Federal Republic of Germany

Progress report under Article 22 of Directive 2009/28/EC on the promotion of the use of energy from renewable sources

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0 INTRODUCTION AND SUMMARY

The German Federal Government recognises the 'energy transition' as a correct and necessary step on the road to a decarbonised, competitive industrial society of the future.

It is a substantial contribution to protecting the climate and is supported by the responsibility towards future generations.

With the energy transition, the Federal Government is pursuing a path towards a reliable, affordable and environmentally sound energy supply future. Renewable energy is to become the cornerstone of energy supply and, together with a consistent increase in energy efficiency and network expansion, and a new, flexible electricity market, is to ensure security of energy supply in a cost-effective manner.

The energy transition will make Germany and its economy less dependent on ever-scarcer fossil raw materials and will at the same time contribute to the security of energy supply. It creates new sources of growth with significant potential for job creation and can act as a catalyst for innovation, new technology and the modernisation and digitalisation of the economy as a whole.

Three objectives drive Germany's energy policy: security of supply, affordability and environmental compatibility. This three-pronged approach to energy policy is based on the Federal Government's energy concept from 2010 and the energy transition resolutions passed by the German Bundestag in 2011. The expansion of renewable energies in the electricity sector and in the heating and cooling sector is a cornerstone of the energy transition.

To date, it has been laid down in law that the proportion of gross electricity consumption supplied from renewable energies should increase to 40 to 45 % by 2025, to 55 to 60 % by 2035 and to at least 80 % by 2050[1]. Under the coalition agreement signed in March 2018, the new Federal Government is striving to achieve a proportion of renewable energies of approximately 65 % by as early as 2030. Renewable energies will therefore play a key role in electricity generation in both the medium and long term. The electricity industry thus makes a vital contribution to climate protection and to the environmental compatibility of the energy economy overall. Renewable energies will therefore continue to provide a considerable, ever-increasing, contribution to electricity supply in Germany than

1 The national targets in Section 1 of the Renewable Energies Act (EEG) are not directly comparable to the figures reported under the National Renewable Energy Action Plan (NREAP) and listed in the progress report, as they are not subject to the calculation rules in accordance with Directive 29/2009/EC.

brown coal. On the morning of 1 January 2018, almost 100 % of the energy consumption in Germany was provided by renewable energies. Furthermore, in the heating and cooling sector the proportion of renewable energies is intended to increase to 14 % by 2020, in accordance with the Renewable Energies Heat Act (EEWärmeG). It is moreover intended for existing building stock to be virtually climate-neutral by 2050.

Overall, the proportion of the gross final consumption of energy from renewable energies in Germany during the reporting period increased from 13.8 % in 2014 to 14.8 % in 2016 (according to the calculation rules under Directive 2009/28/EC). In so doing, the normalised proportion of gross electricity consumption from renewable energies in the reporting period even rose from 28.1 % in 2014 to 32.2 % in 2016.

The growing proportion of renewable energies requires a transition of the entire energy supply system. Firstly, the electricity markets have to adapt to the growing proportion of renewable energies by providing flexibility, among other things. Secondly, the renewable energies also have to become integrated in the electricity markets, by providing ancillary services for the electricity supply system for example. In addition, the expansion of the network in line with demand is one of the top priorities in order to be able to integrate renewable energies into the electricity system to a greater extent.

The transition to mandatory direct marketing and competitive calls for tender for the amount of funding in Germany were two important steps for further integration of renewable energies in the market and ensuring a reliable and predictable expansion path for better synchronisation with the network expansion and the rest of the electricity supply.

As a result of the calls for tender, competition for the most cost-effective energy plants and sites has opened up. Consequently, a considerable decrease in contract award values was observed. In photovoltaic power, the average volume-weighted contract award value dropped from the first bidding round of the pilot call for tender in April 2015 from 9.17 ct/kWh to 4.29 ct/kWh in the last bidding round in 2017 under the 2017 EEG. In the case of on-shore wind energy, the volume-weighted contract award value, based on a 100 % site, fell from 5.78 ct/kWh in the first bidding round in May 2017 to 3.82 ct/kWh in the third bidding round in 2017. At the end of 2016, the average payment for electricity from wind energy was still at scarcely 7 ct/kWh. Community energy companies accounted for more than 95 % of the contract award amounts from the first three calls for tender in the case of on-shore wind energy. In 2017, community energy

companies had two advantages over other stakeholders in the tender procedure: firstly, unlike other providers, they could submit a bid for a wind farm even without approval and then obtained an extended implementation period. Secondly, the amount of funding was not calculated according to the bid price, as was the case for the other stakeholders, but according to the highest successful bid. Owing to the long implementation period, community energy companies could thus offer prices that were not competitively viable for projects that were further advanced in terms of planning. The strong dominance of community energy companies is accompanied by the risk that a gap is created in the expansion of on-shore wind energy as a result of the extended implementation period and an increased implementation risk due to the possibility of participation without approval and exceptions in the contractual penalties for non-performance. In summer 2017, the legislator reacted to this development and temporarily restricted the privileges for community energy companies. According to the coalition agreement, the new Federal Government will in future also ensure a diverse range of stakeholders but only allow approved projects to participate in calls for tender. Only in the call for tender for biomass in September 2017 does the low volume of bids (33 % based on the volume of 122 MW put out to tender) reflect a low intensity of competition. This also had an effect on the bid values and contract award values. The bid values ranged from 9.86 ct/kWh to 16.9 ct/kWh. The volume-weighted average of the contract award values in the biomass call for tender for the volume of 27.55 MW put out to tender was 14.3 ct/kWh and was thus near to the highest values. These values were 14.88 ct/kWh for new plants and 16.9 ct/kWh for existing plants.

The implementation rate is an important indicator for successfully conducted calls for tender: for the first three rounds of the photovoltaic energy pilot calls for tender, the implementation rate is between 92 % (rounds 2 and 3) and 99 % (round 1).

Another important step was the partial cross-border call for tender of renewable energy volumes in the context of cooperation agreements with our neighbours. The expansion of renewable energy has therefore also been integrated on a cross-border basis.

In the reporting period, the Federal Government has moreover further developed the electricity market in order to make it fit for the increasing proportions of fluctuating renewable energies from the wind and sun.

The Electricity Market Act of 30 July 2016 set the course for an electricity market 2.0, that is to say for an electricity market committed to free price signals, shorter

electricity products, the removal of obstacles to flexibility and a free competition for flexibility options in an integrated European internal market, in order to efficiently safeguard security of supply and improve the integration of renewable energies. This reform of the electricity market follows a comprehensive green paper and white paper process in which we have had in-depth discussions with all stakeholders with regard to the effects of the new electricity market design, for the first time also with regular exchange with our European neighbours. In this respect, Germany has originated the format of the ‘electricity neighbours’, in which the 12 neighbouring countries regularly discuss their energy policies and have agreed to work together.

The challenge for the next few years lies in particular in system integration, i.e. making the networks fit for the increasing proportion of renewable energy, and to better coordinate the expansion of renewable energy and network expansion with one another. This includes further speeding up the network expansion, improving the utilisation of the existing networks, better managing renewable energies on a regional basis and reducing internal bottlenecks by means of further measures.

The Federal Government has made enormous strides in this respect too in recent years. For example, 65 routes with approximately 8 000 km of lines were defined as a priority and the planning and approval were fast-tracked by law. 2 600 km of this was expanded as the great direct-current north-south highway. This will significantly improve electricity exchange and also considerably reduce loop-flows to our neighbours. Many of these lines were laid as buried cables to increase public acceptance.
Overall, Germany is investing approx. EUR 60 billion up to 2030 to expand the networks and thus clear the path for the energy transition and electricity trading in Europe.

In all of this, the cost-effective supply for both consumers and for the economy must be kept in mind at all times.

Specifically:

The Renewable Energies Act (*Erneuerbare-Energien-Gesetz*, EEG) is the key instrument for achieving the objectives relating to the expansion of renewable energies in the electricity sector. In recent years, adaptations have been made on an ongoing basis to the rapidly accelerating development of renewable energies. Already by means of the amendment to the EEG in 2014, costs were limited, the expansion of renewable energies has been managed in a methodical manner and renewable energies have been further introduced onto the market.

Since then, a range of instruments have been used to manage the volumes and to focus the extension of renewable energies on cost-effective technologies. Overall, the costs for achieving the expansion targets are thus coming down and the energy transition is becoming more predictable for all stakeholders involved. In particular, renewable energies have been introduced gradually into direct marketing and thus onto the market as a result of the amendments to the Renewable Energies Act (EEG) over the past few years. This is one way in which it has been possible to successfully push forward with the EEG 2014. With increasing market integration, renewable energies are contributing towards security of energy supply. In addition, with the EEG 2014, the next step has been taken with a view to switching the funding system in the future to competitive calls for tender. This was implemented by means of the EEG 2017. Now the payments received by renewable energies for operating their plants will in principle be determined on a competitive basis. The Federal Government is therefore carrying on the development begun in a logical manner: after the abolition of the physical roll-over by the compensation mechanism regulation 2009/10, the introduction of the optional market premium by the EEG 2012 and the introduction of mandatory direct marketing by the EEG 2014, the transition to calls for tender is the next and logical step for greater market closeness and competition for renewable energies. At the same time, this enables better management of the expansion and coordination with network expansion planning, improves planning certainty for the other stakeholders in the electricity industry and is in line with the approach of the European Union for funding of renewable energies that is closer to the market.

By means of the EEG 2017, calls for tender for biomass plants (from an installed capacity of more than 150 kW), for on-shore wind power plants and solar power plants (in each case from a capacity of more than 750 kW) and for off-shore wind power plants have been introduced. These are the volume carriers for the further expansion of renewable energies. As a result, in future more than 80 % of the generated electricity volume from new plants will be determined competitively by means of calls for tender. In so doing, the design of the tender procedure for the specific technologies was adapted in each case to the individual market conditions:

- The determination of the funding level for ground-mounted photovoltaic installations was already changed in 2015 to calls for tender by means of the Regulation on calls for tender for ground-mounted installations (FFAV). Initially, 400 MW per year were tendered and from 2017 the tender volume was fixed at 600 MW per year. The scope for ground-mounted installations was extended to the effect that the Federal Länder

were empowered to permit the awarding of contracts to installations on farmland or grassland areas in less-favoured regions by legal regulation in their regional territory.

- Calls for tender were also introduced in respect of on-shore wind power plants, with the exception of prototypes and installations up to 750 kW. In principle all installations which have approval under the emissions control act can take part. In 2017, the projects of community energy companies were exempt from the approval requirement. Alongside this, the model for geographical diversification of the wind energy expansion (reference yield model) was further developed and the maximum contract award volume was temporarily limited on a local basis in a network expansion area. This should achieve an extension of new wind power plants that is as nationwide as possible. The tender volume initially is 2 800 MW gross and from 2020 increases to 2 900 MW (gross). This ensures a constant and predictable expansion.

- Calls for tender were likewise introduced in respect of off-shore wind power plants. In order to ensure sufficient competition, the areas for future offshore wind farms in the central model have been preliminarily investigated by the government. At the same time, area planning and spatial organisation, plant approval, EEG funding and network connections have become better and more cost-effectively interrelated with one another. To that end, all the relevant regulations were combined into one act (Offshore Wind Energy Act). However, in order to take account of the long lead times for the construction of wind farms and network connections, this system change will only be effective for installations commissioned from 2026 onwards. The definition of the central model is intended to ensure planning certainty in good time for the industry for the period thereafter and avoid a ‘break in the thread’, that is to say an abrupt interruption of the expansion of offshore wind energy, in the case of this still young technology. For the transition period, the annual expansion is managed by means of tenders, in which already planned and approved wind farms can participate. For that purpose, two bidding rounds will be conducted for commissioning in the years 2021 to 2025.

- Calls for tender were likewise introduced for biomass plants with an installed capacity of more than 150 kW. The tendering system should provide not only new installations and also particularly efficient existing biomass plants, with a perspective of financial continuity. In the period up to 2024, the previous funding will come to an end for a total of

approximately 500 MW biogas plants. Therefore, the tender volume was fixed such that it enables a fair chance of participation to existing biogas plants with sufficient lead time in terms of accounting and also enables an extension of new installations. Installations for solid biomass can also participate in the calls for tender. Unlike for the other technologies, the *de minimis* limit for tenders is 150 kW in the case of biomass plants.

A cornerstone for European integration of the EEG is the partial opening for cross-border tenders. The EEG 2017 provides for 5 % of the annual capacity to be installed to be put out to cross-border tender and thus to be opened up to participation by plants in other EU Member States. At the same time, a requirement of the European Commission's environmental protection and energy subsidy guidelines is fulfilled thereby. A prerequisite for participation by foreign plants is that an international agreement exists with the partner country, that the opening corresponds to the principle of reciprocity and that the electricity is physically imported, that is to say that a comparable effect on the German electricity market can be demonstrated. This should not lead to a restriction of the European electricity business.

The first successful cross-border tenders were carried out in the fourth quarter of 2016 with the partner country Denmark. Both Denmark and Germany each conducted one tender for photovoltaic installations, in which in each case installations with sites in both countries were able to take part. In the German tender, with a volume of 50 megawatts, five projects with a site in Denmark were successful. For more information on cross-border tenders under the EEG, see Chapter 11.1.

In the heating and cooling sector, the proportion of renewable energies should increase to 14 % by 2020 according to the Renewable Energies Heat Act (EEWärmeG). Furthermore, a virtually climate-neutral existing building stock is intended to be achieved by 2050. In the Energy Efficiency Strategy for Buildings (ESG) from 2015, it is stated that this goal is only possible by a combination of an increased use of renewable energies and an increase in the energy efficiency of buildings. The 'Efficiency First' principle also applies for the building sector. The proportion of renewable energies in final energy consumption in the heating and cooling sector also needs to be increased further by a considerable amount after 2020 to 2050, in order to achieve the goal of a virtually climate-neutral building stock. On the basis of the target corridor of the ESG it is shown, as a function of the energy efficiency level, in which area the proportion of renewable energies for the building sector has to move in order to achieve the targets.

A number of measures were implemented to support the transformation process in the heating and cooling sector, namely:

- The Renewable Energies Heat Act, which came into force in 2009 and was revised in 2011, provides that building contractors in the case of new builds obtain heat proportionately from renewable energies or compensating measures such as providing additional insulating measures or using cogeneration/district heating.

- The Market Incentive Programme for promoting the use of renewable energies in the heating market (MAP) has been enshrined in the Renewable Energies Heat Act since 2009. The support programme has promoted the installation of different technologies in the sector of renewable energies in the building sector. By means of the amendment to the MAP funding guidelines in April 2015, the funding was expanded (e.g. by yield-dependent funding in the case of solar thermal power plants) and opened up to the commercial sector to a greater extent. In 2016, approx. EUR 182.3 million were paid to approx. 68 000 renewable heating installations in the MAP funding part of the investment subsidies via the Federal Office of Economic Affairs and Export Control (*Bundesamt für Wirtschaft und Ausfuhrkontrolle*, BAFA). In addition, in the KfW section of the MAP (KfW Programme Renewable Energies Premium) repayment subsidies in the amount of approx. EUR 41 million in conjunction with low-interest KfW loans in the amount of approx. EUR 106 million was newly approved for larger, multi-year projects such as heating networks with renewable energies, biomass heating plants, deep geothermal plants etc. in 1 463 funding cases.

- With the CO_2 Building Renovation Programme, energy-efficient construction and renovation with low-interest loans and repayment subsidies and grants are being promoted. The funds for the programmes handled via the KfW were stabilised up to 2018 at a level of EUR 2 billion a year. Furthermore, in 2015 the funding was extended to the sector of non-residential buildings.

The Energy Efficiency Incentive Programme (APEE) which was implemented in 2016 is part of the National Action Plan for Energy Efficiency. With the heating and ventilation package, which was integrated in the CO_2 building renovation programme and in the MAP, the existing funding landscape has been strengthened. As a further component of the APEE, the introduction on the market of innovative fuel cell heating for new builds and existing buildings has

been funded since August 2016. From 2016 to the end of 2017, around 90 000 funding commitments had already been given in the APEE.

In accordance with the requirements of Directive 2009/28/EC, this report focuses on the period from 1 January 2015 to 31 December 2016.

Renewable Energies

Overall, the consumption of energies from renewable sources in Germany in the period from 2005 to 2016 rose from a total of 15 133 ktoe (oil equivalent) to 33 195 ktoe (+119 %). Whilst the electricity sector showed the highest annual growth rate for the use of renewable energies (approx. 10.5 %), overall between the years 2005 and 2016 there was an average growth rate for the consumption of renewable energies of approx. 7.4 % per year. In total the proportion of renewable energies in the gross final consumption of energy in Germany in 2016 was 14.8 % and thus above the value of 14.4 % forecast in the National Action Plan for Renewable Energy (NREAP). By 2020, the proportion in gross final consumption of energy is intended to be at least 18 %.

The normalised proportion of renewable energies in gross **electricity** consumption increased in the reporting period from 28.1 % in 2014 to 32.2 % in 2016, at approx. 185 TWh. Electricity generation from renewable energy sources thus surpasses the estimates of the NREAP for 2016 (168 TWh) by almost 10 %. In the reporting period, in particular the strong growth in the sector of onshore wind energy and the increasing dynamics in the offshore wind energy sector have been contributing factors. The expansion of photovoltaic power (PV) likewise significantly exceeded the forecasts of the NREAP in the years up to 2012. However, from 2014 onwards the PV growth was below the NREAP estimates, with the result that the overall installed capacity then progressively approaches the estimated values in the NREAP. The very high increase in biogas plants from 2009 to 2014 in comparison with the estimates in the NREAP has declined considerably in the reporting period.

The gross final consumption of energy for **heat** from renewable energies (without the biogenic proportion of municipal solid waste) was in both reporting years somewhat above the estimate in the NREAP (in 2015 at 12 714 ktoe as compared with the NREAP estimate of 12 163 ktoe and in 2016 at 13 142 ktoe as compared with the estimate of 12 617 ktoe). The increase since 2005 is attributable primarily to the continuous expansion of the use of solid and gaseous biomass. In particular the externally used heat from biogas plants was above the NREAP forecasts. The use of ambient heat and near-surface geothermal energy by means of heat pumps also developed to a greater extent than expected in the

NREAP. By contrast, the expansion of solar thermal energy and deep geothermal energy grew at a rate below the expectations of the NREAP.

The volume of renewable energies in the **transport** sector in the reporting years were below the values of the last reporting period (2013: 2 932 ktoe; 2014: 3 041 ktoe), with 2 809 ktoe in 2015 and 2 832 ktoe in 2016. The consumption of biodiesel (including HVO) and bioethanol was below the assumptions made in the NREAP. On the other hand, the use of biofuels based on residues or waste significantly exceeded the values forecast in the NREAP, even after the discontinuation of the double counting.

The present data for the reporting year 2015 and 2016 are in part preliminary in nature. In the next progress report, the Federal Government will report any values that may have been updated.

Climate protection and socio-economic effects of renewable energy

In 2015, the use of renewable energy helped to prevent emissions totalling 158 million tonnes of CO_2 equivalents ($CO_{2\ eq}$), and roughly 160 million tonnes $CO_{2\ eq}$ in 2016. The largest reduction in greenhouse gases in both years of the reporting period came in the electricity sector, with in each case approx. 119 million tonnes $CO_{2\ eq}$. In the 'heating and cooling' sector, the use of renewable energy sources resulted in greenhouse gas emissions being avoided in 2015 and 2016 in the amount of 33 and 34 million tonnes $CO_{2\ eq}$, respectively. In the transport sector (without fuel consumption in agriculture, the building industry and the military), the estimated greenhouse gas savings in both of the reporting years were around 6 and 7 million tonnes $CO_{2\ eq}$, respectively (without taking into account indirect changes in land use).

As a resource-poor country, Germany imports the majority of the oil, natural gas and coal that it consumes. These fossil primary energy carriers are being increasingly replaced by renewable energy sources and thus lower Germany's import demand. Without renewable energies, the import demand for fossil fuels in the reporting period would be higher. In 2015, in absolute terms, imports of fossil energy carriers in the sum of EUR 8.8 billion were avoided and thus saved. This corresponds to the previous year's value (DLR et al. 2016). There are no estimates available for 2016.

Employment in the renewable energy sector in Germany stabilised overall in the reporting period. For 2016, around 339 000 people were employed in this sector (329 000 in 2015). A positive evolution was recorded in particular in the sectors of onshore and offshore wind energy. However, positive trends were also

observed in the biogas sector and the two heat technologies, near-surface geothermal energy and small biomass plants. By contrast, a regressive trend could be seen in all segments of solar technologies and in the hydropower and biomass (heating) power plants industry.

Social acceptance of the energy transition and the debate on the affordability of energy for citizens and industry continue to play an important role, as well as the question of the diversity of stakeholders. The affordability of energy for citizens and industry must therefore be safeguarded as the use of renewable energy expands, as must diversity of stakeholders, security of supply and compatibility with national climate protection goals. The amendments to the EEG in recent years – for instance most recently also the passage of the EEG 2017 – have been precisely for this purpose.

Reporting on the Federal Government's Biomass Sustainability Regulations

In its Biomass Sustainability Regulations (Section 64 of the Biofuel Sustainability Regulation [Biokraft-NachV] and Section 72 of the Biomass Electricity Sustainability Regulation [BioSt-NachV]), Germany has undertaken to report to the European Commission on the compliance with the requirements of these regulations within the scope of the progress reports. This is in addition to the template supplied in Section 14 of this report and thus falls outside the reporting obligation relating to the progress report itself.

Reporting as part of the 'Energy for the future' monitoring process

In autumn 2011, the Federal Government launched its own monitoring process called 'Energy for the future'. This involves regular reviews of the objectives of German energy policy and of progress in attaining its targets. The process has no end-date. An annual monitoring report presents the facts and progress in implementing the measures. Every three years, starting in 2014, a comprehensive progress report will be produced, based on data covering several years and providing an opportunity for deeper analysis. The monitoring process is supported by research. An independent committee of four well-known energy experts is on hand to advise the Federal Government.

The developments in the area of renewable energy presented in this progress report are also described in the 'Energy for the future' monitoring process, albeit in a wider context also covering areas like energy efficiency, security of supply, network expansion, power plants and energy prices and costs. The fifth 'Energy of the future' monitoring report was published in December 2016.

Structure of the progress report

This progress report sets out the content required by Article 22 of EU Directive 2009/28/EC. The template provided was used to produce the progress report. Information going beyond the template, such as reports on the Biomass Sustainability Regulations and more detailed Annexes, is identified as such. Wherever was possible in the remaining time, the additional requirements of the revised template sent by the Commission on 31 October 2017 were taken into consideration. Only the required data for the resource assessment newly provided in Chapter 8 could not be filed in good time for the purposes of this progress report.

1 SECTORAL AND OVERALL SHARES AND ACTUAL CONSUMPTION OF ENERGY FROM RENEWABLE SOURCES IN THE PRECEDING TWO YEARS (2015 AND 2016)

(Article 22(1)(a) of Directive 2009/28/EC)

The statements below are largely based on values calculated using the SHARES tool[2] developed by Eurostat. They are essentially based on data from the working group on renewable energy statistics (AGEE-Stat (BMWi 2017f)), which rely substantially on official data and also on scientific surveys, models and in some instances on association data.

All data in this fourth progress report are in accordance with the definitions and calculation rules set out in the National Renewable Energy Action Plan (NREAP), as specified in Directive 2009/28/EC. The years 2015 and 2016 which form the focus of this report are identified as such.

Gross final consumption of energy (GFCE)

The GFCE in the individual sectors and the total GFCE are shown in Table A below. The total GFCE in Germany during the period from 2005 to 2016 remained largely constant, but significantly obscured by economic and temperature-related fluctuations. From 225 588 kilotonnes oil equivalent (ktoe) in 2005, it amounted to 219 773 ktoe in 2015, which was slightly warmer than 2005. In 2016, which was both warmer than 2005 and slightly colder than the previous year, the total GFCE was 223 953 ktoe. The GFCE in the ‘scenario with further efficiency measures’ (EFF) was estimated at 213 122 ktoe in 2015 and 210 089 ktoe in 2016 in the NREAP.

In the ‘heating and cooling’ sector, a temperature-related fall to 107 503 ktoe could be seen during the period from 2005 to 2015 (-6 248 ktoe, which corresponds to -5.5 %). The ‘heating and cooling’ GFCE was again somewhat higher, at 109 899 ktoe in 2016 (-3.5 % compared to 2005) as a result of the temperature conditions. The NREAP value (EFF) for 2016 was 101 581 ktoe.

The ‘electricity’ GFCE fell during the reporting period from 2005 to 2014 and in 2015 and 2016 the values of 50 962 ktoe and 50 989 ktoe, respectively, were around 3 % below that for 2005. In the NREAP (EFF), in 2016 a total of 50 229 ktoe was estimated.

[2] Eurostat (2017), SHARES Tool Manual. http://ec.europa.eu/eurostat/web/energy/data/shares

No significant changes were observed for the 'transport' final consumption of energy (FCE) in the period from 2005 to 2013. Since 2014, consumption rose to 54 619 ktoe in 2015 and 56 039 ktoe in 2016, resulting in an increase by 5.6 % in the overall period from 2005 to 2016. The corresponding value in the NREAP (EFF) is 50 655 ktoe.

Table A: Evolution of (gross) final consumption of energy in Germany in the heating and cooling, electricity and transport sectors and total gross final consumption of energy (in ktoe/year)

	2005	2010	2011	2012	2013	2014	2015	2016
GFCE Heating and cooling[3]	113 751	115 669	105 240	108 215	112 654	103 900	107 503	109 899
GFCE Electricity[4]	52 557	52 591	51 888	51 864	51 655	50 563	50 962	50 989
FCE transport[5]	53 046	51 347	52 131	52 065	53 140	53 959	54 619	56 039
GFCE Total[6,7 8]	**225 588**	**226 702**	**215 823**	**218 999**	**224 342**	**215 060**	**219 773**	**223 953**

Shares of renewable energy in the gross final consumption of energy

The total consumption of energy from renewable sources rose from 15 133 ktoe to 32 084 ktoe (+112 % compared to 2005) in the period from 2005 to 2015 and increased further to 33 195 ktoe in 2016 (+119 %) (Table 1a). Overall this represents an average annual growth rate of around 7.8 % in the years from 2005 to 2015 and 7.4 % in the period from 2005 to 2016. If the three sectors are compared, electricity displayed the highest growth rate during the period from 2005 to 2016, averaging around 10.5 % per year. The average annual increase

3 Final consumption of energy for all energy products, except electricity, for purposes other than transport, plus the consumption of heat for internal use in heat and power plants and heat losses in networks (points '2. Own use by plant' and '11. Transmission and distribution losses', p. 23 and 24 of the Regulation on energy statistics, OJ L 304, 14.11.2008).

4 Gross electricity consumption: gross national electricity production (including own generation), plus imports, minus exports and minus pumping.

5 Consumption in the transport sector according to the definition in Article 3(4)(a) of Directive 2009/28/EC.

6 As defined in Article 2(f) of Directive 2009/28/EC. This includes final consumption of energy plus network losses and own consumption of heat and electricity in heat and power plants (NB: not electricity used for pumped storage or for conversion in electric boilers or heat pumps in district heating plants).

7 The aviation clause in Article 5(6) has no bearing in the reporting period, as the share of aviation in the gross final consumption of energy in Germany in 2015 and 2016 was 4 % in each case, and hence below 6.18 %.

8 The GFCE Total is greater than the sum of the three sub-components on account in particular of the jet fuel only taken into consideration there.

between 2005 and 2016 was approx. 5.7 % in the ‘heating and cooling’ sector and around 3.4 % in the transport sector.

The electricity sector also contributed the most in absolute terms to the increase in the consumption of renewable energy. Gross electricity production from renewable energy rose by 10 739 ktoe from 2005 to 2016, an increase of around 199 %. Gross final consumption of energy from renewable sources for heating and cooling grew by 6 470 ktoe (+83 %) during the period from 2005 to 2016. Final consumption of energy from renewable sources in the transport sector rose by 854 ktoe (+43 %) during the same period.

From the gross final consumption of energy shown in Table A and the consumption of renewable energy in Table 1a, the shares of renewable energy in the GFCE for the individual sectors as shown in Table 1 can be derived.

Between 2005 and 2016, the share of renewable energy in the total GFCE rose from 6.7 %[9] to 14.8 %; 14.4 % was derived in the NREAP for 2016. The somewhat higher value compared to the NREAP is attributable to stronger growth in particular in the electricity sector and in the heating sector, which more than compensated for the smaller increase in the transport sector.

Specifically, the share of renewable energy in the ‘electricity’ sector, after applying the normalisation for wind energy and hydropower, stood at 32.2 % in 2016, 3.4 percentage points higher than the value in the NREAP. This is solely due to an increase in renewable electricity production. In the ‘heating and cooling’ sector, the forecast value in the NREAP (12.4 %) was also exceeded in 2016 with a share of renewable energy of 13.0 %. In the same year the contribution of renewable energy sources in the ‘transport’ sector (6.9 %) was below the estimate in the NREAP (7.1 %).

[9] Based on more recent statistical data, the share of renewable energy in the GFCE for Germany in 2005 (6.7 %), given here and in Table 1, differs from the value given in Annex I, Table A in Directive 2009/28/EC (5.8 %).

Table 1: The sectoral (heating and cooling, electricity and transport) and overall shares of energy from renewable sources[10]

	2005	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**… Targets 2020**
Renewable energy – heating and cooling[11] (%)	6.8	9.8	10.5	10.4	10.6	12.2	12.9	13.0	
Renewable energy – electricity[12] (%)	10.5	18.2	20.9	23.6	25.3	28.1	30.8	32.2	
Renewable energy – transport[13] (%)	4.0	6.4	6.5	7.4	6.9	7.2	6.6	6.9	10.0
Overall renewable energy share[14] (%)	**6.7**	**10.5**	**11.4**	**12.1**	**12.4**	**13.8**	**14.6**	**14.8**	**18.0**
Of which from cooperation mechanisms[15] (%)			0	0	0	0	0	0	
Surplus for cooperation mechanisms[16] (%)			3.2	3.9	2.9	4.3	3.3	3.5	
For information: Overall share of renewable energy according to the indicative trajectory given in Directive 2009/28/EC			8.2	8.2	9.5	9.5	11.3	11.3	18.0
Overall share of renewable energy according to National Action Plan (NREAP)		10.1	10.8	11.4	12.0	12.8	13.5	14.4	19.6

[10] Facilitates comparison with Table 3 and Table 4a in the NREAP.

[11] Share of renewable energy in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Article 5(1)(b) and Article 5(4) of Directive 2009/28/EC) divided by gross final consumption of energy for heating and cooling. The same methodology as in Table 3 of the NREAP applies.

[12] Share of renewable energy in the electricity sector: gross final consumption of electricity from renewable sources for electricity (as defined in Article 5(1)(a) and Article 5(3) of Directive 2009/28/EC) divided by total gross final consumption of electricity. The same methodology as in Table 3 of the NREAP applies.

[13] Share of renewable energy in the transport sector: final consumption of energy from renewable sources in transport (cf. Article 5(1)(c) and Article 5(5) of Directive 2009/28/EC) divided by the final consumption of energy in the transport sector of 1) petrol; 2) diesel; 3) biofuels used in road and rail transport and 4) electricity used in land transport. Electricity consumption from renewable energy in road transport is multiplied by 2.5 in accordance with Article 3(4)(c). The contribution of biofuels made from waste, residues, non-food cellulosic material, and ligno-cellulosic material carries twice the weight of other biofuels when verifying target attainment in the transport sector pursuant to Article 21(2).

[14] Share of renewable energy in the gross final consumption of energy. The same methodology as in Table 3 of the NREAP applies (row G in Table 1a divided by row 4 in Table A).

[15] In percentage points of overall renewable energy source share.

[16] The potential surplus for cooperation mechanisms in percentage points of the total share from renewable energy sources is simply the arithmetical difference from the minimum shares for the indicative trajectory given in Directive 2009/28/EC.

