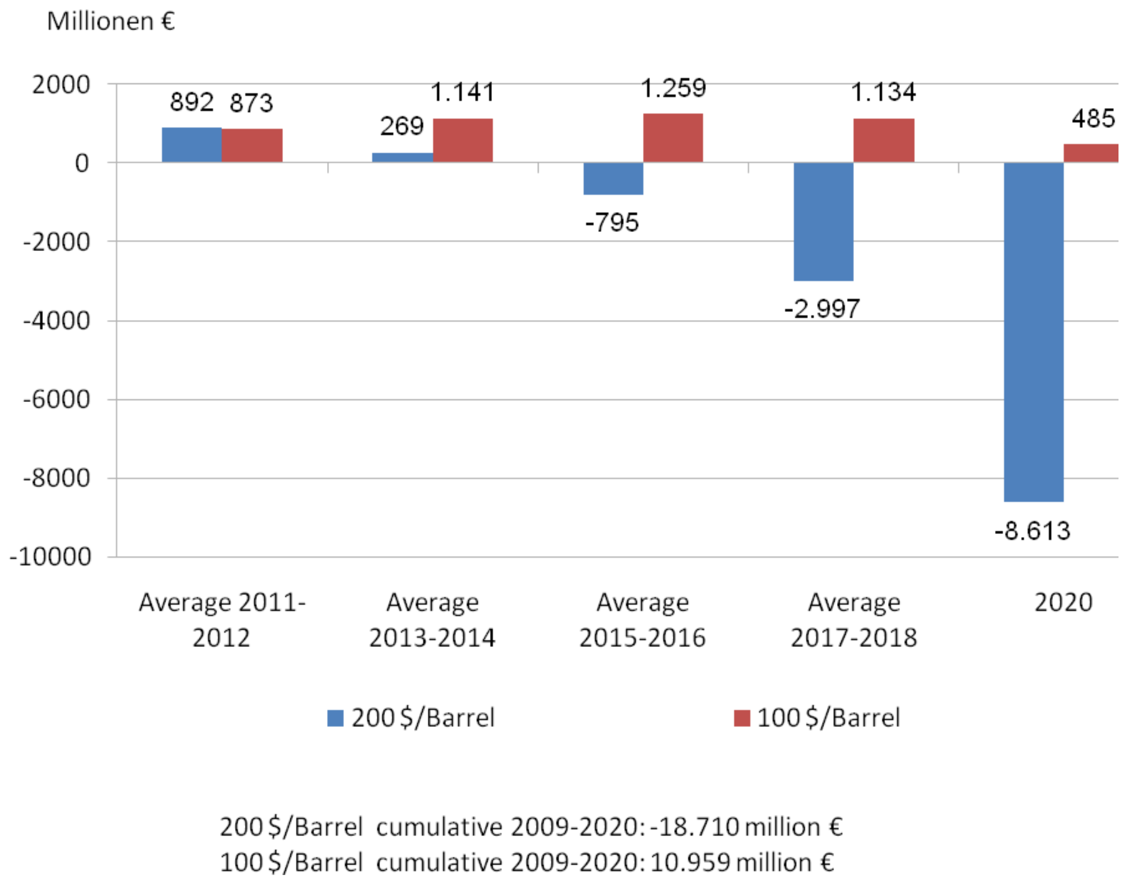

Figure 9: Cost of heat generation from RES

Without allowing for avoided costs, one finds the following support requirement for the heat sector:

Million €	Average 2011-2012	Average 2013-2014	Average 2015-2016	Average 2017-2018	2020	Cumulative (2009-2020)
200 $2008/Barrel	926,57	798,77	500,85	1,25	-	5,37 bn. EUR
100 $2008/Barrel	892,91	1.248,17	1.529,06	1.685,56	1.715,18	14,95 bn. EUR

Table 11: Cost of heat generation from RES

Transport Sector

It is not possible to forecast with any certainty the costs of biofuels up to 2020, as they will depend on a large number of unpredictable factors:

High proportion of raw materials
In the case of biodiesel, raw material costs make up the largest share (about 60%) of the cost of the final product. Biodiesel is therefore highly dependent on the cost of raw materials. A number of developments in biomass cultivation could have a major impact on raw material prices; for instance, cultivation on marginal land with low yields would push up the price of raw materials. However, the use of marginal land could have a positive effect on price through an improved, price-effective CO_2 balance. The raw material price for biofuels will always align itself to the price of oil as a benchmark. Moreover, the prices for agricultural raw materials are even more volatile, making it impossible to predict future prices and/or an average value.

High proportion of production costs
The final price of bioethanol or second generation biofuels is influenced primarily by the high proportion of production costs. In this case, energy costs are the major determining factor. The high proportion of energy costs means that production of these fuels is highly dependent on fossil fuel reference prices.

The future value of avoided greenhouse gas emissions has a further impact on biofuel costs. It is not yet possible to estimate the commercial benefit which will result from lower emissions from biofuels.

Despite the difficulty of predicting costs, it is still possible to make some general statements about the incremental costs of biofuels. Biofuels incur very low CO_2 avoidance costs in comparison with making construction changes to vehicles or increasing the use of electric vehicles. Even if it is possible to realise the 80 % reduction in the cost of batteries predicted by 2020, a small electric car with a range of 100 km still generates incremental costs of nearly Euro 4000.

The figures shown here are our own calculations based on possible increases in the price per barrel of oil to $\$_{2008}$100 and 200 respectively[25]. The figures used by FHI/EEG differ considerably both in terms of their assumptions about oil prices development and on other points. In their ACT scenario, they arrive at the following aggregate values by 2020: electricity sector: € 70,670 m, heat sector: € 62,240 m, transport sector (biofuels): € 17,800 m.

In the heat sector in particular, the calculation of differential costs varies widely from our own. On this scale, this would have a major impact on the acceptance of the growth trajectory.

What is the Expected GHG reduction (t/year)?

Annual CO_2 savings in Germany resulting from the use of renewable energies are currently (2008) about 109, mill. t and will, according to our calculations, rise to 287 mill. t CO_2eq by 2020.

[25] It is assumed that the price of oil will increase incrementally.

What is the expected job creation?

According to AGEE-Stat figures, the number of jobs in renewable energies in Germany increased from 160,000 to 280,000 between 2004 and 2008. The industry has promised to create some 500,000 jobs by 2020. This further doubling would ensure that renewable energy continue to be one of the few driving forces for jobs in Germany.

What is the avoided fossil fuel import?

By our calculations, avoided costs in 2006 were in the region of Euro 5.5 billion. By 2008 they were already Euro 7.8 billion. By 2020, this figure will have risen to Euro 49.6 billion.

What are the avoided external costs?

By our calculations, external costs amounting to Euro 7.5 billion were avoided in Germany in 2005 as a result of renewable energies. In 2008, the figure was already 9.2 billion. By 2020, it will have risen to Euro 12.3 billion.

Conclusion

In this roadmap we have shown that Germany can achieve much more than the target of 18% renewables by 2020 with considerable financial and ecological benefits, and it is only natural that it should therefore offer to other Member States to be a partner for flexible instruments and statistical transfers. Joint projects can increase potential even more. Nonetheless, we consider the opportunities for developing renewable energies to be so attractive also for other Member States that, generally speaking, they should – and should be able to – meet their own targets through domestic actions. The more all Member States promote growth of renewables, the quicker we will be able to accomplish a complete shift to renewable energies in the decades ahead.

Imprint:

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