Table 1a: Calculation table for the renewable energy contribution of each sector to (gross) final consumption of energy (ktoe/year)[17]

		2005	2010	2011	2012	2013	2014	2015	2016
A)	*GFCE from renewable sources for the provision of heating and cooling*	7 768	11 297	11 019	11 284	11 958	12 652	13 817	14 238
B)	*GFCE from electricity from renewable energy sources*	5 387	9 390	10 652	12 045	12 839	13 995	15 458	16 126
C)	*FCE from renewable sources in the transport sector*	1 978	3 071	2 968	3 127	2 929	3 002	2 809	2 832
D)	***Gross total consumption of energy from renewable sources[18]***	**15 133**	**23 759**	**24 640**	**26 456**	**27 726**	**29 649**	**32 084**	**33 195**
E)	*Transfer of energy from renewable sources to other Member States*	0	0	0	0	0	0	0	0
F)	*Transfer of energy from renewable sources from other Member States and third countries*	0	0	0	0	0	0	0	0
G)	***Gross total consumption of energy from renewable sources after adjustment (D)-(E)+(F)***	**15 133**	**23 759**	**24 640**	**26 456**	**27 726**	**29 649**	**32 084**	**33 195**

Electricity sector

In the electricity sector,[19] the gross final consumption of energy for electricity from renewable sources, taking into consideration the normalisation rules in accordance with Annex II to Directive 2009/28/EC (normalised consumption) in 2016 (184 915 GWh) exceeded the estimate in the NREAP for 2016 (168 479 GWh) by nearly 10 %; in 2015 there was a difference of around 12 % (176 860 GWh versus 157 623 GWh).

Owing to the strong growth in the area of onshore wind energy in each of the two reporting years (2015: 3 677 MW, 2016: 4 163 MW), the total installed wind capacity at the end of 2016 of around 45.5 GW was a total of 10 GW higher than the NREAP. Also in the area of offshore wind energy, the two reporting years were characterised by strong momentum. For example, the added capacity in 2015 was a total of 2 289 MW and in 2016 a further 849 MW. By the end of

[17] Facilitates comparison with Table 4a in the NREAP. The differences in 'heating and cooling' and 'electricity' in Tables 1b and 1c result from the inclusion of biogenic municipal waste which is not reported there/does not need to be reported there.

[18] Article 5(1) of Directive 2009/28/EC states that gas, electricity and hydrogen from renewable energy sources should be considered only once. They must not be included in the calculation twice.

[19] The generation of electricity from the biogenic share of waste is not taken into account at this point but is included in the GFCE from renewable sources (Table 1a).

2016, offshore wind power plants with a total capacity of 4 132 MW had been installed (Table 1.b-i).

In 2016, the normalised total electricity production from wind energy (onshore and offshore) of 80 040 GWh was overall 15 457 GWh more than forecast in the NREAP (64 583 GWh) (Table 1.b-ii).

Whilst the increase in photovoltaic capacity up to 2012 took place significantly faster than in the NREAP, in 2015, at around 1.3 GW_p, and in 2016, at around 1.5 GW_p, it was considerably below the NREAP estimate (in each case 3.5 GW_p increase in 2015 and 2016). The installed capacity as at 31 December 2016 of 40.7 GW_p was still only 3.1 GW_p above the value in the NREAP. Electricity generation in 2016 was meanwhile more than 30 % above the estimate in the NREAP (29 148 GWh), corresponding to the installed capacity of 38 098 GWh.

Electricity production from biogas in the years 2009 to 2014 also saw a very large increase compared to the estimates in the NREAP (installed capacity in 2014: 5.4 GW compared to 3.0 GW in the NREAP). In the reporting years 2015 and 2016, however, there was only a small increase in capacity (in each case around 0.2 GW), in particular for increasing the flexibility of installations, that is to say thus scarcely increases electricity production.

Electricity production from solid biomass increased significantly with respect to 2005 and was at a similar level in both 2015 and 2016, whilst electricity production on the basis of liquid biomass – which is at a very low level – increased markedly since 2014.

Furthermore, at that time – as already pointed out in the previous reports – the estimates in the NREAP of installed capacity and electricity generation from hydropower were conservative to allow for uncertainties in the data available, and data adjustments were carried out at a later date (revised upwards). Therefore both the total installed capacity and the (normalised) electricity production are greater than projected in the NREAP.

Despite the great technical potential (UBA 2010), due to economic restrictions, geothermal electricity generation in Germany has developed more slowly than assumed in the NREAP (2016: 175 GWh in comparison to 534 GWh in the NREAP).

Renewable electricity supplies from cogeneration[20] again increased slightly and in 2016 reached a total of 30 891 GWh, a share of around 69 % of total cogeneration-enabled electricity provision from biomass.

Table 1.b-i ***Total actual contribution (installed capacity in MW) of each technology to the use of renewable energy sources in Germany in relation to the binding targets for 2020 and the indicative trajectories for the proportion of energy from renewable sources in the electricity sector[21]***

	2005	2010	2011	2012	2013	2014	2015	2016
Hydropower	**10 858**	**11 218**	**11 436**	**11 257**	**11 240**	**11 234**	**11 399**	**11 300**
non-pumped	4 134	4 252	4 469	4 451	4 434	4 424	4 577	4 573
< 1 MW	613	616	630	635	646	599	612	608
1 MW–10 MW	338	532	621	656	640	684	715	718
> 10 MW	3 183	3 104	3 218	3 160	3 148	3 141	3 250	3 247
pumped	5 648	5 811	5 811	5 650	5 650	5 654	5 666	5 540
mixed[22]	1 076	1 155	1 156	1 156	1 156	1 156	1 156	1 187
Geothermal	**0**	**8**	**8**	**12**	**24**	**24**	**26**	**29**
Solar	**2 056**	**18 007**	**25 917**	**34 077**	**36 711**	**37 900**	**39 245**	**40 716**
photovoltaic	2 056	18 005	25 915	34 075	36 709	37 898	39 243	40 714
concentrated solar power (CSP)	0	2	2	2	2	2	2	2
Tidal, wave, ocean	0	0	0	0	0	0	0	0
Wind	**18 248**	**26 903**	**28 712**	**30 979**	**33 477**	**38 614**	**44 580**	**49 592**
onshore	18 248	26 823	28 524	30 711	32 969	37 620	41 297	45 460
offshore	0	80	188	268	508	994	3 283	4 132
Biomass	**2 374**	**5 458**	**6 419**	**6 756**	**7 034**	**7 258**	**7 467**	**7 670**
solid biomass	1 218	1 500	1 554	1 558	1 623	1 589	1 592	1 600
biogas	1 096	3 548	4 520	4 921	5 148	5 437	5 643	5 839
bioliquids[23]	60	410	345	277	263	232	232	231
Total	**33 536**	**61 594**	**72 492**	**83 081**	**88 486**	**95 030**	**102 717**	**109 307**
of which in CHP:	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[20] Gross electricity production from cogeneration. This takes into account the electricity generation from cogeneration which is associated with cogeneration heat output to other consumers as well as the electricity generation from cogeneration corresponding to internal heat consumption (e.g. fermenter heating in biogas plants).

[21] Facilitates comparison with Table 10a in the NREAP. For greater clarity, Table 1b as shown in the template has been split into Tables 1b-i and 1b-ii.

[22] In accordance with new Eurostat methodology.

[23] Take into account only those complying with applicable sustainability criteria, cf. Article 5(1) last subparagraph of Directive 2009/28/EC.

Table 1.b-ii: Total actual contribution (gross electricity generation in GWh) of each technology to the use of renewable energy sources in Germany in relation to the binding targets for 2020 and the indicative trajectories for the proportion of energy from renewable sources in the electricity sector

	2005	2010	2011	2012	2013	2014	2015	2016
Hydropower[24]	**21 654**	**21 575**	**21 970**	**21 880**	**21 922**	**21 640**	**21 988**	**21 645**
non-pumped	20 620	20 860	21 412	21 374	21 405	21 249	21 704	21 389
< 1 MW	2 446	2 427	2 425	2 431	2 485	2 273	2 270	2 209
1 MW–10 MW	2 044	3 217	3 646	3 826	3 845	4 070	4 167	4 097
> 10 MW	16 960	15 988	16 092	15 853	15 799	15 594	15 919	15 719
pumped								
mixed	830	773	751	736	723	688	652	637
Geothermal	**0**	**28**	**19**	**25**	**80**	**98**	**134**	**175**
Solar	**1 282**	**11 729**	**19 599**	**26 380**	**31 010**	**36 056**	**38 726**	**38 098**
photovoltaic	1 282	11 729	19 599	26 380	31 010	36 056	38 726	38 098
concentrated solar power (CSP)	0	0	0	0	0	0	0	0
Tidal, wave, ocean	0	0	0	0	0	0	0	0
Wind[25]	**26 591**	**43 388**	**46 812**	**49 458**	**52 245**	**58 341**	**71 468**	**80 040**
onshore	26 591	43 273	46 487	48 898	51 364	56 809	66 415	70 980
offshore	0	176	527	807	1 155	1 867	7 040	12 171
Biomass	**11 102**	**29 560**	**32 839**	**39 580**	**41 146**	**43 290**	**44 543**	**44 958**
solid biomass	7 126	10 768	11 296	12 091	11 643	11 868	11 033	10 794
biogas[26]	3 861	17 431	21 189	27 238	29 234	31 113	33 073	33 703
bioliquids[27]	116	1 362	354	250	269	309	437	461
Total[28]	**60 630**	**106 280**	**121 238**	**137 323**	**146 402**	**159 425**	**176 860**	**184 915**
of which in CHP[29]	6 616	20 967	23 188	28 468	27 135	29 251	30 826	30 891

Heating and cooling sector

In the 'heating and cooling' sector, the consumption of renewable energy in 2015 of 12 714 ktoe was slightly higher than the estimate given in the NREAP (12 163 ktoe), and likewise in 2016 (13 142 ktoe versus 12 617 ktoe) (Table 1c). The main reason for the increase from 2005 was the expansion in the use of solid and gaseous biomass.

[24] Normalised in accordance with Directive 2009/28/EC and Eurostat methodology.

[25] Normalised in accordance with Directive 2009/28/EC and Eurostat methodology.

[26] including electricity generation from sewage treatment and landfill gas

[27] Only electricity generation from liquid biomass complying with the applicable sustainability criteria in Directive 2009/28/EC.

[28] Excluding hydropower generation in pure pump storage plants ('pumped')

[29] Gross electricity production from cogeneration. This takes into account the electricity generation from cogeneration which is associated with cogeneration heat output to other consumers as well as the electricity generation from cogeneration corresponding to internal heat consumption (e.g. fermenter heating in biogas plants).

The use of solid biomass (wood) to generate heat for private households was 5 846 ktoe in 2016, as compared to 5 845 ktoe in the NREAP, and thus accounted for around 45 % of the total consumption of renewable energies in the 'heating and cooling' sector. At 671 ktoe in 2015 and 2016, the further expansion of concentrated solar power was considerably below the estimates in the NREAP (741 ktoe in 2015; 842 ktoe in 2016). By contrast, at 890 ktoe in 2015 and 972 ktoe in 2016 the use of environmental heat and near-surface geothermal energy via heat pumps was above the NREAP forecast (800 ktoe in 2015 and 869 ktoe in 2016). The externally used heat from biogas plants was likewise above the NREAP forecast and has increased more than sixfold since 2005, in step with electricity production from biogas (1 675 ktoe in 2016). Analogously to the electricity sector, deep geothermal energy has continued to grow much more slowly than was assumed in the NREAP (100 ktoe in 2016, compared to 325 ktoe in the NREAP) (Table 1c).

Table 1c: ***Total actual contribution (final energy consumption30) from each technology to the use of renewable energy sources in Germany to meet the binding targets for 2020 and the indicative interim trajectory for the shares of energy from renewable sources in the heating and cooling sector (ktoe/year)*** [31]

	2005	2010	2011	2012	2013	2014	2015	2016
Geothermal[32]	**43**	**57**	**60**	**66**	**73**	**91**	**83**	**100**
Solar	**261**	**484**	**554**	**576**	**583**	**627**	**671**	**671**
Biomass	**6 618**	**9 553**	**9 035**	**9 117**	**9 476**	**10 042**	**11 069**	**11 399**
solid biomass	6 299	8 430	7 844	7 862	8 022	8 375	9 255	9 566
biogas	257	849	1 020	1 085	1 298	1 497	1 649	1 675
bioliquids[33]	61	275	171	170	156	170	166	158
Renewable energy from heat pumps[34]	**194**	**531**	**613**	**680**	**746**	**826**	**890**	**972**
- of which aerothermal	37	216	262	308	355	408	462	519
- of which geothermal	124	246	276	296	312	334	344	364
- of which hydrothermal	33	68	73	76	78	82	83	87
Total	**7 115**	**10 626**	**10 261**	**10 440**	**10 878**	**11 584**	**12 714**	**13 142**
of which district heating[35]	215	428	507	641	659	705	823	861
of which biomass in households[36]	4 506	6 079	5 379	5 517	5 634	4 892	5 317	5 846

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

[31] Facilitates comparison with Table 11 in the NREAP. The differences in 'heating and cooling' and 'electricity' in Tables 1b and 1c result from the inclusion of biogenic municipal waste which does not need to be reported there.

[32] Excluding low temperature geothermal heat in heat pump applications.

[33] Take into account only those complying with applicable sustainability criteria, cf. Article 5(1) last subparagraph of Directive 2009/28/EC.

[34] Includes only the renewable environmental heat harnessed by heat pumps according to Directive 2009/28/EC.

[35] District heating and/or cooling from total consumption of renewable energy for heating and cooling. The gross final consumption of energy in the form of heat from heating plants and cogeneration plants for general consumption is reported in the official energy statistics as district heat. The 'net' value is reported in line with the Shares tool, however.

Transport sector

The use of renewable energy in the transport sector (Table 1d) was 2 809 ktoe in 2015 and 2 832 ktoe in 2016.

In 2016 the consumption of biodiesel (including HVO) stood at 1 792 ktoe (2015: 1 790 ktoe), and in the case of bioethanol (including bio-ETBE), consumption was at 742 ktoe and 721 ktoe.

In the case of the other biofuels, current use is 32 ktoe for 2015 and 35 ktoe for 2016.

Even after the discontinuation of the double counting, the introduction of the GHG quota meant that biofuels based on waste and residues were used in significant quantities in the 2015 and 2016 reporting years. In 2015 this total amount was approx. 497 ktoe and in 2016 was 764 ktoe.

The amount of conventional biofuel was thus significantly below the estimated value in the NREAP and the amount of biofuels based on waste and residues was significantly above the estimate in the NREAP.

The largest share in this was represented by the waste edible oils and fats covered under Annex IX Part B to Directive 2009/28/EC (2015: 385 ktoe and 2016: 619 ktoe). On the other hand, fuels based on raw materials in accordance with Annex IX Part A to Directive 2009/28/EC were of comparatively low significance in 2015 and 2016 (see Chapter 8).

In comparison to this, the consumption of fuels that likewise can be counted to the sub-target in accordance with Article 3(4)(e) of Directive 2015/1513 was considerably higher (in the reporting period). The use of biofuels based on energy crops (Article 3(4)(d) of Directive 2009/28/EC) was 2 067 ktoe in 2015 and 1 783 ktoe in 2016.

The consumption of electricity from renewable sources in road transport fell to approx. 3 ktoe in 2016 (approx. 5 ktoe in 2015). The quantity of electricity from renewable sources used in rail transport in 2016 was 281 ktoe (241 ktoe in 2015).[37]

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[36] As share of total consumption of renewable energy for heating and cooling.

[37] The consumption of electricity from renewable sources in rail transport is determined by the same method as in the NREAPs: It was based on the national share of renewable energy in gross electricity consumption two years before the reporting year, which was in turn calculated from the normalised wind and hydro-electric power supplies for these years.

As before, the use of hydrogen/synthesis gas from renewable energy sources in the transport sector played only a very minor role; likewise there is no verified data on this.

Table 1d: ***Total actual contribution from each renewable energy technology in Germany to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable resources in the transport sector (ktoe/year)***[38, 39, 40]

	2015	2016
Bioethanol	742	721
Biodiesel (FAME)	1 627	1 632
Hydrotreated Vegetable Oil (HVO)	163	160
Biomethane	30	32
Fischer-Tropsch diesel		
Bio-ETBE	included in bioethanol	included in bioethanol
Bio MTBE	-	-
Bio-DME	-	-
Bio-TAEE	-	-
Biobutanol	-	-
Biomethanol	-	-
Pure vegetable oil	2	3
Total sustainable biofuels	**2 564**	**2 548**
Of which		
sustainable biofuels produced from feedstock listed in Annex IX Part A	6	7
other sustainable biofuels eligible for the target set out in Article 3(4)(e)	106	138
sustainable biofuels produced from feedstock listed in Annex IX Part B	385	619
sustainable biofuels for which the contribution towards the renewable energy target is limited according to Article 3(4)(d)	2 067	1 783
Imported from third countries	n/a	n/a
Hydrogen from renewables	**0**	**0**
Renewable electricity	**246**	**284**
Of which		
consumed in road transport	5	3
consumed in rail transport	241	281
consumed in other transport sectors	0	0
others (Please specify)	0	0
others (Please specify)	0	0
TOTAL	**2 809**	**2 832**

[38] Amended reporting on the use of sustainable biofuels for the period 2011-2016; a direct comparability with the data published by the BLE in the context of Section 63 of the Biofuel Sustainability Regulation is not possible inter alia because of the different method of taking account of biofuels used outside of the transport sector.

[39] Facilitates comparison with Table 12 of the NREAPs.

[40] For biofuels take into account only those compliant with the sustainability criteria, cf. Article 5(1) last subparagraph.

2 MEASURES TAKEN IN THE PRECEDING 2 YEARS AND/OR PLANNED AT NATIONAL LEVEL TO PROMOTE THE GROWTH OF ENERGY FROM RENEWABLE SOURCES TAKING INTO ACCOUNT THE INDICATIVE TRAJECTORY FOR ACHIEVING THE NATIONAL RENEWABLE ENERGY TARGETS AS OUTLINED IN THE NREAP

(Article 22(1)(a) of Directive 2009/28/EC)

(Reporting pursuant to Article 22(1)(a) of Directive 2009/28/EC is covered in detail in subparagraphs (b)-(f) of Directive 2009/28/EC)

Table 2: Overview of all key strategies and measures

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
Renewable Energies Act [EEG]	Regulatory	Increased share of renewable energy in electricity supply	Investors, private households	Existing	Start: April 2000 (as a successor to the Electricity Feed-In Act which has been in place since 1991); amendments in 2004, 2009, 2012, 2014 and 01.01.2017; the Act has no end-date	EEG amendment of 2017 • Market premium model with mandatory direct marketing is retained. The amount of the market premium is now determined predominantly on a competitive basis for photovoltaic, onshore wind, biomass and offshore wind by way of sector-specific tenders. • Tenders take place on a cross-border basis to a certain extent. • Concrete expansion strategies for wind power, photovoltaic power (PV) and bioenergy are accompanied by the annually provided tender volumes. • Pilot tender procedures allowing competition between PV and onshore wind are created in the EEG 2017 and in order to trial cross-sector tenders from 2018 to

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
						2020. • Certain (small) stakeholders are privileged in the call for tender in order to gain diversity of stakeholders and acceptance of renewable energy production plants. • Regional control mechanisms are used to take account of the costs for grid and system integration (e.g. extension of upper limit in network expansion areas, regulations for offshore wind in the Offshore Wind Power Act). • Ensuring the extension by means of contractual penalties which are safeguarded by the deposit of securities. • Introduction of regional certificates for supported directly marketed electricity.
KfW special programme for 'Offshore wind energy'	Financial	To speed up the expansion of offshore wind energy	Project companies, investors	Existing	Start: June 2011; programme ends when the funding volume has been used up.	Support for the financing of max. 10 offshore wind farms Total loan volume: EUR 5 billion
Grid Expansion Acceleration Act [NABEG]	Regulatory	To speed up the approval process for grid expansion (electricity)	Transmission system operator	Existing	In force since 05.08.2011, amended 20.12.2012 27.07.2013 Entry into force of the Regulation on the Allocation of Planning Approval. Amended on 21.12.2015 (by Article 6 of the Act to Amend Provisions of the Law	Introduction of a Federal Sectoral Plan for extra-high-voltage lines crossing federal state or national borders, in which there is an overriding public interest, and new provisions for a planning approval procedure for such lines Transfer of responsibility for planning approval for

Name and reference of the measure	*Type of mea-sure**	*Expected result***	*Targeted group and/or activity****	*Exist-ing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
					on Construction of Energy Lines) and on 13.10.2016	NABEG lines to a federal authority (BNetzA) Bid to achieve as straight a path as possible for a route corridor The Offshore Federal Sectoral Plan, and from 2019 the Land Development Plan of the Offshore Wind Energy Plan, are to be taken into account in the case of offshore connection lines.
Energy Line Expansion Act [EnLAG]	Regulatory	To speed up the electricity network expansion as a result of this so-called plan justification being laid down in law	Transmission system operators	Existing	Entered into force on 26.08.2009 Amended on 21.12.2015	Definition of 22 grid expansion projects (originally 24) that are intended to be implemented as a top priority – start grid vs then further projects under the Federal Requirements Plan Act Six (originally four) AC projects may be implemented on sub-sections as pilot projects for the use of underground cables on the extra-high-voltage level (to collect experience with these new kinds of technologies). Mandatory underground cabling under certain conditions (minimum distances from housing developments, species and territorial conservation and the crossing of large rivers).
Federal Requirements Plan Act [BBPlG]	Regulatory	To speed up further electricity grid expansion – for incorporation of electricity from renewable energy sources, for the	Transmission system operators	Existing	Entered into force on 27.07.2013 Amended on 21.12.2015	Definition of at present 43 network expansion projects as the Federal Requirements Plan, for which the energy need and the urgent requirement for ensuring

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
		interoperability of electricity networks within the European Union, for the connection of new power stations or for avoiding structural network bottlenecks, also so-called plan justification as in the EnLAG				a secure and reliable network operation exist. Underground cables for lines for extra-high-voltage transmission, priority for underground cabling for direct current plus five further pilot processes for three-phase current.
System Stability Regulation [SysStabV]	Regulatory	Solution to the '50.2 Hz and 49.5 Hz problem' (risk of simultaneous disconnection of RE installations)	Distribution network operators	Existing	Regulation amending the System Stability Regulation of 09.03.2015 Entered into force on 14.03.2015 Amended on 14.09.2016	Provisions on the upgrading of renewable energy and cogeneration plants so that these plants no longer instantly disconnect from the network in the event of under-frequency of 49.5 Hz or over-frequency of 50.2 Hz. Addition of landfill gas, sewage gas and mine gas
Act to Amend Provisions of the Law on Construction of Energy Lines [EnLBRÄndG]	Regulatory	Amendment of provisions of the Law on Construction of Energy Lines (EnWG, VwGO, ARegV, EnLAG, NABEG, BBPlG, UVPG)	See the relevant Acts	Existing	Entered into force on 31.12.2015	See the relevant Acts.
Energy Management Act [EnWG]	Regulatory	Implementation of EU Regulations under the third internal market package for energy, incl. unbundling	Energy supply companies	Existing	Energy Management Act of 7 July 2005, amendment of 14.12.2012, amended 01.08.14 Amended on 21.12.2015	Specification of unbundling (Section 6) Changes in the grid connection for offshore wind power plants (Section 17d) Establishment of a register of all plants at the Federal Network Agency (Section 53b) Two-year cycle for network development

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
						planning for the electricity and gas sectors (previously annual)
Act relating to measuring point operation and data communication in smart energy networks	Regulatory	Legal basis for economically viable introduction of 'smart measuring systems'	Energy suppliers, network operators, end consumers	Existing	Entered into force on 30.08.2016	At the same time the power to issue statutory instruments in the EnWG was rescinded.
Regulations on the operation of an electronic register of regional certificates	Regulatory	Implementation of Section 79a EEG 2017	Electricity market	In development	Starts at the latest on 1 January 2019.	• Operationalisation of the requirements of Section 79 EEG in the form of non-statutory regulations. • Increase local acceptance of the energy transition by the allocation of funded electricity volumes to end consumers in the region.
Regulation on calls for tender for ground-mounted installations [FFAV]	Regulatory	Implementation of Sections 55 and 88 EEG 2014	Electricity market investors	implemented, expired	FFAV entered into force on 06.02.2015, valid for 2015 and 2016	Legal framework for the change in funding for ground-mounted installations from fixed rates of support to tenders, pilot tender procedures
Regulation on the central directory of energy data (Regulation on a register of market master data; MaStRV)	Regulatory	Creation of a central electronic directory of energy data	Electricity market	Existing	The MaStRV entered into force on 1 July 2017; start of the regular register operation intended for end of 2018	• Operationalisation of the requirements of Sections 111e and 111f EnWG in the form of non-statutory regulation. • Creation of an extensive database of all master data for the electricity and gas market. •Pooling of reporting obligations; transparency of the energy market.
Gas Network Access Regulation	Regulatory	Promotion of biogas fed into the natural gas	Investors, operators of	Existing	Entered into force on 09.09.2010; last amended by regulation	The amendments are general in nature and do not specifically relate to

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
[GasNZV]		network by specific regulations in this regard in Part 6	biogas plants		of 11 August 2017 with staggered entry into force of the amendments	biogas: • Withdrawal of the reporting obligation of the Federal Network Agency in relation to feeding-in of biogas • Withdrawal of the provisions relating to measurement which is now governed in the Act on Measuring Point Operation.
Cogeneration Act [KWKG]	Regulatory	New construction, maintenance and modernisation of cogeneration plants and upgrading of conventional plants and new construction of heating and cooling networks and storage systems	Power plant operators, energy suppliers, investors	Existing	Has existed since 2002; amendments 2008, 2012, 2015; last amendment of 17.07.2017, in force since 25.07.2017	2016 and 2017 KWKG amendments: • The 25 % expansion target for total network electricity production was amended to 110 TWh by 2020 and 120 TWh by 2025. With the amendment of the target size, the Federal Government is also deviating from the commitments made in the coalition agreement. • With the 2016 KWKG amendment, the funding cap was increased to EUR 1.5 billion and the funding framework extended until 2022. • Cogeneration plants that replace a coal-fired cogeneration plant receive a bonus. • Existing gas cogeneration plants above 2 MW that are threatened with closure receive limited-term support up to 2019. • The funding levels for new and modernised gas cogeneration plants

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
						overall were increased significantly with respect to the 2012 KWKG. • Introduction of a limit on the funding for own consumption to small plants (up to 100 kW) and energy-intensive operations. • With the 2017 KWKG amendment, tender procedures were introduced for cogeneration plants in the capacity range between 1 MW and 50 MW and for innovative cogeneration systems. • Harmonisation of the privileging of KWKG and EEG levy, adjustment of the limit of costs of electricity-cost-intensive industry based on the Special Equalisation Scheme in the EEG.
Renewable Energies Heat Act [EEWärmeG]	Regulatory	Increased share of renewable energy in heating and cooling supplies (priority: new buildings)	Building owners (private and public)	Existing	Has existed since Jan. 2009; the act has no end-date.	Publication of the second Progress Report on the EEWärmeG at the end of 2015, in which in particular the status of the market introduction of plants for generation of heating and cooling from renewable energy sources is presented.
Market incentive programme on the promotion of the use of renewable energy in the heating market [MAP]	Financial	Increased investment in plants that use renewable energy sources for generation of heating or cooling and in heating networks and heat	Private households, undertakings, independent professionals, municipalities, other legal persons governed by	Existing, reorganisation of funding strategy up to 2019 planned	Directive has already existed in various versions for many years, last significant amendment of the funding directive on 01.04.2015.	The MAP last underwent significant amendment in spring 2015. Funding was expanded, improved and scaled to a greater extent according to the efficiency of the plants. Furthermore, new funding options were

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
		accumulators	private law			created, such as the yield-dependent funding for solar thermal energy and funding for particularly efficient heat pumps in new builds.
KfW support programmes	Financial	Energy efficiency measures in buildings	Private households, housing associations, commonhold associations, commercial companies, municipalities, municipal companies, social bodies	Existing	No end-date specified for measures	Improvement of the support conditions, strengthening of quality assurance, development of support provision for non-residential buildings: new programmes for energy-efficient renovation of commercial buildings and the construction of new commercial buildings and expansion of the Existing renovation programmes to include new-build support for buildings for municipal and social bodies
KfW support programmes for PV battery storage devices	Financial	Support for feeding of PV plants that are beneficial to the system and market and technology development of stationary battery storage systems	Private households, independent professionals, farmers, commercial companies, and companies in which municipalities, churches and charities are involved.	Existing	Term of the programme from 01.03.2016 to 31.12.2018	
Energy Efficiency Incentive Programme (APEE)	Financial	Part a): Energy efficiency measures in buildings Part b): Increased investment in plants that use renewable energy sources for generation of heat Part c): Support for	Part a): Private households, commonhold associations of private individuals Part b): Private households, companies, independent professionals, municipalities,	Existing	No end-date specified for the measures	As an alternative to the fiscal support planned in the NAPE, since 2016 funds in the amount of EUR 165 million p.a. have been provided to the 'Energy Efficiency Incentive Programme (APEE)'. The programme started on 01.01.2016. It supplements and enhances the Existing funding landscape and

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
		the market introduction of fuel cell heating	other legal persons governed by private law Part c): Private households, commonhold associations of private individuals, independent professionals, domestic and foreign companies, contractors, municipalities, municipal companies and municipal special-purpose associations, non-profit organisations and churches			was integrated in the CO_2 building renovation programme and Market incentive programme (MAP).
National efficiency label for old heating systems	Regulatory/for information purposes	Information by means of labels and leaflets on the energy efficiency of boilers that are more than 15 years old	The boiler owner or tenant of the dwelling	New	Entered into force on 01.01.2016	Implementation of an urgent measure from the National Energy Efficiency Action Plan (NAPE)
Energy Saving Regulation [EnEV]	Regulatory	Compliance with minimum standards for the overall energy efficiency (non-renewable portion of primary energy demand and minimum heating protection) of buildings and heating and cooling plants in the renovation and new construction of residential and non-residential buildings	Building owners (private and public)	Amendment, adopted on 18.11.2013, in force from 01.05.2014	Deadline for transposition of Directive 2010/31/EU. The amended Regulation entered into force on 01.05.2014. Transposition of Article 9 of Directive 2010/31/EU (Nearly zero-energy buildings) is still outstanding.	Tightening/updating of the EnEV 2009 in line with the new Buildings Directive

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
Greenhouse gas quota in the Federal Emissions Control Act [BImSchG])	Regulatory	Minimum share of biofuels in the total quantity of fuel brought into circulation; from 2015, minimum saving in greenhouse gases from road transport	Marketers of fuels	Existing	Has existed since 2007; switch from quantity-based to minimum greenhouse gas savings quota in 2015; no end-date.	Transposition of EU law.
37th BImSchV, 38th BImSchV	Regulatory	Non-statutory regulations on the greenhouse gas quota	Marketers of fuels	Adopted in 2017	For transposition of Directives (EU) 2015/652 and 2015/1513, the 37th and 38th BImSchV were enacted. The key aspects were inter alia: - Upper limit for conventional biofuels - Sub-quota for advanced biofuels - Inclusion of electricity used in electric vehicles and renewable fuels of non-biogenic origin	Transposition of EU law.
Biofuel Sustainability Regulation [Biokraft-NachV]	Regulatory	Transposition of the sustainability requirements for biofuels under Directive 2009/28/EC	Persons placing taxable petrol or diesel fuels in circulation commercially or as part of economic undertakings Biofuel manufacturers	Existing	Mostly entered into force on 02.11.2009	Amendment via EAG EE Applicable since 01.01.2011 without restrictions Adjustment after changing the quota to the greenhouse gas quota. The significance of Annex 1 (Section 8(3)), Method for calculation of the greenhouse gas reduction on the basis of actual values has increased greatly as a result of the introduction of the GHG quota.
Government electro-mobility programme	Financial	Increased share of electro-mobility in road transport; strategy to promote research, development and market introduction of electro-mobility	Investors, research, industry	Existing	Implementation of the announced measures started in 2011	Actions envisaged (examples): • R&D programme for accelerated market introduction • Education and training • Charging infrastructure and energy supply • Resources, materials and recycling

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
Promotion of sales of electrically powered vehicles (environmental bonus)	Financial	Increased share of electro-mobility in road transport	Private individuals, businesses, foundations, corporations and clubs	Existing	Applications possible since 2 July 2016	Purchase premium for first-registered electric vehicles (passenger cars and commercial vehicles in classes N1 and N2)
Electro-mobility Act [EmoG]	Regulatory	Increased share of electro-mobility in road transport	Vehicle drivers	Existing	Entered into force on 12 June 2015	Priority given to electric vehicles in road transport (e.g. parking, parking fees, use of public streets and roads intended for specific purposes)
'Energy transition in transport: sector coupling through the use of electricity-based fuels' funding initiative	Financial	Technology development and demonstration: production and use of alternative, electricity-based fuels and incorporation of new technologies in the energy industry.	Research, industrial partnerships	Existing	Announcement of funding: 27.02.2017 Start of project: planned for 2018	Funding initiative under the 6th Energy Research Programme
'Solar construction /energy-efficient city' funding initiative	Financial	Technology development and demonstration: lowering energy consumption, achieving smart networking of electricity, heating and mobility and integration of renewable energy in urban areas	Research, industrial partnerships	Existing	Start of programme: 01.10.2017	Funding initiative under the 6th Energy Research Programme
'Energy storage' funding initiative	Financial	Technology development and optimisation, inter alia increased storage capacity for electricity and heat storage systems, system integration	Research, industrial partnerships	Existing	In force since 17.05.2011 First phase completed in 2016. Report on accompanying review of results published in 2017.	Funding initiative under the 6th Energy Research Programme

Name and reference of the measure	*Type of measure**	*Expected result***	*Targeted group and/or activity****	*Existing or planned *****	*Start and end dates of the measure*	*Amendments to the NREAP*
'Sustainable grids' funding initiative	Financial	Development of sustainable grid technologies, improvement of environmental compatibility, effectiveness and resource efficiency of electricity grids and security of electricity supply	Research, industrial partnerships	Existing	In force since 11.01.2013	Funding initiative under the 6th Energy Research Programme
Act to establish a special 'Energy and Climate Fund' [EKFG]	Financial	Measures in the following areas: energy efficiency, renewable energy, energy storage and grid technologies to support an environmentally sound, reliable and affordable energy supply and climate protection	Programme owners and those eligible to apply.	Existing	Entered into force on 01.01.2011 Amendment entered into force on 29.07.2011 Last amended by Article 1 of the Act of 22.12.2014	Other measures: Further funding available for the development of electro-mobility. Grants for energy-intensive undertakings from 2013 to compensate for electricity price increases caused by emissions trading. Inter alia, financing of the CO_2 building renovation programme and MAP.

* Indicate if the measure is (predominantly) Regulatory, financial or "soft" (i.e. information campaign).
** Is the expected result behavioural change, installed capacity (MW; t/year), energy generated (ktoe)?
*** What is the target group: investors, end users, public administration, planners, architects, installers, etc.? Or what is the target activity/sector: biofuel production, energetic use of animal manure, etc.?
**** Does this measure replace or complement measures contained in Table 5 of the NREAP?

Federal state and municipal schemes

This progress report sets out the provisions enacted by the Federal Government to promote renewable energy, updated since the NREAP. The measures described in the NREAP, mostly model projects by the federal states and municipalities, are too numerous to be presented in updated form in the progress report. However, these regional measures continue to play a major role in attaining the national targets in the field of renewable energy.

2.a. Please describe the progress made in evaluating and improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy.

(Article 22(1)(e) of Directive 2009/28/EC))

When the Renewable Energies European Law Adaptation Act [EAG EE] was being drawn up, it was established that there were no legal barriers to the expanded use of renewable energy in Germany. Although, for example, facilities to exploit wind energy with a total height of more than 50 metres are in principle subject to approval according to Annex 1 No 1.6 to the 4th Federal Emissions Control Regulation [BImSchV], this approval is a matter of course where the criteria are met. Nevertheless, the existing rules are being constantly reviewed and enhanced.

2.b. Please describe the measures in ensuring the transmission and distribution of electricity produced from renewable energy sources and in improving the framework or rules for bearing and sharing of costs related to grid connections and grid reinforcements.

(Article 22(1)(f) of Directive 2009/28/EC)

2.b.1. Energy Management Act [EnWG]

The amendment of the Energy Management Act in 2011 introduced a national grid development plan for extra-high-voltage lines for the first time. In December 2015 the regulations in the EnWG in this respect were updated. This obliges the transmission system operators (TSOs) to draw up a Network Development Plan (NEP) for electricity each year on the basis of an agreed Scenario Framework to determine the nationwide need for network expansion at the extra-high-voltage level for the next 10 to 15 years. The Network Development Plan currently to be examined by the Federal Network Agency considers the year 2030. Since the amendment of 14 December 2012 the sequence of network connections to offshore wind power plants will, from 2013, be laid down in an Offshore Network Development Plan (O-NEP). The TSOs published their draft Network Development Plan for electricity for the first time on 29 May 2012 and their draft Offshore Network Development Plan on 2 March 2013. They are holding public consultations for both drafts and will then submit them to the Federal Network Agency for review. The NEP and O-NEP plans and the associated environmental reports drawn up by the Federal Network Agency are also consulted on by the authority and endorsed in the light of the consultation of the authorities and the

public. The Federal Network Agency presented the Network Development Plan for electricity to the Federal Government together with the environmental report for the first time as a draft Federal Requirements Plan on 25 November 2012.

The current Federal Requirements Plan Act entered into force on 31 December 2015 and marks the completion of the third determination of requirements. The list of necessary energy projects was updated with respect to the earlier version of July 2013. With the passage of the Federal Requirements Plan Act by the Federal legislator, the energy needs and urgent requirement for network expansion projects become binding for the planning stages of federal sectoral planning, regional planning and planning approval procedures. Furthermore, in the current Federal Requirements Plan Act the statutory regulations for the use of underground cables were also amended. For instance, the high-voltage direct-current (HVDC) transmission lines specifically identified with 'E' are to be constructed as a matter of priority as underground cables instead of as overhead lines as previously. The options for underground cabling are moderately expanded for correspondingly identified alternating-current projects. In this case the implementation as underground cables in sections is possible for individual pilot projects.

With the act for fundamental reform of the Renewable Energy Act and for amendment of other provisions of the energy industry of 21 July 2014, the expansion targets for offshore wind energy were also adjusted. This also has effects on the network connection scheme. Although the allocation of connection capacities does take place in the sequence defined in the O-NEP, by 31 December 2020 in principle only a connection capacity of 6.5 gigawatts and in the following ten years a further 800 megawatts per year are permitted to be allocated by the Federal Network Agency, however. In order to achieve the target of 6.5 gigawatts in 2020, the Federal Network Agency is permitted to allocate at most 7.7 gigawatts of connection capacity by the end of 2017. The allocated connection capacity can moreover be withdrawn in the event of significant delays in implementation of a wind park project pursuant to Section 17d No 6 EnWG.

With the Act for the expansion of renewable energy (Renewable Energy Act – EEG 2017)[41] various measures for strengthening the network management and network development for the integration of the new tender model for RE plants were introduced, the options for network bottleneck management were improved and the distribution of costs for delayed connection of offshore plants to the

[41] Renewable Energie Act of 21 July 2014 (Federal Law Gazette (BGBl.) I p. 1066), last amended by Article 2 of the Act of 22 December 2016 (BGBl. I p. 3106).

electricity grid were updated. At present, renewable energy plants, in particular wind power plants, are curtailed to an increasing extent in northern Germany due to bottlenecks in particular in the transmission network, because the electricity is not consumed locally and cannot be transported to the areas of high consumption in the south. In order not to further exacerbate the bottlenecks, in the future the contracts awarded in the tenders for new wind power plants in a so-called network expansion area will be temporarily restricted in terms of volume. The network expansion area includes the northern part of Lower Saxony and Bremen, Schleswig-Holstein, Hamburg and Mecklenburg-Western Pomerania. Each year 58 % of the average growth of the years 2013 to 2015 is permissible there. The necessity of the regulations will be reviewed for the first time on 31 July 2019 and then every two years. In so doing, the progress made in network expansion will be taken into account. The principle that network operators must expand the power lines as required, in order to integrate electricity from renewable energies, continues to apply. In Section 1 EEG 2017 it has also been clarified that the further expansion of renewable energies should take place on an ongoing, cost-effective and network-compatible basis.

The new paragraph 6a in Section 13 EnWG has introduced the option of incorporating cogeneration plants into the network bottleneck scheme as connectable loads. In the past there was no clear legal framework and no suitable processes for this. Section 13(6a) EnWG provides for connectable loads to be integrated into the existing re-dispatch regime in the event of bottlenecks at transmission system level in the network expansion area. The aim of the provision is to reduce the amount of electricity from renewable energy sources that is curtailed as a result of bottlenecks in the transmission system. In order to improve network bottleneck management, a new paragraph 10 was added to Section 13 EnWG. On the basis of the agreed input parameters of the system analyses pursuant to Section 3(2) of the Regulation on network reserves, in the future a forecast of the annual extent of the measures for network bottleneck relief should be made, in particular for re-dispatch and feed management. The forecast must include an estimate of the expected costs.

The EnWG was also amended in various places by means of the Act to amend the provisions for electricity production from cogeneration and for own supply of 22 December 2016 (BGBl. I p. 3106). All high-voltage network operators are required to disclose their expansion plans every year and thus make them transparent for all stakeholders. Consequently, the requirements for the previous network expansion report by operators of high-voltage networks, with a rated voltage of 110 kilovolts, will be amended. The network operator must

show, for the entire network, where the bottleneck problems occur and what expectations it has as regards the future development of the connection capacity of feed-in plants and relief loads. The network maps to be published annually, which should clearly show bottleneck regions, provide greater clarity and a better assessment of the planned measures. High-voltage network operators moreover have to provide a detailed presentation on their website of the expansion or enhancement measures specifically planned for the next five years. In addition, the network operators should conduct an evaluation of the measures that are required for the period between five and ten years, taking into consideration the 'NOVA principle' (Network Optimisation before Enhancement and before Expansion). Furthermore, the publication of the assumptions of the distribution network operators makes an important contribution to the coordination between the planning of the distribution network operators and the network development planning of the transmission system operators. As a further innovation, it is intended to dispense with a restriction on feed-in-side network expansion. In addition, in future it is no longer intended to draw a distinction between network expansion triggered by conventional production plants and that triggered by renewable production plants.

With the introduction of Section 119 EnWG and the regulation based thereon, the framework for use of the support programme 'Schaufenster intelligente Energie – Digitale Agenda für die Energiewende' (SINTEG) [Showcase on smart energy – Digital agenda for the energy transition] was expanded as a real laboratory for the energy transition. By means of this, participants in the project can try out new technologies, processes and business models, for example for digitalisation and integrated energy, and can be largely compensated for financial disadvantages that arise as a result of this. The support programme is aimed at developing and demonstrating model solutions for secure, economical and environmentally compatible energy supply that can be scaled to large-area 'showcase regions' in the case of high proportions of fluctuating electricity generation from wind and solar energy.

2.b.2. Renewable Energies Act

Since its introduction in 2000, the Renewable Energies Act (EEG) has been the most significant statutorily provided funding instrument for electricity production from renewable energy sources. On 1 January 2017, the EEG 2017 entered into force. In comparison with the EEG 2014, it is accompanied by a fundamental overhaul of the system with regard to EEG payment entitlements.

Against the background of the European Environment and Subsidy Guidelines, the EEG 2014 already strove for a funding mechanism that was guided by market principles to a greater extent. In order to further speed up the market integration of renewable energies as expressly provided for in Section 2(2) EEG 2014/2017, the obligation for direct marketing and funding above a market premium was expanded in stages and as a result the fixed EEG feed-in payment as primarily provided originally, was phased out. Already under the EEG 2014, plants with a commissioning date after 31 December 2015 could still only claim the EEG payment with a nominal capacity of at most 100 kW, which also turned out to be reduced in comparison to the sum of the market premium and market revenue, Section 37(2) No 2, (3) EEG 2014. The EEG 2017 carries over these restrictions, Section 21(1) No 1 in conjunction with Section 53 EEG 2017.

Substantial changes emerge building on this in the area of supported direct marketing through the introduction of a tendering system, taking market integration to a new stage. A preparatory pilot tendering system was already planned in the EEG 2014 for PV ground-mounted installations. With the EEG 2017, calls for tender are basically used in the sectors of onshore wind, offshore wind, photovoltaic and biomass. In the sector-specific tenders, the EEG funding entitlement to the market premium is justified by the contract award. The amount of the market premium is in this case still calculated by the principle of the value to be applied which now (in the case of a contract award) corresponds to the bid value and is thus determined on a competitive basis.

The tendering system should enable a controlled cost-effective expansion in line with targets, consistent with the predetermined expansion trajectory. The expansion is managed by means of the sector-specific tender volumes per calendar year as stipulated in Section 28 EEG 2017, which (with the exception of PV plants) correspond to the relevant expansion corridor resulting from Section 4 EEG 2017. The temporarily reduced tender volumes for onshore wind in network expansion areas (which are currently all in northern Germany) additionally have a regional management effect, so as to be able to take into consideration all aspects of network and/or system integration. Special tender specifications are also defined for the sector of offshore wind (Offshore Wind Energy Act (WindSeeG)). The tendering system has furthermore opened up to bidders with plants in other European countries. Under Section 5 EEG 2017, contracts may be awarded to bids from European Member States to the extent of 5 % of the annual capacity to be installed under certain conditions. In general, it should be ensured by means of contractual penalties that successful bids are actually

implemented and the expansion path for achieving climate protection targets can be complied with.

Obtaining diversity of stakeholders was an express objective of the legislator when implementing the tendering system, Section 2(3) second sentence EEG 2017. The EEG has led to decentralisation of electricity production and the energy transition as a whole has led to decentralisation of the energy system, which provides completely new stakeholders with options to help shape the system. For example, not only citizens as operators of PV plants but also associations of citizens have made a notable contribution to the expansion of renewable production plants and, as a result of their commitment and adding value locally, have often contributed to higher levels of acceptance in the region in comparison with measures for achieving the energy transition targets. The risks associated with planning, contract awards and price that have increased as a result of the usually mandatory participation in the tendering system are therefore intended to be lessened for community energy companies in the following ways. Firstly, by means of a *de minimis* limit; when this is undershot participation in the tender is not a prerequisite for EEG support. Secondly, by means of special participation conditions and special price rules for community energy companies that wish to establish onshore wind power plants that fall under the tender scheme. The regulations relating to the special participation conditions for community energy companies in tenders for onshore wind energy, such as extended implementation periods and waiving the presentation of approval, have led to distortions of the tenders, as community energy companies have predominantly been awarded contracts. In this context, the regulations in the first two bidding rounds in 2018 were suspended. This allows a comparison of the different tender conditions on the basis of which it must then be decided whether these special regulations for community energy companies should be permanently retained. It was agreed under the coalition agreement to safeguard the diversity of stakeholders in the future but to allow only approved projects to participate in calls for tender.

New funding is provided by the amendment to the act passed in July 2017 for landlord-to-tenant electricity supply models. It is aimed at supporting tenant participation and realisation of the expansion trajectory for PV plants, the growth of which has been somewhat on the decline recently. Accordingly, in future it will be possible to claim dedicated funding for electricity from new PV plants supplied to residents. Optimisation of the landlord-to-tenant electricity supply regulations was agreed with the coalition agreement.

In the EEG 2017, new provisions were made in Section 53 et seq. EEG 2017, so as to prevent overfunding. To that end, the approach of reducing inter alia electricity tax exemptions and anticipated additional revenues as a result the use of regional certificates (Section 79a EEG 2017) in line with the level of the funding entitlement is being considered in principle.

With regard to the levy, the regulations relating to the privileging of electricity cost-intensive industry to retain their competitiveness and in favour of self-suppliers essentially remain unchanged in terms of content. The scope of the storage privilege was however extended so as to be able to more effectively counter the imminent double loading of a temporarily stored volume of electricity and to eliminate this investment obstacle.

2.b.3. Low-voltage directive and system stability regulation

The Regulation to guarantee the technical safety and system stability of the electricity supply network (System Stability Regulation – SysStabV) has been in force since 26 July 2012. The inverters in existing PV installations need to be modified so they do not all disconnect at 50.2 Hz, but at different frequency levels. The upgrading of the total number of around 500 000 plants has been largely completed.

However, action is still also needed with regard to existing wind power plants, biomass plants, cogeneration plants and small-scale hydropower plants. A study commissioned by the Federal Ministry of Economic Affairs (‘Developing a strategy for upgrading generation plants in the medium- and low-voltage network in order to maintain system security in the event of over-frequency and under-frequency’) shows that plants with a total installed capacity of 27 GW disconnect automatically when the network frequency is reduced to 49.5 Hz. If such a case arose, network operators would no longer be able to stabilise the electricity grid. The frequency protection settings of these plants therefore need to be changed. The amendment to the System Stability Regulation entered into force on 14 March 2015 and as a result the operators of the approx. 21 000 existing plants concerned are obliged to upgrade the frequency protection settings of their plants in line with the specifications.

With the amendment of 14 September 2016, the plants for production of electricity from gaseous and liquid biomass that needed to be upgraded were also joined by landfill, sewage and mine gas. The process of upgrading the plants is ongoing.

2.b.4. ACER: General guidelines and network codes

The Federal Network Agency is affiliated to the European Agency for the Cooperation of Energy Regulators (ACER), which was established in 2009. The purpose of ACER includes drawing up general guidelines with standards for the electricity network codes produced by the European Network of Transmission System Operators for Electricity (ENTSO-E). The main purpose of the European network codes is to promote the implementation of the European internal market for electricity and to overcome problems in cross-border network and market integration through standard rules for all market participants.

2.b.5. Ten-Year Network Development Plan

In December 2016, the ENTSO-E published the third legally valid Europe-wide Ten-Year Network Development Plan (TYNDP), containing grid expansion projects of European importance. It is not binding and is intended to create greater transparency over the necessary expansion of the whole EU transmission system. Once again, network expansion in Germany plays a major role for the TYNDP.

The first Union-wide list of ‘projects of common interest’ (PCIs) entered into force in January 2014. The instrument of the Union-wide list is enshrined in the EU guidelines for trans-European energy infrastructure (TEN-E Regulation). The second Union-wide PCI list entered into force on 27 January 2016. It includes 19 German PCIs in the electricity sector, plus a pumped storage power plant, one PCI in the gas sector and two PCIs in the oil sector with a direct connection to Germany.

The planning approaches of the German NEP are coordinated with the European approaches of the TYNDP and the relevant network expansion plans of European partners documented in the TYNDP were taken into account in the NEP.

3 PLEASE DESCRIBE THE SUPPORT SCHEMES AND OTHER MEASURES CURRENTLY IN PLACE THAT ARE APPLIED TO PROMOTE ENERGY FROM RENEWABLE SOURCES AND REPORT ON ANY DEVELOPMENTS IN THE MEASURES USED WITH RESPECT TO THOSE SET OUT IN THE NREAP.

(Article 22(1)(b) of Directive 2009/28/EC)

A key goal of the energy transition, along with the complete abandonment of nuclear power by the end of 2022, is the accelerated expansion of renewable energy. The proportion of renewable energy in gross final consumption of energy for electricity should rise from 32.2 % in 2016, according to the NREAP, to 38.6 % in 2020. The decision on the energy transition will flesh out the objectives of the Energy Concept of 28 September 2010 and cause them to be implemented faster. Hitherto it has been enshrined in law that the proportion of renewable energies in gross electricity consumption should increase to 40 to 45 % in 2025, to 55 to 60 % in 2035 and to at least 80 % by 2050[42]. In accordance with the coalition agreement signed in March 2018, the new Federal Government is striving to achieve a proportion of approx. 65 % renewable energies by as early as 2030.

The following points summarise the measures decided on in the 'energy transition package' for the renewable energy sector and advances on key measures set out in the NREAP.

3.0. Support schemes

3.0.1 Renewable Energies European Law Adaptation Act [EAG EE]

The EAG EE of 12 April 2011 brought about the following main changes:

- It enables the electronic issue, transmission and redemption of guarantees of origin for electricity from renewable sources. To this end, the EAG EE provides the basis in the EEG for establishing an electronic register of guarantees of origin. Guarantees of origin are issued by the Federal Environment Agency [UBA], which is also responsible for recognising, transferring and redeeming the guarantees. This legal basis has since been further refined by the Guarantee of Origin Regulation [Herkunftsnachweisverordnung], the Guarantee of Origin Implementing

[42] The national objectives in Section 1 of the Renewable Energies Act are not directly comparable to the figures reported in accordance with the NREAP and cited in the progress report, as they are not subject to the calculation rules in accordance with Directive 29/2009/EC.

Regulation [Herkunftsnachweis-Durchführungsverordnung] and the Guarantee of Origin Fees Regulation [Herkunftsnachweis-Gebührenverordnung], which are now in force, see Chapter 5.

- Grid operators are required to provide those wishing to feed in energy with timetables for processing connection requests and establishing the connection to the grid and to supply details to help determine the network connection point and an estimate of the costs to be incurred by the plant operator for the grid connection.
- The Renewable Energies Heat Act is amended to ensure that renewable energy sources are used for heating and cooling when public buildings are thoroughly renovated, and that an example is set by this.
- The power to enact changes to the Biomass Electricity Sustainability Regulation [BioSt-NachV] will be reworded. This is mainly a matter of clarification.

3.0.2 Renewable Energies Act

Introduction

The German Bundestag approved the EEG 2017 on 22 December 2016, and it entered into force on 1 January 2017.

The EEG 2017 promotes the production of electricity from renewable energy sources. In the context of the provisions of distribution of costs (EEG levy), it furthermore provides incentives for direct own use of electricity produced with dedicated RE plants before feeding into the grid (‘own production’).

The EEG contains medium- and long-term targets for the expansion of renewable energies. According to Section 1(2), the proportion of electricity in the gross electricity consumption that is produced from renewable energies is intended to be increased to 40 to 45 % by 2025, to 55 to 60 % by 2035 and to at least 80 % by 2050.

In terms of funding, the EEG 2017 continues with the principles that already characterised the EEG 2014. Accordingly, primary importance is given to market integration of electricity from renewable energy sources, cost-effective extension and effective management of the extension along the expansion corridor.

The objectives are decisively influenced by the overhaul of the system put into effect in the EEG 2017 towards a tendering system. By means of the tender volumes which are specified for each calendar year, a new and effective way of managing the expansion is achieved. In the case of onshore wind, regional

features have also been temporarily taken into consideration, in order to take into account network and system integration aspects. The tenders facilitate an expansion guided by market conditions and competitive pricing, and thus ultimately cost-effective electricity production.

Despite simple and transparent conditions, a tendering system as such represents a great challenge for some, often relatively small, stakeholders. At the same time, precisely these stakeholders can make a not-insignificant contribution to ensuring the success and acceptance of the energy transition, by being actively involved in shaping energy systems and adding value locally. They should continue to be able to perform this role in the context of the tendering system. The legislator took this circumstance into account in the EEG 2017, postulated in the context of the principles in Section 2(3) second sentence EEG 2017, and addressed it by means of specific provisions, such as for example the privileging of community energy companies in calls for tender for onshore wind, in Section 36g. Ultimately, the special provisions in this respect have led to over 95 % of the contracts awarded for onshore wind power plants in all tenders in 2017 going to community energy companies. The risk associated with this of a gap in the expansion on account of a longer implementation period and increased performance risks were dealt with by the legislator with the suspension of the privileges in summer 2017. The coalition agreement provides that in the future the diversity of stakeholders must continue to be ensured, without it being the case, as hitherto, that projects without approval can participate in the tender.

As a result of the Landlord-to-tenant electricity supply Act which supplements the EEG 2017 and entered into force on 25 July 2017, tenants are intended to be directly involved in the energy transition and greater impetus is to be given to the expansion of electricity produced by solar plants.

Lastly, the EEG 2017 introduces a new electricity labelling instrument for regional, directly marketed EEG-funded electricity from renewable energy sources, in the form of regional certificates, in order to increase local acceptance of the energy transition.

With regard to the EEG levy, the reallocation obligation and restrictions for own consumption concepts and the privileges for businesses that have to exist in international competition are largely retained. Content-based amendments to the regulations on own consumption serve to safeguard a structure that conforms to European specifications. Moreover, the regulations in relation to

electricity storage systems were updated so as to overcome legal obstacles and facilitate the use thereof in the energy system.

Overview of funding

In this chapter, an overview will be given of the main amendments in the EEG 2017 from the perspective of their support effect. These include in particular funding mechanisms that were set up for certain technologies and stakeholders in the changeover to a tendering system, regional certificates, and a forecast relating to EEG-funded landlord-to-tenant electricity supply concepts.

The tendering system

The key aim of the market integration of electricity from renewable energy sources is strengthened in the EEG 2017 by the introduction of the tendering system. The original predominantly fixed EEG feed-in payment plays an increasingly secondary role. Since the EEG 2014, the usual case is mandatory direct marketing. The (exceptional) provision that plants with a nominal capacity of up to 100 kW and a commissioning date after 31 December 2015 can still benefit from a comparatively low fixed feed-in payment is however present in essentially unchanged form in Section 21(1) No 1 EEG 2017 (see Progress Report from 2015, Chapter 3.0.2).

The EEG 2017 places further emphasis on the supported direct marketing as top-priority EEG funding mechanism, which justifies the entitlement to the market premium, cf. Sections 20, 19(1) No 1 EEG 2017. The tendering system takes the following approach in determining the claim entitlement and amount of the market premium: the market premium is the difference between the value to be applied and the month market value (ex-post ascertained monthly average stock market electricity price specific to the energy source). Up to the entry into force of the EEG 2017, the value to be applied was in most cases defined by law (corresponded to the funding entitlement for the fixed feed-in payment). By way of sector-specific tenders, in future it will essentially be determined on a competitive basis.

Following the successful trial of calls for tender for ground-mounted solar installations, with the entry into force of the EEG 2017 technology-specific tenders were introduced as a general rule for solar, onshore wind, biomass and offshore wind.

For the EEG funding by way of supported direct marketing, this means: with the change to the tendering system, for the technologies and plants covered thereby

the funding entitlement will be justified by the contract award value. This level will also be determined by the bid value, which is included in the calculation of the market premium as value to be applied. In this respect the calculation basis will be determined on a competitive basis and will no longer solely be defined by law, cf. Section 22(1) EEG 2017. At the same time, there is thus also a change from a price-controlled to quantity-controlled funding system.

Solar plants in principle take part in tenders only above a *de minimis* limit of over 750 kW installed capacity, Section 22(3) second sentence EEG 2017. The intention behind this is in particular to obtain diversity of stakeholders among the operators of relatively small solar plants and to keep the administrative burden low. Solar plants below 750 kW can continue to benefit under the established conditions of EEG funding in the EEG 2014 applicable from January 2016 and do not have to participate in the tenders.

For onshore wind power plants, mandatory participation in tenders is likewise provided only upwards of the limit of 750 kW installed capacity, Section 22(2) No 1 EEG 2017. In line with previous experience relating to the average size of onshore wind power plants, this limitation, in contrast to the case of solar plants, should have a restricted effect. Pursuant to Section 22(2) No 2 EEG 2017, it was also possible for ‘transitional wind power plants’ not to participate in the tendering system. However, this exceptional situation is no longer applicable since 1 March 2017 due to the expiry of the deadline. The third exception regulation concerns pilot onshore wind power plants within the meaning of Section 3 No 37 EEG 2017 with an installed capacity of a total of up to 125 MW per year, Section 22(2) No 3 EEG 2017. The provision is based on the support for the development of innovations and new technologies which are not intended to be restricted by participation in tenders.

In principle, biomass plants participate in tenders above an installed capacity of more than 150 kW, Section 22(4) No 1 EEG 2017. Existing plants whose funding ends can participate in tenders and thus are entitled to claim for a one-off payment of 10-year continuity funding. For plants that were approved or authorised prior to 1 January 2017 and were commissioned before 1 January 2019, transitional regulations apply in accordance with Section 22(4) No 2 EEG 2017.

The tender procedure is defined by general specifications in accordance with Section 28 et seq. EEG 2017 and associated technology-specific specifications. Annual technology-specific tender volumes are specified and (with the exception of biomass and offshore wind) distributed across a number of bidding rounds per

year. The tender volume is intended to bring about the desired scarcity situation for the functional market and thereby instigate competition for capacities and funding. Moreover, the tender volumes (with the exception of solar plants) follow the expansion path specified in Section 4 EEG 2017 and therefore develop their own management effect (see Table 3.1, Table 3.2, Table 3.3 and Table 3.4).

Table 3.1: Tender volumes and bidding rounds for onshore wind, Section 28(1) EEG 2017

Onshore wind	**01.02**	**01.05**	**01.08**	**1.11.17 & 01.10.18 2019**	**Total**
2017		800 MW	1 000 MW	1 000 MW	2 800 MW
2018	700 MW	700 MW	700 MW	700 MW	2 800 MW
2019	700 MW	700 MW	700 MW	700 MW	2 800 MW
From 2020	1 000 MW	950 MW (01.06) and 950 MW (01.10)			2 900 MW

Table 3.2: Tender volumes and bidding rounds for PV, Section 28(2) EEG 2017

PV	**01.02**	**01.06**	**01.10**	**Total PV**
Annual	200 MW	200 MW	200 MW	600 MW

Table 3.3: Tender volumes and rounds for biomass plants, Section 28(3) EEG 2017[43]

Biomass	**01.09**
2017	150 MW
2018	150 MW
2019	150 MW
2020	200 MW

[43] The tender volume is reduced here by the installed capacity of the plants brought into operation in each case in the previous year with statutory funding and increased by the tender volume that was not awarded in the relevant previous year, Section 28(3a) EEG 2017.

2021	200 MW
2022	200 MW

Table 3.4: Tender volumes and bidding rounds for offshore wind, Section 17/Sections 26, 27 WindSeeG

Offshore wind	**01.09 (for the first time in 2021, for pre-investigated areas and plants with commissioning date from 01.01.2026)**	**01.04 (in 2017 and 2018, special tender for the transition phase for existing projects with commissioning date from 01.01.2020)**
2017		1 550 MW
2018		1 550 MW
from 2021	700 to 900 MW (depending on FEP, on average 840 MW per year)	

Table 3.5: Expansion paths at a glance, Section 4 EEG 2017, Sections 1, 17, 27 WindSeeG

	Onshore wind	**Offshore wind**	**Solar**	**Biomass**
2017	2 800 MW		2 500 MW	150 MW
2018	2 800 MW		2 500 MW	150 MW
2019	2 800 MW		2 500 MW	150 MW
2020	2 900 MW		2 500 MW	200 MW
2021		500 MW (exclusively Baltic Sea, Section 27(4) No 1 WindSeeG)		
2022		500 MW (Section 27(4) No 2 WindSeeG)		
from 2023				
2023 to 2025		700 MW (Section 27(4) No 3 to 5 WindSeeG)		

Table 3.6: Increase in installed capacity of offshore wind energy, Section 4 EEG 2017

	Offshore wind
up to 2020	6 500 MW
up to 2030 in total	15 000 MW

Particular features emerge in connection with cross-border and joint tenders for the tender volume of onshore wind and solar plants:

The EEG 2017 opens up the funding mechanism in the context of the regular tendering system for the expansion of renewable energies abroad following the successful trial for PV ground-mounted installations. In accordance with Section 5 EEG 2017, bids for solar plants and onshore wind from other Member States of the European Union to the extent of 5 % of the capacity to be installed annually can be awarded contracts. Essential requirements are that the RE electricity is physically imported to Germany or at least has a comparable effect on the German electricity market. The option for participation of RE plants in other Member States of the European Union remains, subject to an international agreement and the principle of reciprocity. The capacity awarded in this context reduces the relevant annual tender volume for onshore wind and solar; Section 28(1a) No 1, (2a) second sentence No 1 EEG 2017. The details in relation to cross-border tenders are governed by regulation on the basis of Section 88a EEG 2017. In particular, the cross-border renewable energy regulation originally applicable to PV ground-mounted pilot calls for tender was amended for this and its scope was extended to onshore wind energy. The regulation entered into force in August 2017.

Digression: joint tenders

In the EEG 2017 for the first time a specific tender design for 'joint tenders' was set up as a pilot, Section 39i in conjunction with Section 88c EEG 2017. The associated regulation, the Regulation on joint tenders (GemAV), entered into force in August 2017. In this context, solar plants and onshore wind power plants are intended to compete with one another in the tender. In the period from 2018 to 2020, these joint tenders are intended to be trialled. The collected practical experience will be taken into consideration in future legislative activities. For the joint tenders, an annual volume of 400 MW capacity to be installed is provided, Section 28(5) EEG 2017. The 400 MW is to be distributed across two tender

deadlines and in each case reduced in line with the tender volumes for the regular tender for onshore wind and solar, Section 28(1a) No 2, (2a) second sentence No 2 EEG 2017. The contract award procedure in this case for 'distribution network expansion areas' (Section 11 GemAV) will be modified, Section 7 GemAV. By means of a supplement on bids relating to the distribution network expansion region when ordering the bids, the network expansion requirement is to be taken into account at distribution network level when awarding contracts. As a result of this distribution network component, the costs of network and system integration are to be taken into account and a local management effect of PV and onshore wind expansion can be achieved. The distribution network expansion areas are defined in the Regulation on joint tenders and is linked to the feedback capacity of the distribution network in the upstream extra-high-voltage network. The sector-specific specifications in relation to regular tenders shall remain (with the exception of the participation conditions for community energy companies and the reference yield model) generally unaffected.

Table 3.7: Tender volumes and bidding rounds for joint tenders at a glance, as at 17 October 2017, draft bill of the BMWi relating to the Regulation on joint tenders for onshore wind power plants and solar plants

PV & Wind	***01.04***	***01.11***
2018	*200 MW*	*200 MW*
2019	*200 MW*	*200 MW*
2020	*200 MW*	*200 MW*

Moreover, for the years 2019 and 2020, regionally differentiated maximum values for onshore wind are stipulated. Three regions are specified for this, as a function of the wind conditions. The three regions determined in Section 16 GemAV are assigned to specific administrative districts in Annex 2. This mechanism is intended to take account of the fact that the reference yield model is not applicable in the context of joint tenders. However, financial disadvantages at sites with low wind levels are intended to be offset and excessive demand at sites with high wind levels is intended to be avoided.

Table 3.8: Bid highest values for joint tenders at a glance, as at 17 October 2017, reference draft of the BMWi relating to the joint tenders for onshore wind power plants and solar installations

Year/Highest value	*Solar*	*Wind*
2018	*Section 13 GemAV: corresponds to highest value from the last sector-specific PV tender in acc. with Section 29 and 37b(2) EEG 2017*	*Section 14: corresponds to highest values in acc. with Section 13 GemAV*
2019	*see 2018*	*Section 16 GemAV: area-specific uniform highest value, on the basis of Section 36b EEG 2017*
2020	*see 2018*	*Section 16 GemAV: area-specific uniform highest value, on the basis of Section 36b EEG 2017*

End of digression

The general provisions in relation to tenders (Section 28 et seq. EEG 2017) in addition define the time of the announcement of the invitation to tender by the relevant office and the content thereof, that is to say in particular the indication of the relevant bid highest value (Section 29 EEG 2017), and the requirements for bids (Sections 30, 30a EEG 2017) and bidders (Section 34 EEG 2017). The provisions in Section 32 EEG 2017 relating to the tender procedure describe how the admissible bids are to be sorted in a transparent process in order to be able to determine the successful bidders transparently and without discrimination. The WindSeeG modifies some of the provisions for the particular details of tenders for offshore wind, but most of the general provisions are unaltered.

Table 3.9: Bid highest values at a glance

	Onshore	**Solar**	**Biomass**	**Offshore**

	wind			**wind**
2017	7 ct/kWh for the reference site acc. to Annex 2	8.91 ct/kWh	14.88 ct/kWh (16.9 ct/kWh for old plants)	12 ct/kWh for existing projects, Section 33 WindSeeG
from 2018	108 % of the average of the last highest winning bids of the last 3 bid deadlines	analogously to the provisions relating to the value to be applied provided by law, Section 49	Reduction of the previous year's highest value in each case by 1 %	In 2018 10 ct/kWh for existing projects, Section 33 WindSeeG From 2021, lowest bid value on the bid deadline 01.04.2018, Section 22 WindSeeG

In order to support and ensure the achievement of the expansion targets, the EEG 2017 and the WindSeeG provide for the deposit of a security in the tender procedure (Section 31 EEG 2017). In principle, it should be deposited by the bid deadline and serves as security against a contractual penalty in accordance with Section 55 EEG 2017. The implementation of the plants after awarding of a contract should be ensured by penalty payments after the expiry of a technology-specific period corresponding to the usual implementation period for the plant. The amount of the security to be deposited (X €/kW capacity to be installed) is governed on a technology-specific basis.

Table 3.10: Amount of the securities at a glance

Onshore wind	Solar	Biomass	Offshore wind
Section 36a	Section 37a	Section 39a	Section 21/ Section 32 WindSeeG
Bid amount x €30/kW capacity to be installed	Bid amount x €50/kW capacity to be installed (first security €5/kW, second security €45/kW; reduced in some circumstances to €20/kW with proof of advanced stage of planning)	Bid amount x €60/kW capacity to be installed	Bid amount x €200/kW capacity to be installed for preliminarily investigated areas Bid amount x €100/kW capacity to be installed for existing projects

The general provisions relating to tenders are modified and supplemented by technology-specific specifications in the context of Sections 36 to 39h EEG 2017 and the WindSeeG. Significant mechanisms are presented below.

Special contract award conditions are provided in the EEG 2017 for the extension of onshore wind power plants in ‘network expansion areas’, in order to be able to take into account costs of network and system integration for extension (Section 36c in conjunction with Section 88b EEG 2017). The details are governed in Sections 10 to 13 of the Regulation for execution of the renewable energies regulation (EEAV). Essentially, through the definition of an upper limit for the wind power plant extension in network expansion areas it is intended to improve the relationship between the numerous production units and already overloaded network infrastructure in the regions concerned. The closer interconnection of expansion in terms of production and network is intended to promote a more cost-effective restructuring of the energy system.

The tender conditions for onshore wind energy plants of a certain size will moreover be modified with respect to the participation conditions for community energy companies, Section 36g EEG 2017. By means of the optional privileging of community energy companies, the EEG 2017 promotes the attainment of diversity of stakeholders and is intended to contribute to local acceptance of the energy transition in this way. In order to prevent abuse, the objective and subjective prerequisites are fashioned in a restrictive and detailed manner.

Community energy companies that fall under the privileging within the meaning of Section 3 No 15 EEG 2017 essentially benefit from more advantageous participation conditions under Section 36g EEG 2017, which limit the associated planning, award and price risks. In this context, community energy companies are in particular permitted to submit a bid even prior to undertaking the time- and cost-intensive process for granting of approval under the Federal Emissions Control Act (BImSchG). The sincerity of their project may be substantiated by an expert report on the expected electricity yield, in line with the recognised rules of the sector, Section 36g(1), first sentence, No 1 EEG 2017. The security to be paid likewise does not have to be deposited in full at the time of submitting the bid, but can be divided into two instalments, Section 36g(2) EEG 2017. The implementation period for community energy companies is also extended by 24 months, which in particular takes account of the fact that BImSchG approval has not yet been granted. The reduction of the price risk is achieved by the 'uniform pricing method', in contrast to the 'pay-as-bid principle'. Accordingly, the contract award value for bids by community energy partnerships corresponds to the highest bid that is also successful for the same bid deadline, Section 36g(5) first sentence EEG 2017.

The first two tenders for onshore wind energy, in which almost all bids by community energy companies were successful, have shown that the rule/exception relationship of Section 36 EEG 2017 has actually changed into Section 36g EEG 2017. In order to reduce the incentives to exploit a regulation that was intended as an exception and for the purposes of evaluation of the effects of the provision of Section 36g EEG 2017, in the first bidding rounds in 2018 in particular the waiver of the required presentation of the BImSchG approval when submitting the bid was no longer applicable and the implementation period was adjusted accordingly.

In the case of onshore wind energy, the level of the funding entitlement has to be determined in the call for tender in accordance with Section 36h EEG 2017 by means of the calculation of the value to be applied on account of the surcharge value. The determination is in this case based on the reference yield model for the statutory determination of the value to be applied for onshore wind (Section 46 EEG 2017). The different site qualities are taken into account by means of the reference yield model: financial disadvantages at sites with low levels of wind are offset and an overburdening at sites with high levels of wind is avoided. In a departure from the reference yield model, the calculation according to Section 36h EEG 2017 is effected in one stage, which means that there is no differentiation between basic and initial payments. On the basis of the bid at the 100 % site, taking into account the quality factor, which is in particular intended

to reflect the real site conditions (in particular wind conditions), the value to be applied is calculated for the entire funding period. The values to be invested are adjusted at the beginning of the 6th, 11th and 16th year following the start-up of the plant. If, as a consequence of the review, too many or too few payments have been made, they should be refunded under certain conditions.

The provisions in relation to solar plants in the tender (Section 37 et seq. EEG 2017) in particular provide for special regulations with regard to the usable land and the security to be provided.

The extension to agricultural cropland and (provided for the first time) grassland areas (Section 37(1) No 3 (i) and (h) EEG 2017) is managed in a special way in 'less-favoured areas'. Less-favoured areas within the meaning of Section 3 No 7 EEG 2017[44] exhibit relevant persistent natural disadvantages, in particular on account of the nature of the soil, the gradient of slope and a shorter growing season. Bids relating to these areas can only be awarded a contract if the relevant Federal Land has issued a legislative decree therefor, Section 37c EEG 2017.

Privileges for certain stakeholders are not specified in the technology-specific provisions relating to the tender for solar installations. Beyond the *de minimis* limit of 750 kW capacity to be installed, the depositing of the security payment as provided for in Section 37a EEG 2017 in two instalments should have a beneficial effect for small stakeholders, however. Comparably to the special provisions for community energy companies that wish to erect onshore wind power plants, the first security payment must be provided by way of security against any contractual penalty (Section 50(2) No 1 EEG 2017) and the insolvency risk in a low amount when submitting the bid and the second security must be provided within ten working days of the announcement of acceptance of the bid. Successful bidders that provided evidence of an advanced planning stage for ground-mounted open-air or sealed installations and structural installations may moreover benefit from a reduced second security payment. This relief, which is usually of benefit to relatively small projects, is justified by the fact that the sincerity of the project and the implementation thereof is sufficiently demonstrated as a result of the process of providing evidence. As roof-mounted installations do not usually require approval, the process of providing evidence of planning – for example by presentation of a certificate – cannot be conducted in this case and thus the second security must be paid in the full amount.

[44] Section 3 No 7 EEG refers to the European Directives which define the term.

In the case of biomass plants, the EEG 2017 is taking some new approaches in the tender procedure which rather restrict the pool of eligible plants in comparison with the EEG 2014.

Plants which are eligible to participate in the tender must attach the building or operation approval to the bid, showing the sincerity of the project. In the EEG 2017 the reserving of flexible production capacity is moreover now mandatory and no longer merely encouraged via an additional payment for voluntary provision of flexibility (Section 50 EEG 2017). In this respect, the value to be applied that is awarded in the tender procedure is only taken into consideration in the full amount up to the maximum performance which is 50 % of total capacity for biomass plants and 80 % of total capacity for solid biomass plants (Section 39h(2) EEG 2017). In this way, a demand-oriented method of operation is intended to be encouraged.

A further difference in the tender regulations for biomass plants in comparison to the other technology-specific regulations is that in the EEG 2017 the continued operation of old plants is taken into consideration in terms of eligibility for support by allowing them to participate in the tender. This is intended to take account of the fact that some plants need renewed investment before the end of the funding period, for upgrading for example, in order to facilitate a flexible mode of operation. The admissible highest bids for old plants are moreover higher than for new plants. Comparably with the provision for participation of community energy companies, the ‘uniform pricing’ principle also holds true for old plants smaller than 150 kW, such that the value of the highest bid that is also still successful is decisive with respect to the level of the payment. Old plants awarded contracts are in that case considered to be new plants, are thus taken into consideration in the intended tender volume and may be entitled to the market premium that is determined on a competitive basis for at most ten years. However, old plants, just like new plants, also have to comply with the requirements to provide flexibility and demonstrate that they are technically suitable for demand-oriented operation.

Special tender specifications are likewise defined for offshore wind energy. Significant features are: By way of supplementation of the specifications of the EEG 2017, offshore wind energy is regulated in a dedicated act, the Offshore Wind Energy Act (WindSeeG). Initially a distinction is made between tenders for preliminarily investigated areas (Section 16 et seq., Section 9 et seq., WindSeeG) and tenders for existing projects (Section 26 et seq. WindSeeG). In accordance with Section 26(2) WindSeeG, existing projects are considered to be those for which a plan was drawn up or approval was issued prior to 1 August

2016 under Section 5 or 17 of the Sea Facilities Regulation, a BImSchG approval is available or a discussion meeting has been conducted and the plants are planned in specific clusters (cf. Section 3 No 1 WindSeeG). This distinction in particular has effects for the predetermined expansion trajectory (see Table 3.5), the tender volume and the tender deadlines (see Table 3.4), the bid highest values (see Table 3.9) and the security to be deposited (see Table 3.10) and the requirements for bids, Section 20 or Section 31 WindSeeG.

The tender for preliminarily investigated areas is preceded by land development (Section 9 et seq. WindSeeG) on the basis of a land development plan (Section 4 et seq. WindSeeG). Areas under consideration will firstly be identified and the designated areas will be examined with regard to their suitability. The results of the preliminary examination also serve as a calculation basis for potential bidders to make a bid in relation to the preliminarily investigated land.

It must be emphasised that the legal consequence of a contract award goes beyond the justification of entitlement to the market premium both for tenders for preliminarily investigated areas and for existing projects. In both tender variants an entitlement to connection of the awarded plant to the specified connection line is also created. For plants that participate in tenders for preliminarily investigated areas the appropriate connection line emerges, in accordance with Section 24(1) No 3 WindSeeG, from the land development plan within the meaning of paragraph 1 of the WindSeeG. By contrast, existing projects must be guided by the network development plan (Sections 17b and 17c EnWG), Section 37(1) No 2 WindSeeG.

In accordance with Section 24(1) No 1 WindSeeG, a right to conduct a planning approval procedure on the awarded land is moreover justified for successful bidders in the tender for preliminarily investigated areas.

Supported direct marketing outside of the tendering system

New plants that do not participate in tenders owing to exception provisions, existing plants and hydropower and geothermal power plants will continue to be supported under the established system of direct marketing by means of the market premium. That is to say that the value to be applied is in each case defined by law. Significant amendments as a result of the EEG 2017 are presented below for each technology.

The gradual decrease in the values to be invested will be maintained here and is now regulated on a technology-specific basis in Section 40 et seq. EEG 2017 within the regulatory framework of the relevant provisions for the values to be

invested. As a result of the detailed provisions in this area, a greater amount of clarity is created.

Solar

The provisions relating to the values to be invested in solar in supported direct marketing have not significantly changed in terms of content as a result of the entry into force of the EEG 2017. The provision relating to the 'flexible cap' from Section 31 EEG 2014 is now regulated in the EEG 2017 in Section 49 EEG 2017 in a more relevant manner.

Table 3.11: Values to be invested in solar, 1 January 2017, Sections 48, 49 EEG 2017

Installed capacity	ct/kWh
Solar installations on or in buildings	
up to and including 10 kW	12.70
up to and including 40 kW	12.36
up to and including 750 kW	11.09
Ground-mounted solar installations	
up to 10 MW	8.91
Degression	
0.5 % with respect to the value to be applied of the preceding calendar month	1 February 2017
Gradual lowering of the value to be applied when exceeding 2 500 MW by specific amounts in the spectrum 1 % to 2.8 %, Section 49(2) EEG 2017	
Gradual increase in the lowering in the value to be applied when undershooting specific growth values from 200 MW spectrum 0.25 % to 0 %, Section 49(3) No 1 and 2 EEG 2017; **From an undershooting of 800 MW in combination with a one-off increase in the value to be applied to 1.5 % or 3 %, Section 49(3) No 3 and 4 EEG 2017.**	
Value to be applied is zero if 52 000 MW capacity from solar has been additionally created, Section 49(5) EEG 2017	
Payment period: 20 years plus start-up year.	

Onshore wind

The reference yield model, which was already adjusted in the EEG 2014, takes into consideration the different site qualities and is intended, over the duration of the granting of the higher initial payment, to offset financial disadvantages at sites with low levels of wind, was carried over to the EEG 2017 and continues to prevent overburdening at sites with high levels of wind. From 2019 onwards, however, the value to be applied will be calculated by the network operator analogously to the principles of the one-stage reference yield model in accordance with Section 36h EEG 2017, Section 49b EEG 2017.

The decrease in the value to be applied formerly defined in Section 29 EEG 2017 is carried over to Section 46a EEG 2017 with some amendments in terms of content. One particularly relevant content amendment is the relatively significant degression in the value to be applied in the period from 1 March to 1 August 2017. This should slow down the further growth in the short term, since the specified expansion corridor for onshore wind was considerably exceeded in 2014 and 2015. Past developments indicate that the 'flexible cap' provided for the first time in the EEG 2014 was unable to achieve the effect of sufficient volume management, which might be attributable to the fact that the cost-cutting potential and low-interest situation were not adequately reflected in the values. The EEG 2017 has improved this control mechanism, which is suitable per se, in order to be able to ensure a return to the expansion trajectory. This was also necessary for this period as the management effect proceeding on the basis of the tender volume only comes into effect for plants constructed in 2018/2019.

Table 3.12: Values to be invested Onshore Wind, 1 January 2017, Sections 46 to 46b EEG 2017

Value to be applied up to 2018	**ct/kWh**
Basic value, Section 46(1)	4.66
Initial value*, Section 46(2) first sentence	8.38
***) The increased initial value is granted for five years. In accordance with Section 46(2) second sentence it is extended by one month for every 0.36 % of the reference yield by which the yield of the plant undershoots 130 % of the reference yield; in addition extension by one month for every**	

0.48 % of the reference yield by which the yield of the plant undershoots 100 % of the reference yield. **(Reference yield is the calculated yield for the reference plant see Annex 2 EEG 2017 of 31.12.2016, Section 46(2), fourth sentence EEG 2017)**	
Degression	
1.05 % with respect to the value to be applied of the preceding calendar month	Times for 2017 1 March 1 April 1 May 1 June 1 July 1 August
0.4 % with respect to the value to be applied of the preceding calendar month	1 October Times for 2018 1 January 1 April 1 July 1 October
Gradual increase in the lowering of the value to be applied when undershooting specific expansion values spectrum 0.5 % to 2.4 %, Section 46a(2) and (3) EEG 2017.	
Value to be applied from 2019, Section 46b	Amount not determined; guided by results of tender (Calculation of the value to be applied analogously to Section 36h; **one-stage** reference yield model, contract award value is replaced by average from the bid values of the relevant highest bid also awarded for the bidding deadlines from the previous year)
Payment period: 20 years plus start-up year.	

Biomass

The values to be invested for electricity from biomass within the meaning of the biomass regulation and from the fermentation of biowaste and slurry have likewise decreased as a result of the degression. The provision serving for quantity control in Section 28(1) EEG 2014 is cancelled as the expansion is now

managed by means of the tender volume and in this way a deviation from the expansion path for biomass (150 MW per year up to 2019) is prevented.

Table 3.13: Value to be applied in Biomass, fermentation of biowaste and slurry, 1 January 2017, Sections 42 to 44a EEG 2017

Rated capacity	ct/kWh
Biomass	
up to and including 150 kW	13.32
up to and including 500 kW	11.49
up to and including 5 MW	10.29
up to and including 20 MW	5.71
Fermentation of biowaste	
up to and including 500 kW	14.88
up to and including 20 MW	13.05
Fermentation of slurry	
up to 75 kW installed power	23.14
Degression	
Section 44a	From 1 April 2017 on 1.4. and 1.10. of the year by 0.5 %
Payment period: 20 years plus start-up year.	

Landfill gas, sewage treatment gas and mine gas

The EEG 2017 combines the provisions relating to the value to be applied and the degression thereof for landfill gas, sewage treatment gas and mine gas into one provision. The values to be invested take into account the previous degression. They are still subject to an annual degression of 1.5 % in

comparison with the values to be invested in the preceding calendar year in each case.

Table 3.14: Value to be applied in landfill gas, sewage treatment gas and mine gas, 1 January 2017, Section 41 EEG 2017

Rated capacity	ct/kWh
Landfill gas	
up to and including 500 kW	8.17
up to and including 5 MW	5.66
Sewage treatment gas	
up to and including 500 kW	6.49
up to and including 5 MW	5.66
Mine gas	
up to and including 1 MW	6.54
up to and including 5 MW	4.17
from 5 MW	3.69
Degression	
Section 41(4)	From 1 January 2018 by 1.5 %
Payment period: 20 years plus start-up year.	

Offshore wind

The provisions relating to the legally defined payment for offshore wind in the EEG 2017 have not fundamentally changed in comparison with the EEG 2014. The provision relating to legitimate expectations arising from Section 102 EEG 2014 was merged with Section 47(1) second sentence EEG 2017; the concept of the coastline in Section 3 No 36, second clause EEG 2014 was carried over

without any change in terms of content to Section 47(2) third sentence EEG 2017. The lowering of the values to be invested, which was formerly regulated in Section 31 EEG 2014, is now provided in Section 47(5) to (7) EEG 2017.

Table 3.15: Values to be invested Offshore Wind, 1 January 2017, Section 47 EEG 2017

Value to be applied up to 2020	**ct/kWh**
Basic value, Section 47(1), first sentence	3.90
Initial value*, Section 47(2), first sentence, or	15.40
Payment at start Section 47(3)**	19.40
) The increased initial value is granted for the first 12 years from start-up of the plant. It is extended by 0.5 months for every full nautical mile beyond 12 nautical miles and by 1.7 months for every additional full metre of water depth beyond a water depth of 20 metres, Section 47(2), second sentence EEG 2017.** *) This increased value is granted for the first eight years from start-up at the request of the plant operator. It can be extended in the amount of 15.40 ct/kWh analogously to Section 47(2) second sentence EEG 2017.**	
Degression	
Values to be invested in accordance with Section 47(2) and (3), second sentence	
Start-up year 2018 and 2019	0.5 ct/kWh
Start-up year 2020	0.1 ct/kWh
Value to be applied in accordance with Section 47(3), first sentence	
Start-up year 2018 and 2019	1 ct/kWh
Payment period: 20 years plus start-up year	

Hydropower

The value to be applied for hydropower is determined in Section 40 EEG 2017 and, in comparison to the EEG 2014, is correspondingly a lower amount on account of the degression. It is still subject to an annual degression of 0.5 % in comparison with the value to be applied for the preceding calendar year in each case.

Table 3.16: Value to be applied in Hydropower, 1 January 2017, Section 40 EEG 2017

Rated capacity	ct/kWh
up to and including 500 kW	12.40
up to and including 2 MW	8.17
up to and including 5 MW	6.25
up to and including 10 MW	5.48
up to and including 20 MW	5.29
up to and including 50 MW	4.24
from 50 MW	3.37
Degression	
Section 40(5)	From 1 January 2018 by 0.5 %
Payment period: 20 years plus start-up year	

Geothermal energy

The legally determined value to be applied for geothermal energy remains the same at 25.2 ct/kWh, Section 45(1) EEG 2017. The intended degression of 5 % only comes into effect from 1 January 2021 and is now regulated in Section 45(2) EEG 2017 (Section 27(2) EEG 2014).

Table 3.17: Value to be applied in Geothermal energy, 1 January 2017, Section 45 EEG 2017

Rated capacity	ct/kWh
-	25.20
Degression	
Degression, Section 45(2)	From 1 January 2021 by 5 %
Payment period: 20 years plus start-up year	

Reduction in the funding entitlement

In certain cases, the value to be applied may be reduced, sometimes even retrospectively. The EEG 2017 now comprehensively governs the prerequisites and breaches of obligation that may lead to a reduction in the value to be applied to 'zero' in Section 5(51) et seq. EEG 2017.

The most important regulation may well be the regulation relating to electricity production in times of negative prices. It remains essentially unchanged in terms of content in Section 51 EEG 2017 (see content-related statements 2015 Progress Report, Chapter 3.0.2).

In addition to the provision relating to negative prices, new regulations have been established by means of the EEG 2017 which lead to a reduction in the value to be applied and are intended to prevent double support.

In respect of the use of regional certificates in accordance with Section 79a EEG 2017 (at present) for electricity from plants which is sold outside of the tendering system in supported direct marketing, Section 53b EEG 2017 provides for a reduction in the value to be applied of 0.1 ct/kWh. The rule is intended to prevent overloading by anticipated additional revenue on account of the use of regional certificates.

As a result of the simultaneous claiming of an electricity tax exemption and EEG support for the kilowatt hour of electricity it may lead to overloading which is prevented by the provision in Section 53c EEG 2017. Consequently, the value to be applied is reduced by the electricity tax exemption granted to one kilowatt

hour of electricity conducted through a network. The rule is to be applied retroactively from 1 January 2016 in accordance with Section 104(5) EEG 2017.

A breach of obligation that leads to a (retroactive) reduction in the value to be applied to zero in accordance with Section 52(1) first sentence, No 4, third sentence EEG 2017 is essentially committed by a person who, as plant operator whose entitlement was ascertained by way of the tender procedure, does not feed all of the electricity into the network but uses a proportion of it for its own consumption, cf. Section 27a first sentence EEG 2017. In Section 27a second sentence EEG 2017 provision is made for exceptional situations where it is permitted to deviate from this principle. Emphasis is given here to the special market-, system- and network-related situations regulated in Section 27a second sentence No 4 and 5 EEG 2017. In the event of feed-in management measures in accordance with Section 14 EEG 2017 and in times of negative stock market prices within the meaning of Section 51 EEG 2017, the electricity may be used upstream of the network. By means of these exception provisions, the EEG 2017 facilitates the development of meaningful concepts for utilisation of surplus volumes of electricity, from the network or market perspective, upstream of the network. This electricity would otherwise possibly not be produced as a result of curtailment. This result is consistent with the principle that electricity from renewable energy sources must be used as comprehensively and efficiently as possible.

Regional certificates

The EEG 2017 introduces an instrument for proving the regional nature of renewable electricity. In synchronous administration with the trading system for certificates of origin for renewable electricity, Section 79a EEG 2017 provides for the optional use of regional certificates for electricity volumes sold by way of direct marketing with market premium in accordance with Section 20 EEG 2017. Regional certificates are used solely for identifying volumes of electricity that are actually produced in terms of region from the perspective of the final consumer. They are managed by the Federal Environment Office, issued upon request for in each case one kilowatt hour of regional green electricity and redeemed for RE electricity that is verifiably supplied from the region concerned. The redemption then justifies the identification, in the electricity labelling, of part of the EEG share corresponding to the scope of the redemption as ‘produced regionally in relation to electricity consumption’. Through the use of regional certificates, electricity supply companies should be able to communicate the verifiably regional nature to the customer in a transparent and comprehensible manner and thereby create awareness and support from the customer for local plants. Through a

corresponding tariff design, in some circumstances the generation of additional revenue may be possible. In the context of the tendering system it must be assumed that anticipated additional revenue as a result of regional certificates will be priced-in when submitting the bid. In the case of plants supported by direct marketing outside of tenders, additional revenue is taken into consideration in the amount of the funding entitlement. In accordance with Section 53b EEG 2017, the legally defined value to be applied is accordingly reduced by 0.1 ct/kWh.

Landlord-to-tenant electricity supply act

The Landlord-to-tenant electricity supply act entered into force on 25 July 2017. Landlord-to-tenant electricity supply is electricity that is produced by solar installations on the roof of a residential building and is supplied from there and consumed directly by end consumers in that building or in residential buildings or ancillary plants with a direct physical connection thereto. In the future, operators of solar installations with an installed capacity of up to 100 kW may claim the payment of a landlord-to-tenant electricity supplement from their respective network operator for every kilowatt hour of landlord-to-tenant electricity supplied and consumed. This direct support supplements the indirect support through unpaid network charges, reallocation levies linked to network charges and taxes. The aim of the Landlord-to-tenant electricity supply act is to involve tenants in the energy transition and create new impetus for the extension of photovoltaic energy. In particular due to a lack of own supply arrangements within the meaning of Section 3 No 19 EEG 2017 these supply concepts usually represent a challenge as a business model. The Landlord-to-tenant electricity supply act supports these concepts and may contribute to opening up notable expansion potential for photovoltaic energy precisely in cities. This is therefore of key importance, as the solar sector has fallen short of the expansion trajectory of 2 500 MW/year for several years now.

According to current expectations, support for landlord-to-tenant electricity supply will not be associated with a significant (financial) additional expenditure for reallocation systems and network charges. At most an increase of 500 MW (of 2 500 MW) per calendar year is supported by means of the ‘landlord-to-tenant electricity supply supplement’, Section 23b(3) EEG 2017. When claiming the landlord-to-tenant electricity supply supplement, the residents of the dwelling must also be offered an electricity price, consisting of the landlord-to-tenant electricity supply price and the price for additional electricity obtained from the grid, which must not exceed 90 % of the base supply tariff in the relevant network area. This upper price limit in accordance with Section 42a(4) EnWG is intended

to ensure that the landlord, as the plant operator, is not the only beneficiary of the landlord-to-tenant electricity supply supplement.

The supplement is granted solely in respect of plants that had been or were commissioned with or after the entry into force of the Landlord-to-tenant electricity supply act (25 July 2017). The European Commission approved the EEG Landlord-to-tenant electricity supply support under subsidy law on 20 November 2017.

Funding for support via the EEG levy

The regulations relating to the EEG levy serve for distribution of the costs for promoting production of electricity from renewable energies. Within the meaning of the concept of solidarity, in this case the EEG levy is initially applied to each final consumption of electricity. Moreover, by means of the partial exemption of this burden for particular concepts or stakeholders – unlike in the case of direct support – energy policy and industrial policy aims are pursued in terms of reallocation. Privileges in the sector of own consumption and special equalisation schemes for electricity-intensive undertakings continue to be provided essentially in unaltered form by the EEG 2017; any amendments made are presented in the sections below. As a result of the expansion of the scope of the electricity storage privilege, the implementation of different storage concepts is made possible.

Own supply

End consumption for own supply (Section 3 No 19 EEG 2017) is essentially subject to the EEG levy obligation in the full amount just like any other electricity consumption in Germany (Section 61(1) No 1 EEG 2017). As the expansion of renewable energies is a mission for all of society and the burden should be distributed uniformly across all electricity consumers, in principle the EEG levy should be applied to every kilowatt hour of electricity consumed in Germany regardless of its origin. Moreover, externally supplied end consumers should not be disadvantaged with respect to end consumers who produce their own electricity. Rather, the aim is to achieve a ‘level playing field’ consistent with the key importance of the energy-only market for efficient implementation of the energy transition (cf. Electricity Market Act). Distortions of competition and disincentives (such as the price-inelastic ‘passing through’ of conventional own supply power plants, to the detriment of the production from renewable energy sources), are to be avoided.

However, own supply arrangements continue to be privileged under the EEG 2017 in terms of the levy if the electricity is produced from renewable energy sources. Consequently, the EEG 2017, as before, pursues the approach of incentivising participation in the reconfiguration of the energy system, by means of the reallocation privileging. Plants that were commissioned prior to the entry into force of the EEG 2014 are privileged in their entirety under provisions made to safeguard existing conditions, subject to certain requirements.

Section 61(1) first sentence EEG 2014 provided for an obligation for payment of a proportionate EEG levy for electricity end consumptions in own supply arrangements, which since 1 January 2017 has amounted to 40 % of the EEG levy for new renewable energy plants. New conventional power plants paid the full EEG reallocation charge from August 2014. The original regulation in the EEG 2014 provided for a corresponding reallocation privilege (to 40 % reduced EEG levy) also for new highly efficient cogeneration plants. This regulation was also adopted in the EEG 2017, whilst it has not as yet been approved under subsidy law by the European Commission and is therefore not currently enforceable.

For certain end consumptions in own-supply situations, the proportionate reallocation levy could already be waived, even in its entirety, under the EEG 2014 (Section 61(2), (3) and (4) EEG 2014). Pursuant to Section 61(2) EEG 2014 this affected end consumers using particular concepts, if they consume electricity for electricity production (No 1, power station own consumption), if they are neither directly or indirectly connected to a public network (No 2, ‘off-grid systems’), if they supply themselves completely with electricity from renewable energy sources and do not claim any EEG support payments for the electricity that they do not consume themselves (No 3, electricity independence) or if they obtain electricity from plants with at most 10 kW rated capacity and a calendar-year electricity consumption of at most 10 MWh (No 4, insignificant limit).

In addition, the complete exemption of end consumers with existing plants and old existing plants from the obligation to pay the reallocation levy was continued under the conditions of Section 61(3) and (4) EEG 2014 under provisions made to safeguard existing conditions, subject to certain requirements. From an economic perspective, these existing plants represent the overwhelming majority of the special provisions and in particular concern traditional industrial and commercial own production, which is estimated at approx. 60 TWh/year in Germany (cf. forecast ‘End consumption 2015 Planning Premises for the Calculation of the EEG Reallocation Levy, Berlin, 08.10.2014).

In terms of content, essentially hardly anything has changed in these specifications in the EEG 2017. The provisions for reducing the obligation to pay the reallocation levy for end consumption for own supply (Section 5 No 12, Section 61(1) first sentence EEG 2014) have fundamentally been carried over without alteration with regard to content to Section 3 No 19, Section 61(1) No 1, (2) and Section 61b EEG 2017. The waiver of the obligation to pay the EEG levy in the case of the own supply concepts ‘power station own consumption’, ‘off-grid systems’, ‘electricity independence’ and undershooting of the insignificance limit is now included in Section 61a EEG 2017. In this respect, with a view to new plants, this is a primarily systematic redesign of the area of own supply in order to improve comprehensibility.

Content-related amendments concern existing plants and old existing plants that were commissioned before 1 August 2014 and their future participation in the EEG levy, taking into account modernisation measures (Section 61e EEG 2017) and legal succession issues (Section 61f EEG 2017).

Through the EEG 2017, existing plants and old existing plants benefit on an ongoing basis, up to the replacement of the electricity generator, from the ‘EEG levy reduced to zero’. The criteria for existing plants or old existing plants in own production are defined in Sections 61c and 61d EEG 2017. Section 61e EEG 2017 provides that if an electricity production plant (cf. Section 3 No 43b EEG 2017) is refurbished or replaced after 31 December 2017 without expanding the installed capacity, this existing plant or old existing plant (within the meaning of Section 61c or 61d EEG 2017) from then on must participate in the reallocation charge mechanism with a proportionate EEG levy in the amount of 20 %. This is the major change with respect to the EEG 2014, under which modernised or refurbished existing plants, or even existing plants that were expanded by 30 % of capacity, also continued to be exempt from the obligation to pay the reallocation charge.

Through the introduction of Section 61f EEG 2017, which regulates legal succession in own supply situations inter alia in the case of inheritance, the EEG 2017 firstly provides greater legal certainty and secondly specifies the cases in which a reduced EEG reallocation charge exemption is also granted to the legal successors.

The approval under subsidy law of the own supply regulations in the EEG as described expired at the end of 2017. By decision of 19 December 2017 it was renewed by the European Commission. The approval was not granted in respect of the reallocation privileges for own supply from new highly efficient

cogeneration plants, however, as in some situations it can lead to cases of overloading. In respect of own supply from new highly efficient cogeneration plants, the full EEG levy has thus been payable since 1 January 2018 due to the lack of approval under subsidy law. The Federal Government is holding constructive discussions with the European Commission in this regard in order to obtain the previous legal situation as far as possible, whilst at the same time avoiding the identified overloading situations.

Special equalisation schemes

The 2014 EEG amendment also revised the 'special equalisation schemes' under which energy-intensive undertakings only have to pay a reduced EEG levy and brought it into line with the environmental and energy aid guidelines published by the European Commission. The 2017 EEG was not essentially changed with respect to the provisions of the EEG 2014.

The EEG 2017 updates the application conditions for undertakings that belong to a sector in List 1 Annex 4 of the EEG. Instead of an energy cost intensiveness of previously 17 %, these undertakings now have to prove an energy intensiveness of 14 % in accordance with Section 64(1). If the energy intensiveness of the undertaking is more than 14 % but less than 17 % then under Section 64(2) No 2b the undertaking must pay 20 % of the EEG levy for electricity consumption beyond the first gigawatt hour.

Furthermore, Section 64(5a) EEG 2017 created the possibility that undertakings are permitted to submit an application in the Special Equalisation Scheme with their entire electricity volume that is subject to levy and exempt from levy. In particular, this enables own suppliers to achieve the necessary energy cost intensiveness for a limit. As the legal consequence, undertakings then pay, in respect of the entire electricity volume beyond one gigawatt hour, a reduced EEG levy. This also applies to the electricity volumes reduced to zero in accordance with Sections 61c and 61d.

Electricity storage privilege

The electricity storage privilege resulting from Section 60(3) EEG 2014 has become Section 61k EEG 2017. Whilst the regulation for conversion of RE electricity into storage gas and the conversion thereof back into electricity elsewhere was carried over to Section 61k(2) EEG 2017 generally without any changes in terms of content, the provision relating to energy stores 'to be converted back into electricity on site' (Section 60(3) first sentence EEG 2014) was fundamentally amended and its scope was expanded. As a result, the

double taxation of the stored and withdrawn electricity volumes through the EEG levy can be avoided. Many storage operating concepts – which in particular provided for storage utilisation ‘upstream of the network’ and so-called bivalent storage utilisation – were not possible without double taxation of stored and withdrawn electricity volumes under the provisions of Section 60(3) first sentence EEG 2014. For storage concepts that by contrast serve exclusively for storage of own-produced RE electricity and later own consumption, under the provisions relating to own supply in the EEG 2014 the levy could be reduced or even waived for both the stored and withdrawn electricity volumes.

The EEG 2017 solves this problem essentially by the fact that the electricity volumes stored by the store in accordance with Section 61k(1), (1a) first sentence EEG 2017 are exempted from the EEG levy (at the most up to zero) in the same extent and amount as the levy that is payable on end consumption withdrawn from the store. The electricity store is regarded as an end consumer in relation to the storage and as an electricity producer in relation to the withdrawal. Storage losses are exempt from the levy, Section 61k(1) third sentence EEG 2017.

In respect of mixed use stores, which withdraw both ‘upstream of the network’ or to the operator and into the general supply network, a different balancing period (a calendar month instead of a calendar year in the usual case) is defined in particular in Section 61k(1a) second and third sentences EEG 2017 and the reduction of the levy is limited to at most 500 kWh consumed by the store for each installed storage capacity per calendar year.

3.0.3 Renewable Energies Heat Act

The Renewable Energies Heat Act (EEWärmeG), which entered into force on 1 January 2009 and was amended at the beginning of 2011 on the basis of the EAG EE (inter alia expansion of the scope of ‘heating’ to ‘heating and cooling’), addresses, by means of its obligation to use renewable energies, the heating and cooling supply primarily in the construction of buildings. In accordance with Section 1(2) EEWärmeG, the Act is aimed at contributing to increasing the share of renewable energies in final energy consumption for heating and cooling to 14 % by 2020. At the end of 2016, this share was already at 13 %. In accordance with Section 18, the Federal Government regularly submits a status report in relation to this Act. The EEWärmeG status reports (currently: second status report of 18 November 2015) examine the status of the market introduction of installations for the generation of heating and cooling from renewable energies, the technical development, development of costs and economic viability of these

installations, the quantities of fossil fuels saved through the Act and the greenhouse gas emissions reduced by the Act. Furthermore, the statuses of the Federal Länder implementation with respect to the Act are presented and recommendations are made for the further development and future design of the EEWärmeG, inter alia for alignment of the Act with other instruments of the heating market (BMU, 2012; BMWi, 2015).

3.0.4 Market Incentive Programme for the use of renewable energies in the heating market

The Market Incentive Programme for the use of renewable energies in the heating market (MAP) has for many years been a key instrument used by the Federal Government to promote the use of renewable energy in the heating and cooling sector and has been enshrined in the EEWärmeG since 2009 (Section 13 Funding). Whilst the approach of the EEWärmeG in terms of regulatory law targets building construction, the financial support of the MAP is aimed primarily at existing buildings.

The details of the MAP funding are set out in the funding guidelines. These 'Guidelines for the funding of measures for the use of renewable energy in the heating market' are adapted as and when necessary to reflect the state of technology and changes in the market. The programme includes two funding sections. For solar thermal plants, heat pumps and biomass plants in the relatively small capacity range, investment grants are awarded by the Federal Office for Economic Affairs and Export Control (BAFA). Larger plants and heating networks and storage facilities are supported in the context of the KfW Renewable Energies programme (premium) with repayment grants for early, proportionate repayment of low-interest loans from the KfW.

The content of the MAP was last amended in 2015, and the new version of the funding guidelines has been in force since 1 April 2015. The funding was extended, improved and scaled to an even greater extent according to the efficiency of the supported plants. Furthermore, new funding options are created such as the yield-dependent support for solar thermal plants and the funding for particularly efficient heat pumps in new construction. The amendment also opened the programme up to the commercial sector to an even greater extent.

In the 2015 funding year, total funds of around EUR 167 million was paid in the two funding sections (BAFA, KfW) of the MAP and thus an estimated investment volume of roughly EUR 630 million was released. Specifically, in 2015 investment grants of approx. EUR 92.3 million for around 38 200 renewable

heating plants were disbursed from the grant section of the MAP (BAFA), predominantly to private individuals in the one- and two-family home sector. Moreover, in the section of the MAP managed via the KfW repayment grants of approx. EUR 74.5 million were disbursed which were payable mainly for the proportionate repayment of KfW loans granted in previous years. 1 521 KfW loans were newly granted in 2015 and comprise a loan volume of approx. EUR 138 million in connection with repayment grants in the amount of roughly EUR 44 million.

In the 2016 funding year, as the first year in which the new funding rules in accordance with the aforementioned amendment were fully applicable to the programme, it was possible in particular to identify increased demand in the section of the programme managed by means of the BAFA. In total, funding of approx. EUR 243 million was disbursed and thus estimated investment of EUR 1 billion was released. Specifically, in 2016 investment grants of approx. EUR 182.3 million for around 68 000 renewable heating plants were disbursed from the grant section of the MAP (BAFA). In addition, in the section of the MAP managed via the KfW repayment grants of approx. EUR 61 million were disbursed which were payable mainly for the proportionate repayment of KfW loans granted in previous years. 1 463 KfW loans were newly granted in 2016 with a loan volume of approx. EUR 106 million in connection with repayment grants in the amount of roughly EUR 41 million.

3.0.5 KfW support programmes for energy-efficient construction and renovation (CO_2 Building Renovation Programme)

The KfW support programmes for energy-efficient construction and renovation are funded by resources from the CO_2 Building Renovation Programme and are an essential element for energy saving in the building sector. The support programmes are targeted at all owners of residential buildings, commercial buildings, and buildings housing municipal and social bodies (owner-occupiers, private landlords, commonhold associations, housing associations, municipalities, municipal and social organisations and commercial companies). Support is provided for energy improvements – both individual measures (insulation, replacement of windows, upgrading of heating systems) and major renovations – and the construction of new energy-efficient buildings. The levels of support go far beyond the requirements of the EnEV. The rule here is the more energy-efficient a building the greater the level of support.

Support is provided mainly through low-interest loans, which can also be combined with a repayment grant of up to 27.5 % of the amount of the loan

depending on the energy efficiency level. Alternatively, private owners of one- and two-family houses or owners of flats (owner-occupiers and landlords) can also receive a one-off grant for up to 30 % of the investment costs.

Low-interest loans help to reduce the financial costs and grants help to reduce the investment costs. The support also benefits tenants as it reduces the costs attributable to them (modernisation levy).

The funds for the CO_2 Building Renovation Programme were maintained up to 2018 and increased to EUR 2 billion.

Since 2006, the funding has supported the energy-efficient renovation or construction of almost 5 million homes with an investment volume of around EUR 320 billion. Furthermore, since 2007 support has been provided for energy-saving measures at more than 3 000 buildings forming part of the social and municipal infrastructure. The investments supported since 2006 have helped to reduce CO_2 emissions by around 10.3 million tonnes per year. This calculation is based on an average use period of the measures of 30 years.

A new KfW programme for the promotion of energy improvements and the construction of new commercial buildings was launched on 1 July 2015. Since the start of the programme, more than 3 500 low-interest loans for energy improvements and energy-efficient construction have been approved. Since 1 October 2015, support has been provided not only for energy improvements but also for the construction of new energy-efficient buildings for municipal and social bodies.

3.0.6 Energy Efficiency Incentive Programme (APEE)

As an alternative to the fiscal support planned in the NAPE, since 2016 total federal funds in the amount of EUR 165 million per year have been provided for the ‘Energy Efficiency Incentive Programme (APEE)’. The APEE consists of three investment support components and serves to increase energy efficiency measures in the building sector and investment in plants that use renewable energy to generate heat and to assist the introduction on the market of fuel cell heating.

The energy efficiency measures in the building sector are funded as package measures by means of the KfW programmes ‘Energy-efficient renovation’. The package measures comprise the installation of ventilation systems (ventilation package) combined with measures for renovation of the building shell and the replacement of inefficient heating systems with efficient ones (heating package); this includes measures for optimisation of the heating system (heating and heat

distribution). For owners of residential buildings, either a loan or a grant variant are available. In the case of the loan variant a low-interest loan combined with a repayment subsidy of 12.5 % is granted. The amount of the alternative investment subsidy is 15.0 % of the investment costs.

In the case of installation of heating systems based on renewable energy, such as for example a pellet heater, a heat pump or a solar thermal power plant, the APEE is linked to the MAP. If the requirements of the heating package are met, additional support in the amount of 20 % of the normal MAP funding amount is possible for the installation of the new heating system. In addition, there is a one-off lump sum payment of EUR 600 for the simultaneous optimisation of the entire heating system. This additional support can be applied for by private households, companies, independent professionals, municipalities, other legal persons governed by private law within the context of a MAP application.

The introduction on the market of innovative fuel cell heating for new builds and existing buildings has been supported since August 2016 by means of the KfW programme ‘Energy efficient construction and renovation – Fuel cell grant’. Owner-occupiers, commonhold associations of private individuals, independent professionals, domestic and foreign companies, contractors, municipalities, municipal companies and municipal special-purpose associations, non-profit organisations and churches that install fuel cell heating in a residential or non-residential building are eligible to apply for this support. For fuel cell heating with an electrical capacity of 0.25 to 5.0 kilowatts, it is possible to apply for a grant in the amount of up to EUR 28 200, depending on the capacity.

From 2016 to the end of 2017, around 90 000 funding commitments had already been granted via the APEE.

3.0.7 Energy Saving Regulation

More stringent requirements for new builds came into force on 1 January 2016. In this legislative period, the energy-saving law for buildings is intended to be amended and the provisions of the Energy-saving Act, the Energy-saving Regulation and the Renewable Energies Heat Act are intended to be merged into a new Building Energy Act.

3.0.8 National efficiency label for old heating systems

From September 2015, the EU Energy Consumption Labelling for heating systems, water heaters and hot water stores in accordance with Regulations (EU) No 811/2013 and No 812/2013 became mandatory. It applies only in

respect of products that are newly placed into circulation. Thus far the efficiency potential of existing products has not been addressed by means of the EU regulation. The aim of the national regulation to increase the motivation of building owners to replace old inefficient heating systems and thus to increase the rate of replacement of old boilers. The transition from an old inefficient heating system to efficient technologies and renewable energies requires sufficient notice for planning, and this is why building owners have to be encouraged to do so in good time; in the event of failure of the old heating system there is usually too little time to make the change to renewable energies. This can be solved by the national heating label, as the label gives a nudge to replace the boiler regardless of the need for repair or to procure a replacement.

Boilers that are more than 15 years old will be gradually fitted with the new efficiency label for old heating systems from 1 January 2016. Consumers will thus be informed about the efficiency status of their heater and about energy advice offers and support. Heating fitters, chimney sweeps and certain energy advisors are authorised to affix the labels as from 2016; from 2017 onwards, it is obligatory for the district chimney sweeps to affix the labels after inspecting the chimney.

The labelling will take place over a period of eight years in order to evenly distribute the additional demand created thereby for energy advice and heating improvements. The efficiency label for old heating systems is intended to be used up to a rated power of 400 kW (one- or two-family homes up to construction of large multi-storey residential buildings). The efficiency class of the boiler can be determined via a publicly accessible online or app calculator, without having to take measurements or make calculations. The legislative process for the national efficiency label for old heating systems was completed in November 2015 by means of an amendment to the Energy Consumption Labelling Act (EnVKG).

3.0.9 Measures under town and country planning law - amendment to the Federal Building Code

During the reporting period, Germany has made still more provision for climate protection in planning law. The Act to strengthen internal development in towns and municipalities and to further enhance town planning law of 11 June 2013 entered into force on 20 September 2013. The subject of this amendment is the strengthening of internal development in towns and municipalities in the Federal Building Code (BauGB) and the amendments in the Regulation on Land Use

(BauNVO). However, there are also a number of changes relating to climate protection:

Simplification of the granting of approvals for biogas plants under planning law

The privileged treatment of biogas production plants in rural areas is no longer linked to the combustion heat output but only to the capacity of a plant to generate a maximum of 2.3 million standard cubic metres of biogas per year. This allows more flexible operation of the plants to compensate for fluctuations in other sources of renewable energy.

Climate protection and climate adaptation as a catalyst for urban redevelopment measures

In addition to other deficiencies in the field of urban planning, since 2013 a failure to fulfil the requirements of climate change mitigation and adaptation can also be seen as a catalyst for urban redevelopment measures. Explicit identification of climate change mitigation and adaptation issues as grounds for urban renovation measures means that construction of renewable energy plants can be one of the measures in the redevelopment area (Section 136(2) second sentence No 1 BauGB).

Granting of approvals for photovoltaic and solar thermal installations and cogeneration plants in urban areas

Subsidiary ancillary plants to use solar radiation energy in and on roofs and outside walls of buildings in urban areas are now also explicitly permitted under planning law as ancillary plants pursuant to Section 14(1) first sentence BauNVO even if all or most of the energy produced is fed into the public grid (commercial use). This same classification also benefits cogeneration plants, albeit with an elucidatory effect and for reasons of equity with solar installations. They were previously included as part of the building or under Section 14(1) BauNVO. The most recent amendments of the BauGB and the BauNVO within the reporting period do not relate to renewable energies.

In addition, the Act establishing a flexibility clause for the federal states on the stipulation of minimum distances between wind power plants and permitted uses of 15 July 2014 also entered into force on 1 August 2014. It gives the federal states the authority, up until 31 December 2015, to make the eligibility for privileged treatment under planning law for wind power plants in rural areas dependent on compliance with certain distances from permitted building uses

named in federal state law. The amendment provides for specific rules in the individual federal states on the distances between wind power plants and other permitted uses, such as residential development, and thus helps to make planning law more flexible.

Federal Länder initiative on wind energy

In its energy concept, the Federal Government has decided to work with the federal states to launch an initiative to earmark new sites for wind power plants by way of modifications to land-use plans, to identify and develop approaches that enable the use of wind energy to be expanded while safeguarding nature and the environment, and to gain acceptance from the population. Since May 2011, representatives from central government and the federal states have therefore been meeting regularly within the Federal Länder initiative on wind energy to exchange information and experiences. Current problems associated with the expansion of onshore wind energy are addressed, and possible solutions discussed.

3.0.10 Federal Requirements Plan Act (BBPlG)

The Federal Requirements Plan Act identifies, for the conversion and expansion projects listed therein, the energy need and the urgent requirement for ensuring a secure and reliable operation of the transmission network.

The cross-border and transnational extra-high-voltage lines play a key role and are labelled accordingly. These account for 26 of the current total of 43 projects in accordance with the BBPlG. The Grid Expansion Acceleration Act (NABEG) then applies to these projects in the subsequent steps of the process.

Also identified are pilot projects that are possible under the BBPlG, in which the network operators can trial the use of new technologies (high-voltage direct-current transmission (HVDC), high-temperature overhead line conductors, underground cables). The HVDC transmission lines that are specially identified to that end are to be constructed primarily as underground cables instead of as overhead lines, as in the past.

3.0.11 Grid Expansion Acceleration Act (NABEG)

The conversion and expansion of the grid infrastructure is essential for transporting electricity from renewable energy plants to consumers. The aim of the NABEG is to speed up approval procedures for cross-border and transnational extra-high-voltage lines.

Federal Sectoral Planning and Federal Network Plan

As a result of the NABEG created in 2011, the planning and approval procedures for cross-border and transnational extra-high-voltage lines can be conducted by the Federal Network Agency in order to speed up the expansion of these lines.

The procedure is divided into two stages: first, route corridors in which the lines are to later run are defined in the Federal Sectoral Plan. In the second step, the planning approval procedure, the exact construction of the line in question is planned. Through the Regulation on the Allocation of Planning Approval [Planfeststellungszuweisungsverordnung], the federal states have transferred the responsibility for the planning approval procedure to the Federal Network Agency. The Federal Network Agency is therefore a 'one-stop-shop' for the procedures under the NABEG. The federal states, public stakeholders and the general public are involved in all the process steps.

Network development for offshore wind energy

The organised and economically efficient connection of offshore wind farms will advance the spread of offshore wind energy. Offshore wind farms are connected in clusters as shared connections. The annual Federal Sectoral Plan for offshore wind in the Exclusive Economic Zone (EEZ) identifies clusters of offshore wind farms (OWP) that are suitable for shared connections. It also includes the necessary routes for the shared connections, locations for the converter platforms and cross-border power lines, and descriptions of possible interconnections. The expansion planning of wind farms and networks takes place in a transition period (OWP start-ups in 2021 to 2023) on the basis of the 2017-2030 O-NEP to be reviewed by the Federal Network Agency by the end of 2017. This O-NEP is the last O-NEP. Future expansion planning of wind farms and networks (after 2023) will take place on the basis of the central tender model by means of a land development plan prepared for the first time in 2019.

3.0.12 Energy Management Act [Energiewirtschaftsgesetz]

The 'Third Act to Reform Energy Management Regulations' of 20 December 2012, announced in the Federal Law Gazette [BGBl.] on 27 December 2012, amended the Energy Management Act [EnWG] as from 28 December 2012.

Existing pumped storage power plants will be exempt from network charges for a period of 10 years if they increase their pump or turbine capacity by at least 7.5 % and their energy storage capacity by at least 5 % after 4 August 2011. The previous legislation, under which existing pumped storage power plants had to

increase their pump or turbine capacity by at least 15 % and their energy storage capacity by at least 5 % in order to be exempt from network charges, has proven not to be feasible in practice. The amendment has lowered the requirements in two respects. In this way, greater incentives for investments in existing pumped storage power plants have been provided.

The EnWG was amended and supplemented multiple times with effect from 1 January 2016:

By means of the **Electricity Market Act** of 26 July 2016 (BGBl. I p. 1786) the aims and basic principles of the further developed electricity market (‘electricity market 2.0’) were included in the Energy Management Act (EnWG). These provisions ensure free competitive pricing and allow price peaks on the electricity markets. The provisions relating to balancing group management and to the equalisation energy system are developed as a key instrument for a secure electricity supply.

In this respect, the **electricity network access regulation** (Strom-NZV) was also amended. In order to use existing capacities in a more cost-effective and environmentally compatible manner, entry barriers for providers of load management measures and renewable energy plants were removed in the controlled energy market; as a result, the use of flexibility options was facilitated.

In order to ensure security of supply even under changed conditions on the electricity market, the legal bases for a capacity reserve were established. The capacity reserve serves to safeguard the electricity supply. It is used in order to ensure security of supply, even if despite free pricing on the electricity exchange there is no sufficient supply, so as to enable a balance between supply and demand. To that end, capacities outside of the electricity market are kept available and used as required. Furthermore, the **regulations on the grid reserve** were extended beyond 31 December 2017 and the regulations relating to reimbursement of costs were amended.

In the context of the Act for modernisation of the network charge structure (Network charge modernisation act), which was passed by the German Bundestag on 30 June 2017, the transmission system operators were also granted the option of procuring **special network engineering resources** as an ancillary service in order to ensure appropriate operation of the transmission system.

Finally, the monitoring of security of supply is improved due to its key importance. The **report on security of supply** to the electricity markets appears

at least every two years and also looks at Germany in the context of the European electricity markets. This takes account of the fact that real synergies are being created as a result of the increasing integration of the electricity market into the European electricity markets. In the regional grouping, load peaks and production capacities can be equalised much more effectively, and as a result fewer production capacities overall are required.

The **Act on Digitalisation of the Energy Transition** of 29 August 2016 (BGBl. I p. 2034), provides the legal bases for the economically viable introduction of 'intelligent measuring systems'. The previous regulatory authorisation in the EnWG was dropped in favour of a separate Act. The decentral electricity supply system of the future is characterised by two-way flows of information and electricity, and passive consumers of electricity are increasingly becoming 'prosumers' who are actively participating in the design of the electricity supply system. Taken together, these changes in particular increase the demands imposed on the measuring and communication technologies and data processing systems to be employed. In this connection, intelligent measuring systems play an important role. Depending on the equipment in each case, they can provide the necessary consumption information for end consumers, network operators and producers; they can be used to convey network status data and to support safe and reliable management measures, and they serve as a kind of communication platform in the intelligent energy network. In this case, cross-sector use of intelligent measuring systems is also being set up, for example for electricity, gas, district heat and heating or in the 'smart home' sector. Thus, the benefit for consumers can be maximised. However, intelligent measuring systems are also an instrument for greater energy efficiency. End consumers obtain precise information about their consumption behaviour. Intelligent measuring systems also enable the implementation of variable tariffs. Platform compatibility and especially the manufacturing in accordance with a privacy-by-design standard of the Federal Office for Safety in Information Technology are the features that distinguish intelligent measuring systems from conventional systems ('smart meters').

Market master data register

Sections 111e and 111f EnWG and the Regulation on the market master data register, which is based thereon and entered into force on 1 July 2017, form the bases for the establishment of a market master data register (MaStR)[45] by the Federal Network Agency (BNetzA). The aim is to improve the safeguarding and

[45] The MaStR can be viewed online at www.marktstammdatenregister.de.

monitoring of security of supply, in particular the safe operation of energy supply networks and monitoring of security of supply, and to simplify the reporting obligations under energy laws by bundling data notifications. This is intended to reduce bureaucracy in the acquisition of data and ensure the availability and quality of historical energy data for a range of stakeholders. The Federal Network Agency will run the market master data register as an online database that is intended to be ready for use in full from the end of 2018.

3.0.13 Greenhouse Gas Quota in the Federal Emissions Control Act (BImSchG)

Up until the end of 2014, a key funding instrument for biofuels was the biofuel quota. The size and design of the quota system is regulated in the Federal Emissions Control Act (Section 37a to Section 37g).

From 2015, this requirement has been changed to a reduction in greenhouse gases. The aim is to promote biofuels with a better GHG performance more heavily so that greater contributions can be made by fuels to meeting the climate protection commitments. From 2015, those who have made the commitments accordingly have to ensure that the GHG emissions of the fuels that they place into circulation (petrol, diesel and biofuels) in total are reduced by a fixed percentage with respect to the fossil reference value. For 2015 and 2016, this was 3.5 % and since 2017 it has been 4 %. From 2020 onwards, a further increase to 6 % has been determined.

Biofuels placed in circulation since January 2011 to meet the biofuel quota must still satisfy the sustainability requirements under the Biofuel Sustainability Regulation [Biokraft-NachV].

3.0.14 National Platform for Electro-Mobility, Government Electro-Mobility Programme

Alongside the information on the use of renewable energy set out in the NREAP, the Federal Ministry for Economic Affairs and Technology (BMWi), together with the Federal Ministry for Transport and Digital Infrastructure (BMVI), the Federal Ministry for Education and Research (BMBF) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) set up a Joint Agency for Electric Mobility (GGEMO) on 1 February 2010, which continues to provide a single point of contact with the Federal Government. The National Platform for Electro-Mobility (NPE) was also set up in 2010. Representatives from industry, research and politics work closely together in this forum. Concrete

implementation steps are defined and proposed, with the aim of establishing Germany as the leading market for and the leading provider of electro-mobility. The NPE consists of a steering group and six working groups with some 20 members each.

Between 2010 and 2012, the NPE presented three important reports (taking stock of developments to date in electro-mobility in Germany / opportunities for German business and the efforts that the NPE considered necessary for the country to become both a leading market and a leading provider / importance of the showcase projects and the research and development that are needed in the market preparation phase).

The Government's Electro-Mobility programme of May 2011 had picked up key recommendations from the NPE report and started work on implementing them, the report says. The progress report on the market preparation phase was published by the NPE in 2014.

3.0.15 Electro-Mobility Act

The Electro-Mobility Act (EmoG), which entered into force on 12 June 2015, was intended to promote the widespread use of electro-mobility. Electrically operated vehicles (passenger vehicles and light commercial vehicles) can thus be given priority with regard to parking, use of public roads or streets for certain purposes and for allowing exceptions to access restrictions or through-passage prohibitions in the local municipal areas. The responsible local authorities can arrange the privileges at their own discretion.

3.0.16 Promotion of the sale of electrically operated vehicles (environmental bonus)

In order to promote electro-mobility, since 2 July 2016 it has been possible to apply for a premium for new purchases of electric vehicles[46]. This amounts to EUR 2 000 for a battery powered electric vehicle or fuel cell vehicle and EUR 1 500 for an externally charged hybrid electric vehicle. The manufacturer of the vehicle must give the buyer at least the same amount of discount in order for the funding to be granted. Federal funds in the amount of EUR 600 million have been provided for the funding programme (up to 2019 at the latest). With

[46] Directive for promotion of the sale of electrically operated vehicles (environmental bonus) of the Federal Ministry for Economic Affairs and Energy: http://www.bmwi.de/Redaktion/DE/Downloads/B/Bekanntmachung-richtlinie-zur-foerderung-des-absatzes-von-elektrisch-betriebenen-fahrzeugen.pdf

this level of funding, it should be possible for 300 000 vehicles to be sponsored. However, up to January 2017 only 10 835 applications had been submitted.

3.0.17 Other measures to promote renewable energy

'Electricity Market' platform

The overall objective of the electricity market platform is the further development of the electricity market 2.0, so that this ensures a reliable, optimally cost-effective and environmentally compatible electricity supply with growing shares of electricity from wind and solar energy (BMWi, 2017e). Four working groups discuss the following topics:

- The Security of Supply and Market Design working group deals with the question of how the high level of security of supply in Germany and Europe can continue to be ensured in the future. How does the electricity market 2.0 need to evolve in order for the electricity supply to remain safe, clean and affordable in the future?

- Times with a great supply and times with a low supply of electricity from renewable energy sources will alternate, because in the future in particular wind energy and photovoltaic energy will increasingly define the electricity supply in a decisive manner. Accordingly, the electricity system must be able to compensate for these fluctuations in a fast and flexible manner. The Flexibility working group deals with the subject of flexibility in terms of both supply and demand.

- The focus of the Development of Promotion of Renewable Energies working group is the further expansion of renewable energies and the development of the provisions under the EEG 2017. The Diversity of Stakeholders / Community Energy working sub-group held detailed discussions on the possible effects of the shift of funding to tenders on diversity of stakeholders and community energy. Its findings had an influence on the EEG 2017. In future, the working group will deal with the implementation of the EEG 2017.

- The 'European Electricity Market Integration' working group supports the European discussion on the development of the EU electricity market design. Among other things, it deals with development of the European electricity markets, regional approaches to safeguarding security of supply, improved integration of renewable energies and enhanced regional cooperation in the expansion of renewable energies.

'Energy Networks' platform

Stable network operation and a reliable supply of electricity can only be guaranteed with efficient and modern transmission and distribution systems. It was against this background that the Federal Ministry for Economic Affairs launched the permanent 'Energy Networks' platform in February 2011 (BMWi, 2017b). Here, the key stakeholders – grid operators, national and regional institutions and associations – work together to develop solutions for network expansion and modernisation of electricity grids. The following thematic priorities are at the centre of the work of the platform:

- social acceptance of the construction of electricity lines,
- network development plans,
- planning and approval procedures for electricity lines,
- connecting offshore wind farms to the grid,
- regulatory framework conditions for investment in networks,
- development of intelligent networks and smart meters,
- maintenance of safe network operation.

The work of the 'Energy Networks' platform is conducted in regular plenary sessions and four thematic working groups.

Buildings energy transition platform

It is the aim of the Federal Government to achieve a virtually climate-neutral building stock by 2050. In order to contribute to achieving this goal, on 3 July 2014 the Buildings energy transition platform was founded (BMWi, 2017d), where relevant interest groups from industry, civil society and research meet with representatives from the federal and regional authorities. Current developments are presented and discussed at the sessions. In the context of the two platforms – Buildings and Energy Efficiency (see below) – joint working groups whose preliminary findings and conclusions have a bearing on the work of both platforms regularly convene to discuss the following subjects:

- Innovative funding concepts
- Legal framework/EDL

- Competitive tendering
- System issues
- Support programmes
- Advice and information

Energy efficiency platform

Increasing energy efficiency is a cross-cutting problem that can only be solved by society as a whole. It is also in the interest of energy consumers, as increasing energy efficiency contributes to reducing energy costs to a significant extent. The Energy Efficiency platform intends to develop and discuss joint solutions with relevant stakeholders from industry, civil society, research and the government departments concerned as well as the federal states (BMWi, 2017a). It is composed of a plenary and various working groups (see above in the section 'Buildings Energy transition platform') and sits at regular intervals. Among other things, it accompanies the development of the National Energy Efficiency Action Plan (NAPE).

Research and innovation platform

The research and innovation platform (R&I platform) conducts a dialogue on the strategic alignment of energy research policy with national stakeholders from the spheres of politics, industry and research (BMWi, 2017c). Associations, selected businesses, research institutes and the government departments concerned at a federal and regional level are represented in the platform. Since May 2015, two sessions have been organised each year. In order to more effectively utilise and to interlink to a greater extent the diverse research activities in Germany, the R&I platform brings together and coordinates the long-term energy research networks. Around 2 300 experts are registered in the 7 subject-specific networks (currently: renewable energies, electricity networks, buildings and districts, energy system analysis, flexible energy conversion, energy efficiency in industry and trade, biomass). Short-term issues are discussed in flexible and fixed-term ad-hoc working groups, for example in the cross-network Start-ups working group. The findings are taken into consideration inter alia in the preparation of a new energy research programme.

Expert Agency for Onshore Wind Energy

Since 2013 the Expert Agency for Onshore Wind Energy [Fachagentur Windenergie an Land – FA Wind] has supported the expansion of onshore wind

energy in Germany in a manner that is compatible with nature and the environment. FA Wind is organised as an association supported by central government, the federal states, municipal umbrella organisations, energy companies and civil society organisations. It advises planning authorities on the expansion of onshore wind power and contributes to the general dissemination of knowledge to increase the acceptance of the use of onshore wind energy.

'Energy transition' research forum

The 'Energy transition' research forum is a dialogue platform in which representatives from central government, the federal states, universities and other academic bodies, business and society discuss key issues relating to the energy transition. The options and proposals drawn up in the research sector are evaluated and recommendations and further research needs are derived from these.

Energy research

The Federal Government's planned reorganisation and decarbonisation of the German energy supply system on the basis of high efficiency and extensive use of renewable energy by 2050 can only be achieved through significant technological innovations in nearly all components of the energy system. Energy research is therefore a strategic element of energy and economic policy in shaping the energy transition. The basis of the funding policy of the Federal Government in this area is the current 6th Energy Research Programme, which sets out the entire energy chain, from the development of the technical and technological components of energy supply and transition to transport and distribution, including storage through to energy use in various sectors. The reorientation of energy and climate policy also gives rise to new and additional assumptions for the energy research policy of the Federal Government. In order to take stock, the Federal Government is planning to present a new 7th Energy Research Programme in 2018 and has begun the preliminary work for this. To that end, at the end of 2016 a broad consultation process was initiated which integrates key formats of the energy research policy (R&I platform, research networks). From a scientific standpoint it is accompanied by the strategic key project 'Trends and perspectives of energy research'.

Key priorities for support in the field of renewable energies include research and development activities on the use of wind energy and photovoltaic power. In the short and medium term, the use of wind energy can deliver the greatest and most economic contribution to increasing the proportion of energy from renewable sources in the production of electricity in Germany. Further technical

innovations are necessary in order to be able to unlock potential on land (onshore) and at sea (offshore) in a fast, cost-effective and environmentally compatible way. In the area of photovoltaics in particular, there is a need to improve efficiency levels of overall systems, achieve significant cost reductions and improve the reliability of installations.

In terms of content, the research funding awarded during the reporting period focussed on the optimisation of rotor blades, bearings and gear mechanisms for wind power plants, but also on improved forecasting methods for wind power plants in wooded areas and the optimisation of the installation, operation and maintenance of wind power plants. In the area of photovoltaics, the focus was on systematically improving performance by process optimisation, service life extension and development of new cell types. Funding was therefore awarded to pioneering crystallisation methods for producing solar cells and the development of modules with particularly high efficiency levels.

In the field of bioenergy, areas of focus are the unlocking of the potential of biogenic residues and waste materials and the optimisation of the integration of bioenergy in regional and national energy systems, with the objective of increasing system stability and energy efficiency.

Support is also provided for measures in the fields of deep geothermal energy, solar thermal power plants, hydropower and ocean energy. Research funding in the field of low-temperature solar thermal energy is particularly awarded to systems engineering for solar heating and building integration.

In the context of the energy storage funding initiative, since 2012 the Federal Government has funded around 250 projects for developing technologies relating to storage facilities. The spectrum ranges from batteries for household use, electricity storage facilities in the megawatt range up to projects for long-term storage of renewable energy, in which the production of hydrogen in electrolysers takes place by means of renewable electricity. A report on the accompanying review of the success of the storage initiative should now be available.

3.1. Please provide the information on how supported electricity is allocated to final customers for the purposes of Article 3(9) of Directive 2009/72/EC.

(Article 22(1)(b) of Directive 2009/28/EC)

The electricity from renewable energy supported through the EEG by market premiums, fixed feed-in payments and the landlord-to-tenant electricity supply supplement is marketed on the energy exchange by the TSOs or directly by the plant operators or third parties. The difference between the marketing revenue on the one hand and the feed-in payments and market premiums on the other as well as the costs of promotion of landlord-to-tenant electricity supply is passed on in the form of the EEG levy (Section 60(1) EEG 2017) in such a way that each electricity supply company bears the same costs per kilowatt-hour of electricity supplied to non-privileged end-consumers. Whether electricity supply companies pass the costs on to the final consumers and, if so, in what amount, is not a matter for the EEG but is subject to the individual contracts concluded under private law, which generally involve passing the costs on to the end-consumers, however.

Section 78 EEG 2017 and Section 42(1) and (5) EnWG define how electricity supply companies can display the EEG levy to final consumers and how the electricity funded under the EEG must be shown on electricity bills, on the internet and in advertising material to end-consumers. Depending on the levy that they pay, electricity supply companies inform end-consumers of a proportion of electricity from ‘renewable energy, funded under the Renewable Energies Act’ on their electricity bills, on the internet and in advertising material.

The electricity supply company also has to inform the final consumer of the other components of the electricity mix and of environmental effects on the electricity bill, on the internet and in advertising material ‘in a consumer-friendly manner and in a graphic format of an appropriate size’ (Section 42(2) EnWG[47]). The electricity supply company has to add the average values for the electricity mix and the environmental effects in Germany. The electricity mix may include nuclear power, coal, natural gas, other fossil fuels, renewable energy sources funded under the Renewable Energies Act, and other types of renewable energy. In addition, since the start of 2017 it has been permitted to display, in the electricity labelling for the share funded under the Renewable Energies Act, under certain conditions, the extent to which this electricity share was produced in the region in relation to the electricity consumption, Section 42(5) second sentence EnWG.

In the event of supply of end consumers with landlord-to-tenant electricity supply for which a landlord-to-tenant electricity supply supplement is paid under the

[47] Amended by Article 6 Act for introduction of tenders for electricity from renewable energies and in relation to further amendments of the law on renewable energies Act of 13 October 2016 BGBl. I p. 2258 with effect from 1 January 2017.

EEG, in accordance with Section 78(7) first and third sentence EEG 2017 this electricity share is to be indicated to the landlord-to-tenant electricity supply customer in question in the electricity labelling as ‘landlord-to-tenant electricity supply, funded under the Renewable Energies Act’. If multiple end consumers participate in a landlord-to-tenant electricity supply project under the landlord-to-tenant electricity supply model, the landlord-to-tenant electricity supply consumed in a calendar year is, for the purposes of electricity labelling, to be distributed among the landlord-to-tenant electricity supply customers in question according to the ratio of their annual consumption and indicated to the landlord-to-tenant electricity supply customers accordingly (Section 78(7) second sentence EEG 2017).

4 PLEASE PROVIDE INFORMATION ON HOW, WHERE APPLICABLE, THE SUPPORT SCHEMES HAVE BEEN STRUCTURED TO TAKE INTO ACCOUNT RES APPLICATIONS THAT GIVE ADDITIONAL BENEFITS, BUT MAY ALSO HAVE HIGHER COSTS, INCLUDING BIOFUELS MADE FROM WASTES, RESIDUES, NON-FOOD CELLULOSIC MATERIAL, AND LIGNO-CELLULOSIC MATERIAL.

(Article 22(1)(c) of Directive 2009/28/EC)

4.1. Provisions in the EEG

The EEG 2017 and the WindSeeG contain provisions aimed at promoting certain technologies.

In addition to the pilot onshore wind power plants already presented in the section relating to calls for tender (see Chapter 3.0.2), which may under certain circumstances be exempt from participation in tenders, the 'innovation calls for tender' must be emphasised at this point. This special tender design takes a cross-technology rather than cross-sector approach and is established in Sections 39j, 88d EEG 2017. By means of a regulation to be enacted, a detailed design will be created. The aim of the innovation calls for tender is the promotion of innovative system- or network-appropriate plant concepts. The tender volume provided for this amounts to 50 MW per year, Section 28(6) EEG 2017. Unlike the special call for tender for 'joint tenders' for solar and offshore wind, in general they are not included in the sector-specific tender volumes.

In addition, pilot offshore wind power plants receive special support in Part 5, Section 68 et seq. WindSeeG. Under Section 3 No 6, first clause WindSeeG, pilot offshore wind power plants means the first three offshore wind power plants of one type for which there is evidence that a significant innovation going far beyond the prior art has been trialled. The status of an offshore pilot wind power plant must be determined by the Federal Office for Navigation and Hydrography, Section 68(1) second sentence WindSeeG. An EEG funding entitlement under Section 19 EEG 2017 can in principle be made in this respect – namely restricted up to an installed capacity of 50 MW per calendar year – even though they have not participated in tenders, Section 69 WindSeeG.

4.2. Cogeneration

Along with the provisions in the EEG on the use of heat and in the MAP, the Cogeneration Act (KWKG) of 19 March 2002, last amended on 17 July 2017, supported cogeneration, or combined heat and power (CHP), plants in the 2015

and 2016 reporting years. Here a distinction must be drawn between funding conditions up to 31 December 2015 and the new funding conditions from 1 January 2016, as well as the support provided to certain plants by means of tenders.

Table 4.1: Funding for cogeneration plant operators (source: KWKG 2012)

Plant category	**Object of funding**	**Amount of supplement**	**Duration of payment of supplement**
New plants > 2 MW_{el}	Section 7(4)	< 50 kW: 5.41 > 50 kW to 250 kW: 4.0 > 250 kW to 2 MW: 2.4 > 2 MW: 1.8	30 000 hours at full capacity (HFC)
New plants > 50 kW_{el} to 2 MW_{el}	Section 7(2)	< 50 kW: 5.41 > 50 kW to 250 kW: 4.0 > 250 kW to 2 MW: 2.4	30 000 HFC
New plants up to 50 kW_{el}	Section 7(1)	5.41	10 years or 30 000 HFC
Fuel cell plants	Section 7(1)	5.41	10 years or 30 000 HFC
Modernised plants < 50 kW_{el}	Section 7(5)	5.41	10 years or 30 000 HFC 5 years or 15 000 HFC
Modernised plants > 50 kW_{el}	Section 7(5)	< 50 kW: 5.41 > 50 kW to 250 kW: 4.0 > 250 kW to 2 MW: 2.4 > 2 MW: 1.8	30 000 HFC (50 % reconstruction costs) 15 000 HFC (25 % reconstruction costs)
Retrofitted plants > 2 MW_{el}	Section 7(6)	See above	30 000 HFC (50 % reconstruction costs) 15 000 HFC (25 % reconstruction costs) 10 000 HFC (10 % reconstruction costs)

The KWKG 2012 promoted the construction and modernisation of high-efficiency CHP plants with no limit as to size, initially independently of whether they are run on renewable or other energy sources, with a supplement paid for the electricity produced according to the size and age of the plant (see Table 4.1).

The construction and expansion of heat networks is funded with an investment grant. The construction of cooling and heat storage facilities has also been funded with an investment grant since the last amendment to the KWKG 2012. The expansion of cogeneration was supported in the KWKG 2012 with funding totalling up to EUR 750 million per year; of this, up to EUR 150 million was earmarked for expansion of heat networks. The KWKG amendment passed in August 2012 built on the changes made in the summer of 2011 (extension of the funding period from 2016 to 2020 and removal of the previous dual cap with a limit of six years' operation, or four years for industrial CHP plants, plus a maximum of 30 000 hours at full capacity) to improve support still further. The payment for all plants was thus increased by 0.3 ct/kWh. Plants covered by emissions trading receive an additional 0.3 ct/kWh. An additional payment band (50 kW to 250 kW at 4 ct/kWh) was also introduced and the funding eligibility requirements for plant modernisation projects were modified. Other changes are the addition of heating and cooling storage facilities in cooling networks and CHP retrofitting in condensation plants, improved funding conditions for heating and cooling networks with small nominal ranges and simplified procedures for heat networks and small CHP plants.

The 2016 KWKG amendment has raised the funding cap to EUR 1.5 billion and introduced support for existing plants for public supply of district heat; the moderate increase in the funding rates (cf.) aims to facilitate further expansion of cogeneration plants in today's difficult market environment. The funding is specifically aimed at promoting cogeneration electricity fed-in to the public grid, mandatory direct marketing and further measures such as promotion of heat storage facilities, with a view to enabling CHP plants to react in a more flexible manner to the fluctuating feed-in of renewable energies into the electricity system and into heating networks. Lastly, the 2017 KWKG amendment introduced funding rates determined by means of tenders for CHP plants with an electrical capacity between 1 and 50 MW. Moreover, a new funding category was created for innovative CHP systems, where the funding levels are again determined by means of tenders.

To ensure that the expansion target for cogeneration plants is in line with the other objectives of the energy transition, with the KWKG 2016 it is being

changed from the previous target of 25 % of net electricity production to a target level of 110 TWh in 2020 and 120 TWh in 2025.

Table 4.2: Funding for CHP plant operators for new construction (source: KWKG 2016)

Electrical capacity		**Network feed-in**		**Own supply**		
Up to and including 1 MW and > 50 MW	**CHP capacity share (kW)/case (supplement in ct/kWh)**	**Section 7(1)**	**Section 7(2) bonus payment for replacing a coal CHP plant**	**Section 7(3) No 1**	**Section 7(3) No 2 feed-in in customer plants or closed distribution networks**	**Section 7(3) No 3 electricity cost-intensive undertakings**
	up to 50	8.0	8.6	4.0	4.0	5.41
	50-100	6.0	6.6	3.0	3.0	4.0
	100-250	5.0	5.6	-	2.0	4.0
	250-2 000	4.4	5.0	-	1.5	2.4
	>2 000	3.1	3.7	-	1.0	1.8
1 MW up to and including 50 MW		Determination of funding levels by means of tender, plus coal replacement bonus of 0.6 cent when replacing a coal CHP plant		No funding		

The supply by CHP plants in properties and districts up to 1 MW and > 50 MW is still funded by cogeneration supplements, the level of which is classified according to capacity. The levels of funding for new and modernised gas-fired CHP plants were considerably increased overall.

Through the introduction of a coal replacement bonus, the replacement of coal CHP plants by gas CHP plants is intended to be incentivised in a targeted manner. CHP plants that replace a coal-fired CHP plant receive a bonus. Existing gas CHP plants from 2 MW for public district heat supply that are threatened with closure receive fixed-term support up to 2019.

In the KWKG 2016, mandatory direct marketing for CHP plants > 100 kW_{el} was introduced as a new feature. By means of this, greater alignment of plants to the electricity market should be achieved, so that the CHP plants can react more effectively to the feed-in of renewable energies.

In the KWKG 2016, the modernisation of CHP plants is stepped up to a minimum age of 10 years and the rating category was extended to > 50 kW_{el}. The modernisation situation for mini-CHP plants is therefore abolished. The retrofitting of plants up to 2 MW_{el} was extended to all plant sizes > 50 kW_{el}.

By means of the KWKG 2017, in the sector of plants with an electrical capacity of more than 1 up to and including 50 MW, funding levels are now determined on the basis of tenders. If a plant awarded a contract by means of a tender replaces an existing coal CHP plant, the supplement payment in the amount of the bid value increases by the carbon replacement bonus. Within the tendering system, only new plants and modernised plants are supported with an investment level of 50 % or more. Own supply is excluded under the tender system.

In addition, support for innovative CHP systems was introduced, where the level of funding is likewise determined by means of tenders. Innovative CHP systems mean particularly energy-efficient and low-greenhouse-gas systems in which CHP plants produce or convert CHP electricity and heat in conjunction with high shares of heat from renewable energies in line with demand. The decarbonisation of grid-bound heat is addressed by the mandatory incorporation of renewable heat into innovative CHP systems.

Overall, by 2021 a total of 200 MW CHP capacity will be put out to tender per year, in two bidding rounds per year, of which 150 MW is allotted to conventional CHP plants and 50 MW to innovative CHP systems. More precise details of the tenders are governed by a regulation passed in May 2017.

Table 4-C shows the funding levels for heat storage facilities and heat networks. In total the funding volume per project was raised from EUR 5 to 10 million (heat storage facilities) and from EUR 10 to 20 million (heat networks). The Federal Government is reacting to the challenges in the electricity market by means of this, in conjunction with the mandatory direct marketing and focussed support for CHP electricity fed into the grid, and incentivising a more flexible mode of operation for CHP plants and the integration thereof into volatile renewable electricity production.

Table 4.3: Support for networks and storage facilities (source: KWKG 2012/2016)

Type		Investment grant	KWKG 2012	KWKG 2016
Heating and cooling networks	Small distribution networks (DM < DN 100)	EUR 100 /m line, max. 40 % of costs	EUR 10 million / project	EUR 20 million / project
	Large distribution networks (DM > DN 100)	30 % of costs	EUR 10 million / project	EUR 20 million / project
Heating and cooling storage facilities	Small storage facilities (< 50 m^2 volume)	EUR 250 / m^2 volume	EUR 5 million / project	EUR 10 million / project
	Large storage facilities (> 50 m^2 volume)	EUR 250 / m^2 volume; max. 30 % of costs	EUR 5 million / project	EUR 10 million / project

In respect of small plants, the KWKG is accompanied in the context of the NKI by the 'Directive for promotion of CHP plants up to 20 kWel (mini-CHP directive)', in the version of 15 December 2014.

The market incentive programme for renewable energies (KfW premium section) also supports biomass plants for combined heat and power (CHP) production with an installed nominal heat capacity of more than 100 kW and up to 2 000 kW, which use wood pellets, logs or wood chips for example. The erection and expansion of plants for combined heat and power generation using deep geothermal energy (from a drilling depth of 400 m and a nominal heat capacity of at least 4 000 kW_{th}) is also eligible.

The market incentive programme for renewable energies (KfW premium section) also supports heating networks that are supplied with heat from renewable sources of energy provided that this heat comes almost exclusively from highly efficient cogeneration plants, waste heat or renewable energies, or combinations of these heat sources. Plants and networks that already receive support under the EEG or KWKG are excluded from this.

The BMUB's mini-CHP plant incentive programme aims to boost the expansion of cogeneration plants < 20 kW_{el} in the construction sector. The Federal

Government's support programme supports the decentralised generation and supply of combined heat and power to single- and multi-family houses and the small business sector. The Directive on funding for CHP plants up to 20 kW_{el} entered into force for the first time in April 2012 and was amended on 15 December 2014. The mini-CHP plant incentive programme that entered into force on 1 January 2015 aims to provide an additional incentive for greater use of mini-CHP plants. The amendment to the mini-CHP plant incentive programme increased the basic funding for the small capacity category, introduced bonus funding for highly energy-efficient CHP plants and simplified the technical requirements. The amendment introduced a 'thermal efficiency' bonus as an additional percentage-based supplement to the basic funding (+25 %) in order to improve thermal efficiency and thus the overall efficiency of the mini-CHP plants supported. An 'electricity efficiency' bonus (+60 %) was introduced in parallel to this to provide an incentive for an accelerated market introduction of plants with a particularly high level of electricity efficiency, e.g. fuel cells.

A measure from the 'Climate Change 2020 Action Programme' has been implemented with the amended mini-CHP plant guidelines (BMUB, 2015).

Various requirements have to be met in order to obtain funding, including minimum sizes for integrated heat storage facilities, minimum primary energy savings, management of heat stores, measuring system to determine the current electricity requirements (BAFA, 2015).

4.3. Amendment to the Biomass Regulation

Within the scope of the payment rules in the EEG, the Biomass Regulation [BiomasseV] governs which materials are recognised as biomass for the purpose of payments, which technical methods of electricity production from biomass fall within the scope of the EEG, and what environmental requirements have to be met in the generation of electricity from biomass.

EEG plants commissioned up to 31 December 2011 are covered by the Biomass Regulation in the version in force from 18 August 2005 (for electricity generation from scrap wood and the use of vegetable oil methyl ester in some existing plants, different transitional provisions apply under the EEG 2012).

The Biomass Regulation was extensively amended with effect from 1 January 2012. In addition to its existing scope of regulation, it also governs which materials qualify for a fuel-based payment under the EEG 2012, which energy-related reference values should be used to calculate this payment and how the fuel-based payment should be calculated. Furthermore, scrap wood (with the

exception of industrial waste timber) from then on is no longer a recognised biomass within the meaning of the Biomass Regulation.

The Biomass Regulation was amended again in the course of the comprehensive reform of the EEG in 2014. The provisions on fuel-based payments and the corresponding energy-related reference values were deleted and not replaced. This marked an end to the increased support given to certain biomass fuels (e.g. maize, sugar beet and cereals in biogas plants).

The amendment of the EEG 2017 brought about only one change to the Biomass Regulation on 13 October 2016: waste liquors from cellulose pulp production from then on are no longer a recognised biomass within the meaning of the Biomass Regulation.

4.4. 37th Regulation implementing the Federal Emissions Control Act (Regulation on inclusion of electricity-based fuels and co-processed biogenic oils in the greenhouse gas quota [37. BImSchV])

By means of the Regulation implementing the Federal Emissions Control Act (Regulation on inclusion of electricity-based fuels and co-processed biogenic oils in the greenhouse gas quota [37. BImSchV]) enacted in the first half of 2017, the following amendments were made in particular:

- Electricity-based fuels should be included in the greenhouse gas quota in future provided that the electricity used to generate these fuels comes from renewable energy.
- Furthermore, up to the commitment year 2020 also co-processed biogenic oils are to be included in the greenhouse gas quota.

This regulation was introduced in particular for the purposes of transposition of Directive (EU) 2015/652.

4.5. 38th Regulation implementing the Federal Emissions Control Act (Regulation laying down further provisions for the reduction of greenhouse gases in fuels [38. BImSchV])

The 38th Regulation implementing the Federal Emissions Control Act (Regulation laying down further provisions for the reduction of greenhouse gases in fuels [38. BImSchV]) enacted by the Federal Cabinet in November 2017 serves for transposition of Directive (EU) 2015/652 (implementation provisions relating to the Fuel Quality Directive) and Directive (EU) 2015/1513 (Directive on avoidance

of indirect land-use changes). In particular, the following amendments were made:

- In order to avoid indirect land-use changes, in future an upper limit for conventional biofuels of 6.5 % will be introduced. Conventional biofuels above the upper limit will be treated as fossil fuels.
- A sub-quota will be introduced for advanced biofuels (from 0.05 % in 2020 rising to 0.5 % in 2025).
- The values for the greenhouse gas emissions of fossil fuels and the basic value are adjusted to the new targets.
- Electrical power used in electrically driven road vehicles can be included in the greenhouse gas quota in future.
- The scope of application of the greenhouse gas quota will in future be expanded to also include other fossil fuels, in particular natural gas and liquefied petroleum gas. Moreover, biogenic liquefied petroleum gas will also be included in the quota in future.

4.6. Accompanying actions

The use of the measures mentioned above is also supported by ‘accompanying actions’ such as investment support for individual plants and the funding of know-how (studies, knowledge transfer).

Examples of investment support include funding for individual plants (‘beacon projects’), regional funding, all the way through to large-scale aid for research issues (BtL, wood gasification, PtG, PtL).

5 PLEASE PROVIDE INFORMATION ON THE FUNCTIONING OF THE SYSTEM OF GUARANTEES OF ORIGIN FOR ELECTRICITY AND HEATING AND COOLING FROM RES, AND THE MEASURES TAKEN TO ENSURE RELIABILITY AND PROTECTION AGAINST FRAUD OF THE SYSTEM.

(Article 22(1)(d) of Directive 2009/28/EC)

The specifications of Directive 2009/28/EC regarding guarantees of origin for electricity from renewable energy sources were transposed in Section 3 No 29 and Section 79 EEG 2017 and subsequent non-statutory regulations based on this Act:

- the Renewable Energies Regulation of 17 February 2015, which establishes a framework for guarantees of origin,
- the Guarantee of Origin and Regional Certificates Implementing Regulation of 15 October 2012, which governs the details of registering electricity generation plants and members of the register, and issuing, transferring, recognising and redeeming guarantees of origin, and
- the Guarantee of Origin and Regional Certificates Charges Regulation of 17 December 2012.

These legal bases stipulate that the Federal Environment Agency (UBA) should act as the central government office for the Guarantee of Origin Register (HKNR) for electricity from renewable energy sources for Germany. Based on these regulations, the UBA issues guarantees of origin on application, redeems them, transfers them within Germany and abroad and recognises foreign guarantees of origin. For this purpose, the UBA has set up an electronic database (HKNR), which records the issue, transfer and redemption of guarantees of origin. The HKNR went live on 1 January 2013.

The HKNR works like an online banking system: operators of plants that produce electricity from renewable energy can register themselves and their plants in the HKNR. For every megawatt hour of electricity, a guarantee of origin is placed in their account. The grid operator, as an independent and expert third party, notifies the UBA of the volumes of electricity produced. The guarantees of origin are tradable. The Federal Environmental Agency is responsible for checking the data and the system. An electronic control system safeguards the reliability of the system.

The UBA issued a total of 15.1 million guarantees of origin for the 2015 production year and a total of 16.7 million[48] guarantees of origin for the 2016 production year so far.

Electricity supply companies that wish to identify electricity from other renewable energies (that is to say electricity from renewable energies that is not funded by the EEG levy) in the electricity labelling scheme are required, under Section 42(5) first sentence No 1 EnWG, to redeem guarantees of origin for this electricity, provided that the case of Section 42(5) first sentence No 3 EEG 2017 is not present (application of ENTSO E mix to electricity of unknown origin). Under Section 42(7) EnWG, the UBA is given access to the electricity supply companies' data on electricity labelling, so that it can compare this with the guarantees of origin issued and redeemed and thus monitor the trade in guarantees of origin to pick up any fraud or abuse. Only an electricity supply company can redeem the guarantees of origin. A total of 87.5 million guarantees of origin[49] were redeemed in the HKNR in 2015 and 84 million guarantees of origin were redeemed in 2016.

For international trade, the UBA uses the electronic interface of the Association of Issuing Bodies (AIB). This enhances the reliability of the German system and of the European market in guarantees of origin. In 2015, a total of 80.3 million guarantees of origin were imported and 6.3 million guarantees of origin were exported. In 2016, a total of 80.2 million guarantees of origin were imported and 5.8 million guarantees of origin were exported.

The main importing countries in 2014 were Norway (56 %), Austria (14.8 %), Sweden (9.3 %) and Switzerland (9.1 %).

The UBA lays down a number of rules to make the HKNR system in Germany fraud-proof and reliable. These include: identity checks on the participating operators in the HKNR using the PostIdent process from Deutsche Post AG or by checking the IDs of foreign participants; checking the authorisation of registrants; issuing a user name and password and use of Captcha; roles and rights scheme; entry of VAT identification number to assist in detecting possible VAT fraud; encrypted electronic communication; use of environmental experts to verify plant data and volumes of electricity.

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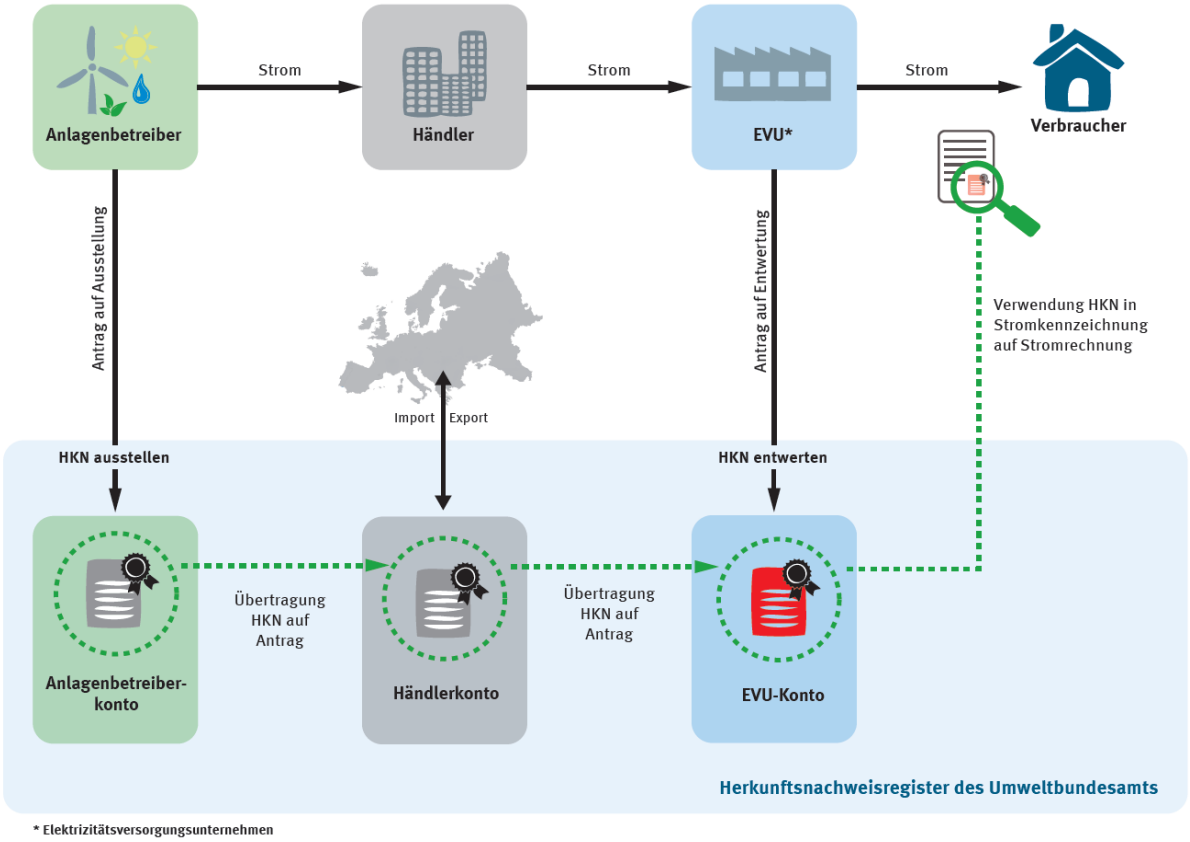
48 For 2016, it is not possible to make a final statement in this respect, as guarantees can still be issued up to the end of 2017. The latest information is from 30 June 2017.

49 Rounded values in each case.

In accordance with Section 31 KWKG, operators of highly efficient CHP plants can also apply for a guarantee of origin from the Federal Office for Economic Affairs and Export Control in respect of electricity produced in cogeneration.

Figure 5.1: The system of guarantees of origin in Germany



German	English
Anlagenbetreiber	Plant operator
Strom	Electricity
Händler	Trader
EVU*	ESC*
Verbraucher	Consumer
Antrag auf Ausstellung	Request for issue
HKN ausstellen	Issue guarantee of origin
Import	Import
Export	Export
Antrag auf Entwertung	Request for redemption
Verwendung HKN in Stromkennzeichnung auf Stromrechnung	Use of guarantee of origin in electricity labelling on electricity bills
Anlagenbetreiberkonto	Plant operator account
Übertragung HKN auf Antrag	Transfer of guarantee of origin on request
Händlerkonto	Trader account

EVU-Konto	ESC account
Herkunftsnachweisregister des Umweltbundesamts	Federal Environment Agency’s register of guarantees of origin
*Elektrizitätsversorgungsunternehmen	*Electricity supply company
HKN entwerten	Redeem guarantee of origin

6 PLEASE DESCRIBE THE DEVELOPMENTS IN THE PRECEDING 2 YEARS IN THE AVAILABILITY AND USE OF BIOMASS RESOURCES FOR ENERGY PURPOSES.

(Article 22(1)(g) of Directive 2009/28/EC)

The availability of biomass resources depends on the quantities that can be provided subject to technical, economic and ecological restrictions and the effect of competing demands for their use. Bottlenecks in availability and shortages may be statistically invisible if some market operators switch to other raw materials, leading to bottlenecks or displacement effects there, or if they shift use to other times. That is why estimates of the availability of biomass are fraught with uncertainty.

This section describes the use of biomass resources for energy purposes based on the categories defined in the progress report template document (Table 4) and, where possible, estimates availability.

The balance-sheet of energy-related biomass use forms the principal basis for the official energy statistics and conclusions from surveys and special evaluations (including survey on use of wood fuel in households, evaluation of EEG data, results of monitoring of wood raw materials). These energy statistics only allow a limited breakdown by type (e.g. logs, wood chips, pellets, common arable crops, energy crops, residues, waste) and particularly by origin of the different biomass components (e.g. forestry and landscape conservation wood, domestic raw materials, imports). Therefore, the current findings of the Joint Wood Energy Enquiry (UNECE/FAO, 2015), information from the Federal Office for Agriculture and Food [BLE] (BLE, 2016; BLE, 2017) and findings from regular surveys in the context of expert reports (e.g. German Biomass Research Centre [DBFZ] (DBFZ, 2015b; DBFZ, 2017)) will additionally be referred to below. The use of biomass for energy purposes is extremely heterogeneous and decentralised and recording of the use of biomass remains largely uncertain.

The total primary energy use from biomass, including the biogenic fraction of waste, was 26 021 ktoe in 2015 and 25 830 ktoe in 2016 (cf. Table 4). In the reporting period, approx. 5 % of this was imported from other EU countries and approx. 12 % from non-EU countries in the form of raw materials or fuels. Wood-based biomass used for heating and electricity made up the largest share with around 45 % (residues and co-products from the wood industry, scrap wood, wood biomass used directly for energy purposes), followed by common crops for

biogas and biofuels (22 %) and for use in the transport sector (8 %) (see Table 4).

Table 4: Use of biomass for energy purposes

	Amount of domestic raw materials (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		**Primary energy obtained from domestic raw materials (ktoe)**		**Amount of imported raw materials from EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)**		**Primary energy obtained from imported raw materials (EU) (ktoe)**		**Amount of imported raw materials from non-EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)**		**Primary energy obtained from raw materials from non-EU (ktoe)**	
	2015	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Use of biomass for heat and electricity:												
Wood biomass from forests and other wooded land that is used directly for energy purposes (fellings etc.) [50]	24 602	23 452	5 297	5 049	79	75	16	15	4 915	4 685	1 050	1 001
Residues and co-products from the wood industry etc.[51]	11 870	11 315	2 458	2 343	79	75	16	15	4 049	3 860	836	797
Common crops for biogas and biofuels (maize, grass, cereals, sugar beet, rapeseed, oil palm)[52]	64 463	66 543	5 709	5 889	25	21	9	7	274	348	91	115

[50] Calculations of the Thünen Institute for International Forestry Management and Economics.

[51] Including black liquor; calculations of the Thünen Institute for International Forestry Management and Economics.

[52] Calculation based on the liquid biomass and biogas used according to the BMWi (2017f) in 2015 and 2016, the substrate shares for liquid biomass according to the BLE (2017) and for biogas

	Amount of domestic raw materials (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from domestic raw materials (ktoe)		Amount of imported raw materials from EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from imported raw materials (EU) (ktoe)		Amount of imported raw materials from non-EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from raw materials from non-EU (ktoe)	
	2015	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Energy crops (grasses etc.) and short rotation trees (please specify)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Agricultural by-products / processed residues and fishery by-products: excreta and landscape conservation grass for biogas[53]	53 605	53 374	937	968	0	0	0	0	0	0	0	0
Biomass from waste (municipal, industrial, sewage sludge etc.), incl. sewage treatment gas and landfill gas[54]	N/A	N/A	6 285	6 382	0	0	0	0	2 822	2 700	551	526

according to the DBFZ (2017), conversion factors according to BioGrace for liquid biomass and NREAP for biogas and energy and water contents according to NREAP.

53 Calculation based on the biogas used according to the BMWi (2017f) in 2015 and 2016, the substrate shares according to the DBFZ (2017) and the conversion factors and energy and water contents according to NREAP.

54 Landfill gas, sewage treatment gas, biogenic fraction of waste, other solid biomass (non-timber incl. sewage sludge) according to the BMWi (2017f), wood-based biomass from waste according to Thünen (2017) and waste-based proportion of biogas and liquid biomass; calculation of biogas proportion based on the biogas used according to the BMWi (2017f), the substrate shares according to the DBFZ (2017) and conversion factors, energy and water contents according to NREAP; calculation of liquid biomass proportion based on liquid biomass used according to the BMWi (2017f), the substrate shares according to the BLE (2017), the conversion factors according to BioGrace and the energy and water contents according to BioGrace and NREAP.

	Amount of domestic raw materials (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from domestic raw materials (ktoe)		Amount of imported raw materials from EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from imported raw materials (EU) (ktoe)		Amount of imported raw materials from non-EU (1 000 m^3 for forestry; 1 000 t_{FM} for agriculture)		Primary energy obtained from raw materials from non-EU (ktoe)	
	2015	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Other[55]	156	149	34	32	0	0	0	0	48	46	10	10
Use of biomass for the transport sector:												
Common arable crops for biofuels (rapeseed, oil palm, soya, maize, cereals, sugar beet, sugar cane)[56]	2 687	1 895	849	580	4 257	3 683	966	813	1 387	2 012	377	502
Energy crops (grasses etc.) and short rotation trees for biofuels	0	0	0	0	0	0	0	0	0	0	0	0
Other (waste, residues, primarily UCO (used cooking oil))[57]	N/A	N/A	168	168	N/A	N/A	251	371	N/A	N/A	111	246

[55] The range of 'Other' materials used in biomass plants in accordance with the Joint Wood Energy Enquiry (Thünen 2017).

[56] Calculation based on the biofuels based on common arable crops brought onto the market in Germany in 2015 and 2016 and certified as sustainable (BLE, 2017), conversion factors according to BioGrace and energy and water contents according to BioGrace and NREAP.

[57] Calculation based on the biofuels based on waste brought onto the market in Germany in 2015 and 2016 and certified as sustainable (BLE, 2017) and conversion factors according to BioGrace.

6.1. Biomass to generate heat and electricity

6.1.1 Wood biomass

Wood biomass, total. The information relating to the wood biomasses used for 2015 (in Table 4) are largely based on the Joint Wood Energy Enquiry (JWEE) (UNECE/FAO, 2015), which were derived for 2016 on the basis of 2015 taking into consideration the overall development in the various consumption sectors and for the types of wood. This international reporting for the wood sector is conducted by the Thünen Institute for Germany (Thünen, 2017). Differences with respect to the volume structure published in Chapter 1 result in particular on account of the different methodological approaches and findings relating to wood consumption for private households. In the future, harmonisation in this respect will be sought.

In the reporting years 2015 and 2016, a total of around 58 million m^3 and 55 million m^3, respectively, of wood biomass (including scrap wood, cf. Chapter 6.1.5) was used to provide electricity and heat. In comparison to 2005 (30.3 million m^3), a strong increase in wood biomass used for energy purposes can be seen (UNECE/FAO, 2015).

Imports and exports. The relationship between the use of domestic wood biomasses and wood imports was derived on the basis of the total wood revenue and trade, which may of course be significantly different from the timber used exclusively for energy purposes. The reason for this is that credible figures for foreign trade of wood segments used for energy purposes are only available to a very limited extent (for example only for wood pellets), which is predominantly attributable to the fact that foreign trade statistics are not broken down by the type of use of the wood components.

The import of wood-based biomass used for energy purposes as determined for JWEE was a total of approx. 21 % in 2015 and is estimated to be of the same order of magnitude in 2016. Imports from the EU were marginal, whilst import from non-EU countries represented a substantial proportion of the raw material basis in particular in the case of residues and by-products from the wood industry (especially sawmill by-products and wood pellets) and wood-based waste, with 25 % each. Around 17 % of the wood biomass from forests and other wooded areas directly used for energy production also originated from non-EU countries in 2015 and 2016. Exports also occur for a variety of wood fuels, according to industry data. In the case of scrap wood, according to market reports, in 2015 exports amounted to 315 000 tonnes and in 2016 to almost 400 000 tonnes

(EUWID 2017), which corresponds to around 530 000 m^3 and 670 000 m^3, respectively.[58]

Use of direct supply of wood biomass for energy generation

The use of the direct supply of wood biomass for energy generation in 2015 and 2016 exceeded the use of the indirect supply of wood biomass for energy generation (residues and co-products from the wood industry, wood-based biomass from waste and other wood-based biomass) by a considerable margin.

There was no accurate breakdown by types of wood on the basis of the JWEE. Mantau (2013) undertook to create such a breakdown for 2011 and 2012 and identified raw wood[59] (approx. 50 %; mainly used as domestic fuel), forest waste wood[60] and bark (approx. 30 %; predominantly used in biomass heating (power) plants) and residues from landscape design and conservation (15 %; approx. half of municipal green pruning and landscape conservation timber, predominantly used in biomass heating (power) plants; rest predominantly products similar to firewood from gardens, mainly used as domestic fuel).

The estimates relating to the direct supply of wood used for energy purposes (raw wood, forest waste wood and bark, wood from landscape conservation) fluctuate to a very great extent and depend on the technical, economic and ecological restrictions considered. Whilst in some cases even greater untapped potential can be seen in the case of wood from thinning, canopy waste etc. (DBFZ, 2015a), other studies conclude that an increase in the wood used for energy purposes is only viable at the expense of material utilisation of wood and/or biodiversity (Ewald, Rothe et al. 2017).

Wood from short-rotation coppices (SRC) also only made a very small contribution to the provision of wood biomass for energy purposes in 2015 and 2016 and is not identified separately due to the low quantities.

Use of indirect supply of wood biomass

In the JWEE system and in accordance with the EU statistics regulation, solid residues from the wood industry, which are used in particular in industry but also in the energy business and the private sector for the provision of electricity and heating, and black liquor, which is used exclusively in industry for proportionate

[58] Conversion with the aid of the conversion factors specified in the JWEE for taking into account the water content and density of scrap wood (UNECE/FAO, 2015).

[59] Raw wood: essentially wood with a diameter > 7 cm.

[60] Forest waste wood: essentially wood with a diameter < 7 cm, plus rejected raw wood.

commercial energy supply, are subsumed under this biomass category. In 2015, black liquor represented 30 % of energy use from residues and co-products from the wood industry (UNECE/FAO, 2015). The DBFZ (2015a) does not assume any untapped potential in respect of these biomasses.

Use of wood-based biomass from waste

The use of wood-based municipal and industrial waste for energy purposes amounted to approx. 2.3 million ktoe in 2015 (UNECE/FAO, 2015). The role played by imports of scrap wood has already been addressed. In this connection it is clear that the supply of these types of wood is highly dependent on international trade and can only be quantified for Germany with difficulty.

6.1.2 Biomass from agricultural land

In relation to the provision of heat and electricity, in the reporting period biomass from agricultural land was used to the extent of 98 % as a substrate for biogas production, approx. 2 % for production of vegetable oil and in very minor amounts for the provision of solid fuels. The figures in Table 4 on the use of common crops for biogas and biofuels are derived from the AGEE-Stat data for biogas and liquid biomass used in 2015 and 2016 (BMWi, 2017f), where the data for biogas was set off against the shares of substrate input (DBFZ, 2017) and the data for liquid biomass was set off against the shares of raw materials and imported raw materials that were used (BLE, 2016). The import of biogas substrate could not be identified on the basis of the available data, although, for example, a low level of imports of maize silage are to be assumed close to the border (AFC, 2016).

For generation of biogas

Most energy production from biogas for heat and electricity is based on regenerating raw materials. In terms of the energy content of substrate usage, a total of around 78 % of biogas was obtained by fermenting common renewable raw materials in the reporting period (DBFZ, 2017). In 2015, around 64.5 million tonnes of fresh mass (t_{FM}) of biomass from agricultural land was used for biogas production and the use thereof for production of heat and electricity, and in 2016 this figure was around 66.5 million t_{FM} (Table 4). The biggest energy-related contribution from renewable raw materials (approx. 77 %) came from maize silage. This was followed, some way behind, by grass silage (approx. 11 %) and grain and whole cereal plant silage (together approx. 8 %) and sugar beet (approx. 2 %) (DBFZ, 2017). Other crops such as catch crops (approx. 1 %) and special energy crops such as Silphium perfoliatum and

mixed wild plants (in total approx. 1 %) also played a very minor role in the reporting period of 2015 and 2016.

For production of vegetable oil

Vegetable oils were used for energy production almost exclusively in different sizes of district heating plants for combined heat and power generation (DBFZ, 2015b). Palm oil (with 77 % in 2015 and 85 % in 2016) represented the largest proportion of the vegetable oil used, followed by rapeseed oil (23 % in 2015 and 15 % in 2016) (BLE, 2017). In addition to the import of palm oil, a significant proportion of the rapeseed oil or rapeseed is also imported. Compared to the use of vegetable oils in the fuel sector, the quantity used in stationary energy plants is very small.

For provision of solid fuels

Crops which are used exclusively for the provision of heat and electricity have not so far been grown on a significant scale. In a few arable locations, willows and poplars have been cultivated in short rotation (cf. Chapter 6.1.1) and Miscanthus has been cultivated for the production of solid fuels. The proportion of hay and special energy grasses in the provision of heat and electricity is still very low and can also only be quantified with a low level of certainty. Thus it is not currently possible to report any figures in Table 4.

Estimating the supply of biomass from agricultural land for the production of heat and electricity is primarily a question of the available land area and its consequences for biodiversity – a question which cannot be answered in the context of this progress report.

6.1.3 Agricultural and fishery by-products and residues

The use of agricultural and fishery by-products and residues listed in Table 4 reflects the use as biogas substrate. The calculation for this was performed analogously to that described in 6.1.2. The use of agricultural and fishery by-products and residues as solid fuels could not be identified separately and is included in waste, but makes up less than 1 % there.

For production of biogas

Manure, which includes animal excreta in the form of slurry and solid manure, accounts for the most significant component in this segment. In 2015 and 2016, in each case approx. 12 % of the total biogas produced was obtained from manure (DBFZ, 2017). In this connection, cattle slurry accounted for almost half,

followed by cattle solid manure, pig slurry, poultry manure, dry chicken manure and pig solid manure. In the reporting period, landscape conservational material contributed approx. 0.5 % of the total heat and electricity provision on the basis of biogas (DBFZ, 2017). No detailed data are available in relation to the use of crop residues (straw, beet leaves, etc.) in biogas plants. At present, less than 20 % of the manure produced is used for the production of biogas (UBA, 2016). The availability of manure for energy purposes is thus to be regarded as being higher but is also dependent on technical and economic restrictions in addition to the number and type of livestock farms.

For provision of solid fuels

As well as being used in biogas plants, straw is used for direct provision of electricity and, in particular, heat (DBFZ, 2015b), in the form of one commercial, large-scale plant and around a hundred smaller plants for heating with straw or straw pellets (FNR, 2015b). The overall extent of this use of straw is low and can only be statistically quantified in part. In Table 4, straw is subsumed under 'Other waste and agricultural residues (solid biomass, non-wood)'. Straw is the biomass with the greatest relevance in terms of volume among the agricultural residues but the supply of straw is highly dependent on finding alternative ways of safeguarding the humus balance.

6.1.4 Biomass from waste

In the reporting period, waste biomass was inter alia fermented into biogas, recycled in combustion plants or used as a raw material for fuel production (cf. Chapter 6.2). The incineration of biogenic waste, both in pure form (e.g. scrap wood, cf. Chapter 6.1.1) and as a mixture (e.g. household waste) was by far the most important element. Imports play a role only in the case of scrap wood (cf. Chapter 6.2). Table 4 shows the biomasses used for electricity and heat production (biogenic waste from households, industry, trade and agriculture, sewage slurry, sewage gas and landfill gas); this data was derived with the aid of data from AGEE-Stat, DBFZ (2017), BLE (2016) and Thünen (2017).

The ***generation of biogas*** for use for electricity and heat production in the reporting period was based in each case to the extent of 4.5 % on municipal biowaste and residues from industry, trade and agriculture (DBFZ, 2017).

In addition to vegetable oils, small amounts of ***liquid waste biomass*** are also used for electricity and heat production. In 2015 this also included approx. 0.2 ktoe used cooking oils (UCO), for which sustainability certificates were issued

(BLE, 2016). In 2016, according to the BLE, UCO was no longer used as biofuel (BLE, 2017).

Primary energy provision (electricity and heat) from the ***biogenic fraction of waste***, which was mainly used in waste incineration plants, totalled 2 994 ktoe in 2015 and approx. 3 101 ktoe in 2016.

The ***use of wood-based biomass from waste*** (scrap wood) is described in Chapter 6.1.1.

The biogenic waste that used to be deposited in landfill sites produces ***landfill gas*** that can be used to produce energy, mainly to be turned into electricity. On account of the prohibition on sending untreated residual waste to landfill that has been in force in Germany since 2005, the availability of landfill gas is further decreasing. The corresponding primary energy provision (electricity and heat) amounted to a total of 94 ktoe in 2015 and went down to 85 ktoe in 2016.

Primary energy provision for heat and electricity from ***sewage treatment gas*** was approx. 452 ktoe in 2015 and approx. 466 ktoe in 2016.

6.2. Biomass for the transport sector

The data relating to the use of biomass for the transport sector in Table 4 was derived from the figures provided in the evaluation and status report of the BLE on the use of biofuels, the raw materials used and the origin of the raw materials (BLE, 2016; BLE, 2017) and conversion factors in the NREAP and BioGrace. In so doing it was assumed that no biofuels were used in Germany in 2015 and 2016 without certification of compliance with the sustainability criteria (see Chapter 13 in this respect). On account of the strongly intertwined international relationships in the biofuels sector, estimates of the supply have been dispensed with here.

6.2.1 Common arable crops

The dominant domestic raw material for biofuel production in Germany based on arable crops was rapeseed, with an estimated annual volume of around 2.3 million t_{FM} in 2015 and around 1.5 million tonnes in 2016. Other domestic raw materials were various types of cereals (combined total of approx. 280 kt_{FM} in 2015 and 330 kt_{FM} in 2016) and sugar beet (approx. 85 kt_{FM} in 2015 and 50 kt_{FM} in 2016) for bioethanol used in Germany. Cereals (approx. 1 700 kt_{FM} in 2015, approx. 1 600 kt_{FM} in 2016), rapeseed (approx. 1 090 kt_{FM} in 2015 and 760 kt_{FM} in 2016) and maize (approx. 990 kt_{FM} in 2015 and approx. 1 050 kt_{FM} in 2016)

and sugar beet (approx. 500 kt_{FM} in 2015 and approx. 260 kt_{FM} in 2016) accounted for the largest shares of raw materials in terms of imports from other EU countries. Primarily palm oil (approx. 865 kt_{FM} in 2015 and approx. 1 220 kt_{FM} in 2016), maize (approx. 250 kt_{FM} in 2015 and approx. 150 kt_{FM} in 2016) and sugar cane (approx. 160 kt_{FM} in 2015 and approx. 600 kt_{FM} in 2016) made up the imports from non-EU countries. Biomethane used as fuel was produced solely on the basis of waste and residues in the reporting period (BLE, 2016; BLE, 2017). Waste and residues such as used cooking oils are analysed under 6.2.3.

6.2.2 Energy crops

No biofuels have so far been produced in Germany on a commercial scale from alternative, multiannual dedicated bioenergy crops such as grasses or short rotation trees.

6.2.3 Waste and residues

A breakdown of the waste and residues used to produce the biofuels placed into circulation in Germany is provided in Chapter 8. In 2016, used cooking oils accounted for around 99 % of the raw material basis for biofuels from waste and residues, relatively large amounts of which were imported from other EU and non-EU countries (BLE, 2016; BLE, 2017). The production of biomethane for use in transport is predominantly based on pulp from alcohol distillation and to a lesser extent on waste from organic waste collection bins, slurry and sewage slurry. In the reporting period, the majority of the raw materials came from within Germany (BLE, 2016; BLE, 2017). Processes for the production of liquid biofuels based on ligno-cellulosic wastes and residues are currently still at the pilot stage in Germany.

7 PLEASE PROVIDE INFORMATION ON ANY CHANGES IN COMMODITY PRICES AND LAND USE WITHIN YOUR MEMBER STATE IN THE PRECEDING 2 YEARS ASSOCIATED WITH INCREASED USE OF BIOMASS AND OTHER FORMS OF ENERGY FROM RENEWABLE SOURCES. PLEASE PROVIDE WHERE AVAILABLE REFERENCES TO RELEVANT DOCUMENTATION ON THESE IMPACTS IN YOUR COUNTRY.

(Article 22(1)(h) of Directive 2009/28/EC)

7.1 Land use for renewable energies

Land for the production of regenerative energy is mainly used to cultivate biomass for energy-related use, and to a much lesser extent, for wind power plants and ground-mounted photovoltaic installations. The amount of land used for geothermal energy and hydropower (other than storage facilities and storage dams) is insignificant.

7.1.1 Bioenergy

The figures relating to land taken up for bioenergy in Table 4a refer to the agricultural land in Germany that was used for domestic production of bioenergy carriers. Figures relating to the use of woodlands for bioenergy cannot be provided on the basis of the currently available data.

Since, at the time of cultivation, the later use is often not yet determined, in the official statistics there is no distinction between cultivation for food or fodder and that for energy purposes. Consequently, corresponding assumptions are required for figures relating to land use for bioenergy. In this case, the data from the FNR (2017a) is used, which derives the land use for domestic production of the individual bioenergy carriers from the land used for the individual crops, net trade balance sheets and the raw material demand for the various applications (AFC, 2016). The land areas thus determined are therefore to be understood as computational variables that estimate the agricultural land in Germany that is necessary for domestic production of, for example, biofuels. It is therefore possible that differences may arise in relation to the extent of the land areas associated with the domestic use of biofuels, as can be derived from the BLE findings (BLE, 2016).

The land actually used in Germany for bioenergy applications in both Germany and abroad cannot be exactly determined on the basis of the currently available data. The land use associated with imported bioenergy products and raw

materials also was not taken into consideration below, but may take up a considerable proportion.

The amount of land taken up for the cultivation of energy crops rose to a total of 2.4 million ha in the reporting period. The cultivation of maize (grain for bioethanol production and primarily silage maize for biogas extraction) accounted for by far the greatest area used for the cultivation of energy crops.

Table 4a: Domestic agricultural land use for production of crops dedicated to energy production

Land use	**Area (ha)**				
	2012	2013	2014	2015*	2016**
1. Land used for common arable crops	2 148 100	2 055 300	2 340 600	2 431 800	2 396 700
of which:					
Rapeseed for biodiesel and rapeseed oil	786 000	614 000	799 000	800 000	760 000
Plants for bioethanol	200 300	172 700	187 500	205 000	203 500
Plants for biogas	1 161 800	1 268 600	1 354 100	1 426 800	1 433 200
of which					
Maize (silage)	834 000	848 000	877 000	937 000	948 000
Whole crop (silage)	153 000	162 000	199 000	199 000	199 000
2. Land used for other energy crops	2 600	3 300	4 900	4 900	5 400
of which					
Silphium (for biogas)	100	300	400	400	800
Miscanthus (solid fuel)	2 500	3 000	4 500	4 500	4 600
3. Land used for short rotation trees (SRC)	5 000	6 000	6 000	6 600	6 600
Energy use, total	2 160 000	2 060 000	2 350 000	**2 410 000**	**2 420 000**

* preliminary values, ** estimated values
Source: (FNR, 2017a)

It can be seen from Table 4a that the land area used to produce biofuels – analogously to the level of production – has remained relatively stable over the past few years. The environmental impact of this is discussed in Chapter 9. The land for the cultivation of substrates for biogas production also expanded further in the reporting period. Whilst in 2009 it represented 530 000 ha, the figures recorded were 1 354 000 ha in 2014, 1 426 800 ha in 2015 and 1 433 200 ha in 2016 (FNR, 2017a).

Of the biogas substrates, maize (some 948 000 ha in 2016) accounts for by far the greatest area. The area for cultivation of maize for biogas plants more than

doubled from 2009 to 2016 and in 2016 represented approx. 44 % of the total arable land used for the cultivation of silage maize (Destatis, 2017c; FNR, 2017a), while the area of fodder maize has been more or less constant for some years. The amount of land used for cultivation of Silphium doubled during the reporting period to approx. 800 ha, but continues to make only a minor contribution to the production of biogas substrates.

The area under other ‘dedicated bioenergy crops’, such as short-rotation trees in short-rotation coppices (SRC) or Miscanthus for use as solid fuel also continued to increase. In total, the dedicated bioenergy crops SRC, Miscanthus and Silphium again represented only approx. 0.5 % of the total area sown for energy purposes in 2016, however.

Environmental impact. In regions where high livestock numbers coincide with a high incidence of biogas plants, there is often the problem of particularly high levels of nutrient excess due to the application of organic fertilisers (manure and regenerating raw materials fermentation residues). As a result, the risk of gaseous nutrient losses and nitrate leaching increases. Moreover, the risk of erosion by the late stand density is increased in the case of maize. In practice, a high proportion of maize in the crop rotation cycle is often associated with high levels of ammonia in the air and nitrates in the groundwater, a negative humus balance and an increased risk of attack by pests (particularly corn borer and corn rootworm), an impoverishment of agricultural biodiversity and an adverse effect on the look of the landscape (BfN, 2010b; TAB, 2010; KLU, 2013; Lower Saxony Ministry of Agriculture, 2014). The large-scale cultivation of maize for biogas production and animal husbandry has the effect in some areas of Lower Saxony with a high density of biogas and livestock that maize takes up well over 50 % of arable land in some municipalities (Lower Saxony Ministry of Agriculture, 2012; Lower Saxony Ministry of Agriculture, 2014).

Loss of grassland and intensification of use. With the increasing demand for biomass for energy-related use, grassland has grown in importance as a supplier of substrate. The intensification of use may compromise the quality of the grassland affected in Germany and reduce its value in terms of biodiversity. On the other hand, valuable areas are sometimes lost when grassland is ploughed up for arable use. Ploughing up grassland produces high CO_2 emissions because of the breakdown of humus, is generally unhelpful in terms of safeguarding biodiversity and soil and water quality (BfN, 2010a), and is inconsistent with the Federal Government’s climate objectives. Approximately 4.62 million hectares was used as permanent grassland in Germany in 2013 (Destatis, 2015). This means that grassland accounted for just under 28 % of

agricultural land. Based on the statistical data, the area of permanent grassland as a percentage of agricultural land fell by 5.3 % from 2003 to 2013 (taking into account the fact that the total agricultural area fell by 1.8 %). According to an analysis of IACS data, about half of the ploughed-up area is used to grow maize (vTI, 2009). In response to the increase in ploughing of grassland, some federal states then prohibited reuse.

Biodiversity. Negative effects on biodiversity may come from the intensification of use and the loss of agricultural micro-structures such as hedges, uncultivated field edges and other border areas and the ploughing of areas of great importance to biodiversity such as fallow and low-input land (directly or as a result of relocation processes in Germany and abroad). These also affect participation in agri-environmental measures and create difficulty in assigning and maintaining nature conservation areas because of the increased pressure on the land.

Water volume. There is as yet no indication that the availability of water in Germany is being adversely affected by the cultivation of energy plants. However, there are significant differences between crops in terms of the amount of water they require. Poplar and willow in short-rotation coppices have been reported to possibly lead to locally reduced levels of groundwater regeneration (Richter, Jansen et al., 2014).

Water quality. Only approx. 7 % of the bodies of flowing water and 26 % of the lakes in Germany met the targets of the Water Framework Directive in the period from 2009 to 2014 and achieved a ‘good state’ (UBA, 2017a). Nitrate and phosphate use and profound changes in hydromorphology make agriculture one of the main reasons why a ‘good state’ cannot be achieved. Agriculture is also a contributing factor in exceeding the nitrate limit value of 50 mg/l in upper groundwater at 28 % of measuring points in the impact measuring network (BMUB and BMEL, 2017). The increase in the area of land used to produce bioenergy could aggravate the impact of agriculture on groundwater, not least by ploughing up areas of permanent grassland. The additional use of nutrients by regenerating raw materials fermentation residues also exacerbate the problem.

Soil quality. The effects of bioenergy production on soil quality that may arise where conditions otherwise remain constant are:

change in the level of organic soil content from changes in crop rotation cycles, land use and intensity of farming,

increased risk of erosion by wind and water,

increased risk of soil compaction.

There has been no nationwide study of changes in the ecological state of the soil in agriculturally used areas in Germany, so no definitive conclusions can be drawn.

7.1.2 Photovoltaic

The amount of land taken up by ground-mounted photovoltaic installations (ground-mounted PV installations) in relation to the energy output has steadily decreased in recent years as a result of efficiency improvements in modular technology. The amount of land taken up on plants commissioned up to and including 2010 was on average around 3.56 ha/MW (ZSW, IWES et al., 2014). Ground-mounted installations commissioned in 2011 required approx. 2.5 ha/MW, whilst plants that started up in 2015 in the context of the FFAV only required 1.6 ha/MW (BNetzA, 2016).

Up to and including the start-up year 2013, in total around 23 700 ha was taken up by ground-mounted PV installations. Of this, approx. 14 800 ha were in conversion/reserved zones or industrial areas, approx. 2 500 ha on the verges of roads and railways and approx. 6 400 ha on arable land (ZSW, IWES et al., 2014).

With the change in the way the level of funding for ground-mounted photovoltaic installations is determined to a tender-based system (FFAV), for 2015 and 2016 the type of eligible land in less-favoured regions has been expanded to arable land and grassland. The ground-mounted PV installations constructed in 2015 and 2016 take up approx. 1 138 ha, of which 248 ha is arable land in less-favoured regions (BNetzA, 2017)[61].

In accordance with the new EEG 2017, from 2017 the federal states are able to stipulate individually, by a legal decree, whether and to what extent arable land and/or grassland in less-favoured regions should be considered for tenders (clause allowing opening-up of land at federal state level under Section 37c EEG 2017). In Bavaria and Baden-Württemberg, such decrees on the opening-up of land are in force (e.g. such areas accounted for 62 % of the contract amount, i.e. 124 MW of in total 201 MW awarded in the bidding round of June 2017).

[61] The EEG plant master data was filtered by ground-mounted photovoltaic installations with the start-up years 2015 and 2016.

7.1.3 Onshore wind energy

On account of the comparatively low significance of the land taken up by wind power plants, this value has thus far not been recorded in Germany. Based on a rough estimate of around 0.2 ha[62] reserved area per wind power plant, it can be assumed that around 5 500 ha[63] were occupied by wind power plants at the end of 2016. In addition, due account should be taken of the land used by the construction of additional infrastructure, such as access routes, car parking areas and power lines. This particularly applies to the use of wooded areas for wind power plants. The land taken up by onshore wind power plants is not insignificant, but the areas between the individual installations are still usable, albeit mainly limited to agriculture and forestry.

7.2 Price evolution

The following subsections present the rents and land prices and trends in prices of the relevant raw materials used to produce bioenergy in Germany, which are only partly attributable to bioenergy use.

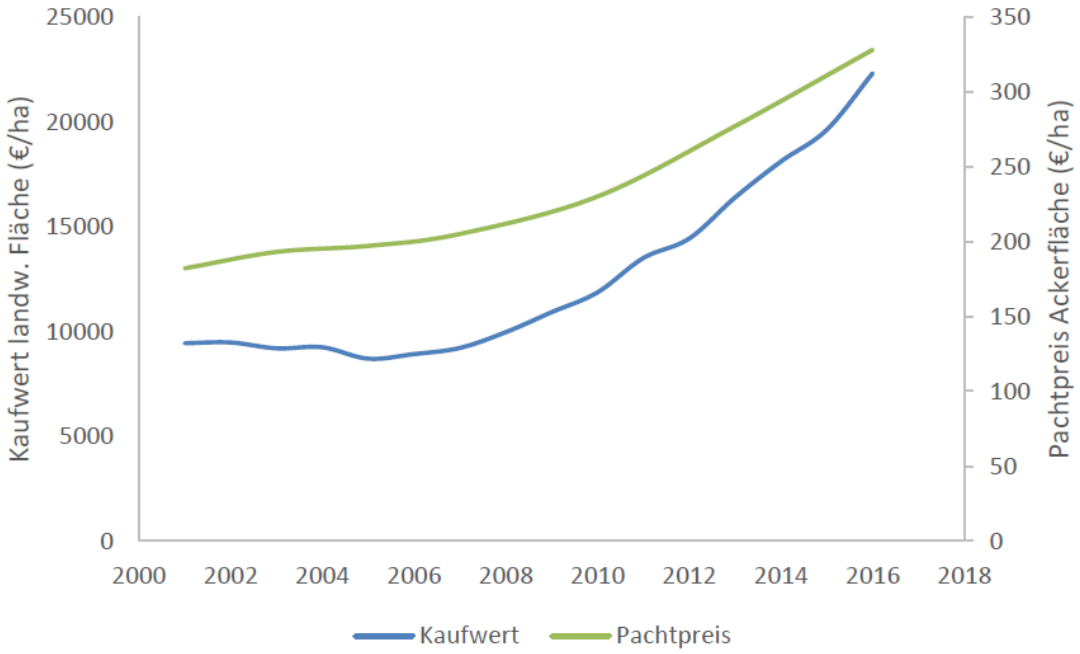
7.2.1 Rents and land prices

For some years, a strong increase in the purchase and rent prices for land used for agriculture has been in evidence. The purchase value rose by around 140 % from 2007 to 2016, and rents by 80 % (Destatis, 2017b).

[62] The calculation of 0.2 ha/WPP applies to modern wind power plants and takes account of the area permanently reserved during the operating time of the WPP for the crane footprint and the foundations. Data was evaluated for 4 types of WPP that obtained the most approvals in 2016. The values for the total reserved area for these plants were between 0.13 and 0.19 ha/WPP.

[63] The total land reserved by wind power plants describes the total plant stock, and thus also includes older existing plants with smaller foundations and crane footprints. Since the estimated value of 0.2 ha nevertheless was used, the reserved land calculated at the end of 2016 is to be regarded as being conservative.

Figure 7.1: Development of purchase values and rents for agricultural land



Quelle: (Destatis 2017b)

German	English
Kaufwert landw. Fläche (€/ha)	Purchase value for agricultural land (€/ha)
Pachtpreis Ackerfläche (€/ha)	Rent for arable land (€/ha)
Kaufwert	Purchase value
Pachtpreis	Rent
Quelle: (Destatis 2017b)	Source: (Destatis, 2017b)

Here too the effects are not only to be found in bioenergy utilisation. There are reports from some regions with a high density of biogas plants that the increased demand for land is affecting rents. In some regions with a high density of biogas plants, the increased demand for land can cause a considerable increase in the price level for new leases (Lower Saxony Ministry of Agriculture, 2014). This affects livestock rearing regions in the west of Lower Saxony, for instance, in which rents are already above average (Lower Saxony Ministry of Agriculture, 2012; Lower Saxony Ministry of Agriculture, 2014). In these extreme cases, the high rents are mainly attributable to the combination of a high density of refineries (especially pig fattening) and biogas plants which, with their demand for land for silage and energy maize, but also for the spreading of the accumulating manure and fermentation residues, trigger regional competition over land use, which contributes to a rise in land prices (LSN, 2014).

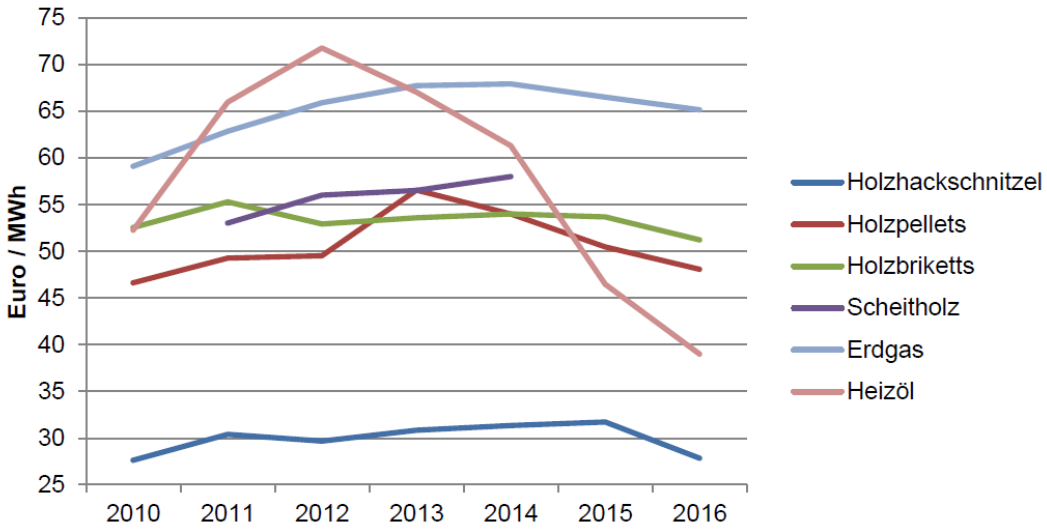
7.2.2 Wood-like biomass

The increased demand for wood has been reflected in a corresponding increase in wood prices in recent years; reverse trends influenced by the steep fall in oil prices can be observed. Demand for wood as a material only recovered slowly from the economic downturn in 2009, but the long-term upward trend continued initially. Demand for energy-related use also increased constantly.

Wood chips. The price of forest wood chips has doubled from 2003 to 2013, continued to increase further and in 2015 reached the provisional highest value at 31.71 €/MWh. The price of SRC wood chips was somewhat lower at the end of 2015 (29.03 €/MWh) for the same water content category (35 %) (CARMEN, 2017d). From 2015 to 2016, the price of forest wood chips fell by approx. 12 % (CARMEN, 2017c).

Logs. The increase in wood-fired heating systems has resulted in an increase in demand for logs. Overall, prices have seen an upward trend in recent years (CARMEN, 2015). The main ways of procuring logs remain self-promotion or trees felled in privately owned forests. The reference price is thus reduced by the personal contribution provided (Mantau, 2012; TFZ, 2015). At the regional level, demand clearly outstrips supply in some cases. The dependence on oil and gas prices is not so marked here. Accordingly, no reduction in prices was observed up to the start of 2016 (FNR, 2017b).

Figure 7.2: Evolution of fuel prices



Quelle: Holzhackschnitzel Holzpellets, Holzbrikkets: Carmen e.V.: Scheitholz: TFZ; Heizöl, Erdgas: Destatis

German	English
Euro/MWh	Euros/MWh
Holzhackschnitzel	Wood chips

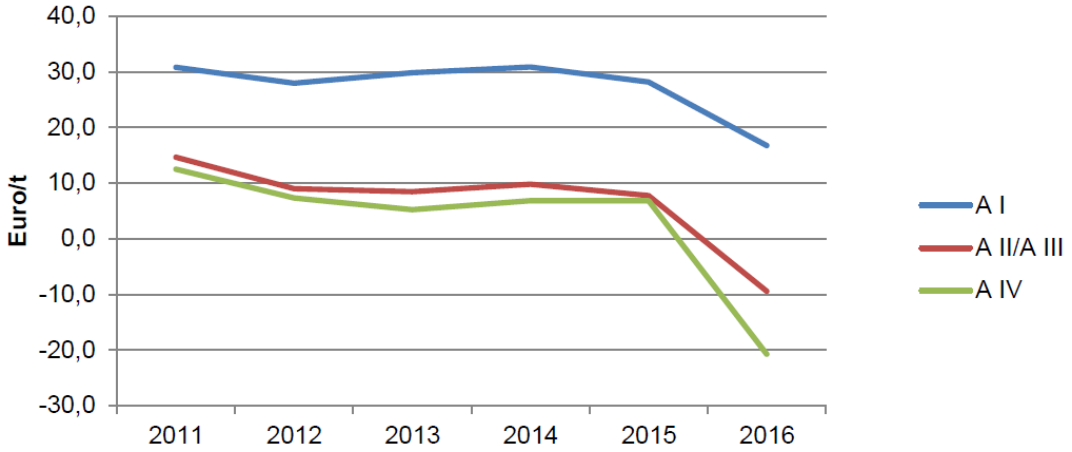
Holzpellets	Wood pellets
Holzbriketts	Wood briquettes
Scheitholz	Logs
Erdgas	Natural gas
Heizöl	Heating oil
Quelle: Holzhackschnitzel, Holzpellets, Holzbrikkets: Carmen e.V.: Scheitholz: TFZ: Heizöl, Erdgas: Destatis	Source: Wood chips, wood pellets, wood briquettes: Carmen e.V.; logs: TFZ; heating oil, natural gas: Destatis

Wood pellets. The prices for wood pellets have been influenced strongly by heating oil prices. After the prices rose up to the start of 2015 (FNR, 2017b), which reflected the growing demand for pellets as a result of the clear growth in pellet-fired plants in Germany (Mantau, 2012; DEPI, 2015), the average price for wood pellets from 2014 to 2016 fell by approx. 10 % (CARMEN, 2017a).

Wood briquettes. The price for wood briquettes moved between the price for logs and the price for wood pellets. In the reporting period, the price also decreased for wood briquettes by comparison with 2014, but, at 5 %, did not fall as much as that for wood pellets (CARMEN, 2017b).

Scrap wood. The rise of scrap wood and thus also the price thereof are linked to construction activity and the rise in plywood, the use of the price level of waste for waste incinerators, the operation of scrap wood power plants and weather conditions. After three mild winters in succession, plant shutdowns and extended auditing periods (after a relatively long time with the difficult financial situation), in the reporting period stock levels were high and at the end of 2016 reached such an extent that some municipal disposal and processing entities imposed temporary stops on acceptance (EUWID, 2016). On regional markets there were supply bottlenecks of scrap wood. The scrap wood prices fell to a correspondingly significant extent in the reporting period, depending on the category and region. In particular in southern Germany the prices for scrap wood in category IV fell very sharply. Whilst in 2014 they were still positive, in October average acceptance prices of € 15 in October 2015 and € 55 in October 2016 were recorded (EUWID, 2014). In respect of clean, processed scrap wood, the decline in prices was much more moderate. Despite negative prices, scrap wood continued to be imported in the reporting period.

Figure 7.3: Evolution of scrap wood types



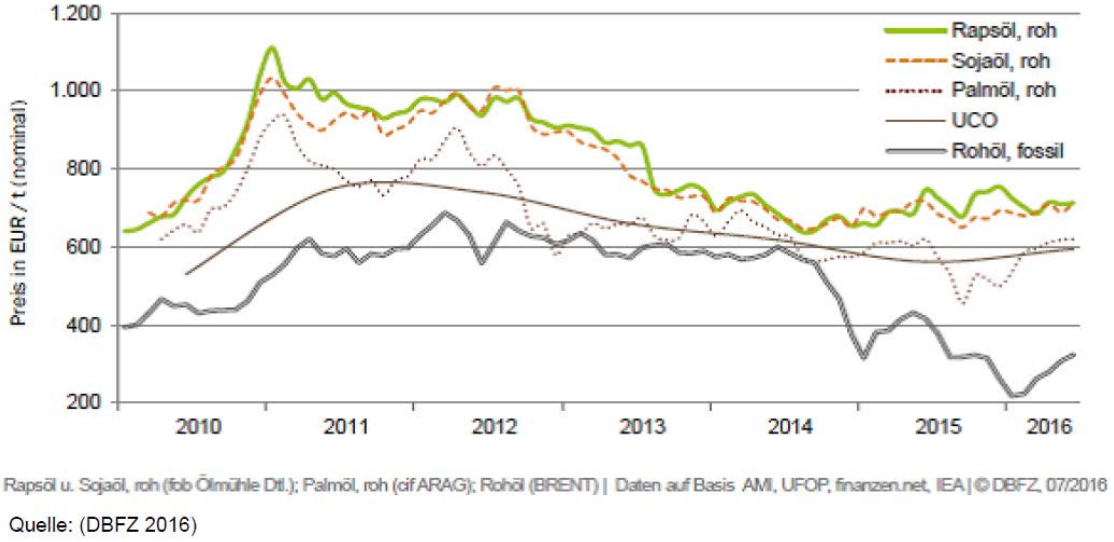
Quelle: EUWID 2016, 2017

German	English
Euro/t	Euros/tonne
Quelle: EUWID 2016, 2017	Source: EUWID 2016, 2017

7.2.3 Vegetable oils

Oilseeds and vegetable oils obtained from them are used as energy sources both in the transport sector and in district heating plants. Their prices are largely determined by the situation on the world market (FNR, 2015a). Prices for vegetable oils have fallen since 2011. After the prices for rapeseed oil and crude palm oil converged in 2014, in 2015 they diverged from one another again. The price for crude palm oil fell in 2015 but the prices for rapeseed oil and soya oil rose again (DBFZ, 2016). In 2016, the prices for both rapeseed oil and palm oil continued to rise and at the end of 2016 reached around EUR 870 per tonne for rapeseed oil and around EUR 750 per tonne for palm oil (UFOP, 2017).

Figure 7.4: Evolution of vegetable oil prices



Quelle: (DBFZ 2016)

German	English
Preis in EUR/t (nominal)	Price in EUR/t (nominal)
Rapsöl, roh	Rapeseed oil, crude
Sojaöl, roh	Soya oil, crude
Palmöl, roh	Palm oil, crude
UCO	UCO
Rohöl, fossil	Crude oil, fossil
Rapsöl u. Sojaöl, roh (fob Ölmühle Dtl.); Palmöl, roh (cif. ARAG); Rohöl (BRENT) | Daten auf Basis AM, UFOP, finanzen.net, IEA | © DBFZ, 07/2016	Rapeseed oil and soya oil, crude (fob oil mill Dtl.); palm oil, crude (cif. ARAG); crude oil (BRENT) | Data based on AM, UFOP, finanzen.net, IEA | © DBFZ, 07/2016
Quelle: (DBFZ 2016)	Source: (DBFZ, 2016)

7.2.4 Substrates for biogas generation

The prices for the majority of substrates used to produce biogas are scarcely dependent on the world market as their high water content means they are only transported short distances. The range of substrate costs is therefore relatively wide and the costs differ to a considerable extent from region to region. The average substrate costs for 2014 as determined in operator surveys were EUR 35.9/t_{FM} for maize silage for biogas plants. In terms of the methane yield, silage maize in 2014 thus remained the most cost-effective biogas substrate (at EUR 0.34/m^3CH_4), apart from waste and residues, and grass silage the second most cost-effective biogas substrate at EUR 0.35/m^3CH_4 (DBFZ, 2015b).

7.2.5 Producer prices for agricultural and forestry products

Agricultural products. The producer price index for agricultural products is measured against the base year of 2010. In 2015, the index rose by 7 % compared to 2010, and fell by 3.8 % compared to 2014. The increase in the index for plant products (+14.3 %) was clearly greater than that for animal products (+2.1 %) (Destatis, 2016; Destatis, 2017a). In 2016, price levels were 6.6 % higher compared to 2010. Whilst the index for animal products fell slightly (-0.3 %), it rose more significantly for plant products (+17.1 %) (Destatis, 2017d).

Forestry products. Wood products for energy production are additionally reported in the producer price index for forestry products for information purposes. The prices of wood products for energy production rose by 7.5 % in 2015 (Destatis, 2016) compared to the base year of 2010 and fell in comparison with the previous year by 2.8 %. The increase is largely due to rising prices for wood pellets and wood briquettes produced from sawdust and sawmill by-products, and the rising price of industrial timber. Compared to 2015, the price of wood products for energy production in 2016 fell further, with the result that the index was at a similar level to that from 2010 (+0.2 %) (Destatis, 2017d). In particular, the industrial timber price fell from 2015 to 2016 (-7.3 %) on account of the oversupply of scrap wood for industry, the mild winter and the lower oil price. Whilst the prices for fuel wood (beech) in 2015 rose by 0.8 % compared to the previous year, they fell again by 0.8 % in 2016 (Destatis, 2017a).

8 PLEASE DESCRIBE THE DEVELOPMENT AND SHARE OF BIOFUELS MADE FROM WASTES, RESIDUES, NON-FOOD CELLULOSIC MATERIAL, AND LIGNO-CELLULOSIC MATERIAL.

(Article 22(1)(i) of Directive 2009/28/EC)

Statistical information on the production of biofuels based on raw materials in accordance with Annex IX Part A to Directive 2009/28/EC in Germany is not available, but figures can be provided in relation to the raw materials for the volumes of biofuels placed into circulation in Germany on the basis of the available BLE data for both reporting years (cf. Table 5). The total use (transport sector and other types of traffic) of biofuels in accordance with Annex IX Part A to Directive 2009/28/EC was approx. 6 ktoe in 2015 and around 7 ktoe in 2016. This corresponds to a share of in each case 0.01 % of the total energy consumption in the transport sector. Biofuels based on biowaste collected separately in private households were particularly significant. In addition, in 2016 fuels based on industrial waste and in 2015 fuels based on straw and crude glycerine were used to a greater extent.

Table 5: Development of biofuels produced from the feedstocks listed in Annex IX to Directive 2009/28/EC (ktoe)[64]

Feedstock as listed in Annex IX Part A to Directive 2009/28/EC	2015	2016
(a) Algae if cultivated on land in ponds or photobioreactors		
(b) Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under point (a) of Article 11(2) to Directive 2008/98/EC	0.2	<0.1
(c) Biowaste as defined in Article 3(4) of Directive 2008/98/EC from private households subject to separate collection as defined in Article 3(11) of that Directive	1.9	2.0
(d) Biomass fraction of industrial waste not fit for use in the food or feed chain, including material from retail and wholesale and the agro-food and fish and aquaculture industry, and excluding feedstocks listed in part B of this Annex	0.5	1.3
(e) Straw	1.3	-
(f) Animal manure and sewage sludge	<0.1	<0.1
(g) Palm oil mill effluent and empty palm fruit bunches		3.0
(h) Tall oil pitch		
(i) Crude glycerine	1.0	0.1
(j) Bagasse	0.4	0.4
(k) Grape marcs and wine lees	0.1	0.1

[64] Evaluation of the nabisy database of the BLE, as at December 2017.

(l) Nut shells		
(m)Husks		
(n) Cobs cleaned of kernels of corn		
(o) Biomass fraction of wastes and residues from forestry and forest-based industries, i.e. bark, branches, pre-commercial thinnings, leaves, needles, tree tops, saw dust, cutter shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil		
(p) Other non-food cellulosic material as defined in point (s) of the second paragraph of Article 2		
(q) Other ligno-cellulosic material as defined in point (r) of the second paragraph of Article 2 except saw logs and veneer logs		
Feedstock as listed in Annex IX Part B to Directive 2009/28/EC	**2015**	**2016**
(a) Used cooking oil	385	619
(b) Animal fats classified as categories 1 and 2 in accordance with Regulation (EC) No 1069/2009 of the European Parliament and of the Council	-	-

9 PLEASE PROVIDE INFORMATION ON THE ESTIMATED IMPACTS OF THE PRODUCTION OF BIOFUELS AND BIOLIQUIDS ON BIODIVERSITY, WATER RESOURCES, WATER QUALITY AND SOIL QUALITY WITHIN YOUR COUNTRY IN THE PRECEDING 2 YEARS. PLEASE PROVIDE INFORMATION ON HOW THESE IMPACTS WERE ASSESSED, WITH REFERENCES TO RELEVANT DOCUMENTATION ON THESE IMPACTS WITHIN YOUR COUNTRY.

(Article 22(1)(j) of Directive 2009/28/EC)

The development of agricultural production is influenced by various factors. In addition to global population growth and resource-intensive consumption patterns in industrialised countries, which entail an increase in the demand for agricultural goods, the cultivation and marketing of raw materials for the production of biofuels is another factor. It is therefore difficult to empirically verify the direct effects of biofuel production on the overall agricultural production system or demonstrate a monocausal link between the two. This is particularly true given that the German agricultural market is closely tied to the global markets.

It is generally the case that pressure on agricultural land is increasing. The risk of the expansion of land used for agriculture and especially the intensification of agriculture are associated with this. More intensive utilisation of agricultural land in Germany is essentially linked to risks in relation to biodiversity, water resources and water and soil quality and the state of terrestrial ecosystems (BfN, 2010b; BfN, 2015; UBA, 2015). For example, the constriction of crop rotation cycles, the restriction to a few particularly high-yield varieties and the high use of fertilisers and plant protection compositions have a negative effect on agricultural biodiversity. The loss of agriculturally/ecologically significant structures and forms of land use, like extensively used grassland, fallow, borders, unused marginal areas of parcels as a result of a generally increased pressure on use of agricultural land (BfN, 2010b) also has a negative impact on biodiversity. The decrease in the existence of representative bird species in agricultural land is a key indicator of deficiencies in terms of sustainability (UBA, 2017a). The most significant consequences of intensive agriculture in respect of water and soil quality include nitrogen input into groundwater, nutrient input in surface groundwater and eutrophication, loss of humus, soil erosion and soil compaction. Nitrogen emissions into the air can lead to eutrophication and acidification of terrestrial ecosystems. The individual crops differ in terms of their impact on biodiversity, water resources and water and soil quality.

The most important raw materials cultivated in Germany for the production of biofuels and bio-liquids are rapeseed, followed by cereals (primarily wheat), sugar beet and grain maize (cf. Chapter 6, 7, 13; (BLE, 2016; FNR, 2017a)). The land used in Germany for this purpose was 800 000 ha and 760 000 ha for rapeseed, 148 000 ha and 144 000 ha for cereal, 39 500 ha and 41 800 ha for sugar beet and 17 500 ha and 17 700 ha for grain maize, for 2015 and 2016 respectively (FNR, 2017a).

In direct comparison with other crops, such as sunflower or winter cereal, rapeseed has often shown to be less cost-effective (SRU, 2007; BfN, 2010b). For instance, the cultivation of rapeseed frequently leads to excess nitrogen in the land and thus to an increased risk of groundwater being polluted by nitrogen losses. Due to the susceptibility of this crop to insect food and fungal attack, rapeseed is moreover associated with a relatively high use of plant protection compositions (EEA, 2007; vTI, 2010). The humus balance in the case of rapeseed is crucially dependent on whether the rapeseed straw remains on the field. The cultivation of sugar beet by contrast always exhibits a marked humus consumption (EEA, 2007; TAB, 2010). With respect to the risk of erosion and soil compaction owing to the use of difficult harvesting technology, the risk in sugar beet cultivation is very high. The erosion risk of grain maize is increased by the late harvesting. Likewise the cultivation of grain maize is associated with increased risks of nitrate leaching and on account of its self-compatibility the risk of narrow crop rotation cycles and thus negative effects on agricultural biodiversity.

In perspective, the use of straw to produce BtL fuel represents a significant risk to the target of balance humus level, provided that the removal of straw is not effectively bound to the locally specific soil conditions.

10 PLEASE ESTIMATE THE NET GREENHOUSE GAS EMISSION SAVINGS DUE TO THE USE OF ENERGY FROM RENEWABLE SOURCES.

(Article 22(1)(k) of Directive 2009/28/EC)

In 2015, the use of renewable energy sources produced a net saving on greenhouse gas emissions of approx. 158 million tonnes of CO_2 equivalent. The vast bulk of this, just over 119 million tonnes of CO_2 equivalent, was achieved by generating electricity from renewable energy sources. The consumption of renewable energy sources to provide heating and cooling produced greenhouse gas emissions approx. 33 million tonnes of CO_2 equivalent lower than the substituted mix of fossil energy sources. The consumption of biofuels led to around 6 million tonnes $CO_{2\ eq}$ fewer greenhouse gas emissions (without taking into account indirect changes in land use).

The total net emissions avoided by renewable energies were some 160 million tonnes $CO_{2\ eq}$ in 2016, corresponding to the only slightly higher use in 2016 compared to 2015. The electricity sector contributed just over 119 million tonnes $CO_{2\ eq}$, the 'heating and cooling' sector over 34 million tonnes $CO_{2\ eq}$, and the consumption of biofuels in the transport sector approx. 7 million tonnes $CO_{2\ eq}$ to the total GHG reduction.

With regard to the GHG saving as a result of biofuels, it must be noted that on account of the balancing of the use of methanol that has generally been practised hitherto in the production of biodiesel and the regulations on the substitution of fossil CO_2 with biogenic CO_2 formed in the production of bioethanol, the emission reductions from the use of biofuels has proven to be at least partially too optimistic. In the context of circulars to the EU certification systems, the European Commission has provided relevant clarifications that were to be transposed to these systems.

This calculation of greenhouse gas emissions avoided is based on the actual, non-normalised energy supply from renewable energy sources.[65] The detailed methodology and the data sources used in the emission balance for renewable energy sources are described in detail in UBA (2017b).

[65] The energy supply from renewable sources in the electricity, heating and transport sector (only biofuels in that case which are used solely in the transport sector, without other transport) was used to estimate the savings in greenhouse gas emissions in 2015 and 2016. Unlike the tables in Chapter 1, the actual electricity production from wind energy and hydropower, and the total final consumption of energy from liquid biomass to provide electricity and heating were used. This only has a minor impact on the results of the greenhouse gas audit, however.

Table 6: Estimated GHG emission savings from the use of renewable energy (million tonnes CO_2eq)

Environmental aspects	2015	2016
Total estimated net GHG emission saving from using renewable energy[66]	***157.6***	***160.5***
- Estimated net GHG saving from the use of renewable electricity	118.8	119.4
- Estimated net GHG saving from the use of renewable energy in heating and cooling	32.6	34.1
- Estimated net GHG saving from the use of renewable energy in transport[67]	6.3	6.9

[66] The contribution of electricity, hydrogen and gas from renewable energy sources should be reported depending on the final use (electricity, heating and cooling or transport) and only be counted once towards the total estimated net GHG emissions savings.

[67] Only through the use of biofuels in the transport sector (without other transport). Greenhouse gas avoidance through the use of renewable electricity in transport is included under the electricity sector. The figures are consistent with those of the BLE (2017), only other transport (order of magnitude of the GHG reduction 0.4 million tonnes CO_2 equivalent/year) was subtracted.

11 PLEASE REPORT ON (FOR THE PRECEDING 2 YEARS) AND ESTIMATE (FOR THE FOLLOWING YEARS UP TO 2020) THE EXCESS/DEFICIT PRODUCTION OF ENERGY FROM RENEWABLE SOURCES COMPARED TO THE INDICATIVE TRAJECTORY WHICH COULD BE TRANSFERRED TO/IMPORTED FROM OTHER MEMBER STATES AND/OR THIRD COUNTRIES, AS WELL AS ESTIMATED POTENTIAL FOR JOINT PROJECTS UNTIL 2020.

(Article 22(1)(l) and (m) of Directive 2009/28/EC)

For the current 2015/2016 reporting period, the indicative trajectory for Germany according to Directive 2009/28/EC provides for a minimum share of renewable energy in gross final consumption of energy of 11.29 %. As shown in Table 1, the actual share of renewable energy in the GFCE was 14.6 % in 2015 and 14.8 % in 2016, and hence well above the indicative trajectory in both reporting years.

The values for gross final consumption of energy in the reporting period given in Table A (2015: 219 773 ktoe, 2016: 223 953 ktoe) produce a minimum consumption of energy from renewable sources needed to achieve the trajectory of 24 812 ktoe for 2015 and 25 284 ktoe for 2016. The actual consumption of 32 084 ktoe in 2015 and 33 195 ktoe in 2016, as shown in Table 1a, thus results in a surplus of 7 272 ktoe for 2015 and 7 911 ktoe for 2016 (Table 7).

At 14.8 %, the proportion of renewable energy in Germany in 2016 was already well above the minimum values for the 2017/2018 reporting period (13.73 %). It can therefore presently be assumed that, at least for the reporting period covered by the next progress report (2017/2018), Germany will achieve renewable energy surpluses over the indicative trajectory, which can perhaps be made available for statistical transfer and joint projects. As the indicative trajectory defined in the Directive in the last few years up to 2020 becomes increasingly steep, according to which the majority of the increase is only intended to take place in the last four years of the decade, in order to achieve the 2020 target it is still vital to continue with the measures for expansion of renewable energies.

The mandatory expansion corridor in the electricity sector of a 40 % to 45 % share of renewable energy in gross electricity consumption in 2025, as provided for in the EEG, is compatible with the objectives of the energy concept and the German NREAP. The annual renewable energy expansion on which the expansion corridor is based has been around the same level for the last ten years. An average level of 10 TWh per year was achieved during this period,

which was even surpassed in 2015 and 2016 on average. The introduction of the tender procedure in the EEG 2017 moreover enables the implementation of the expansion corridor to be steered even more reliably in future. To this end, annual tender volumes will be defined for onshore and offshore wind energy, photovoltaic energy and biomass plants.

Table 7: Actual and estimated excess and/or deficit (-) production of renewable energy compared to the indicative trajectory which could be transferred to/from other Member States and/or third countries (ktoe)[68,69]

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Actual/estimated excess or deficit production[70]			**6 895**	**8 436**	**6 546**	**9 390**	**7 272**	**7 911**	*4 130*	*5 976*		*3 065* [71]

For the years after the reporting period, i.e. 2017 to 2020, the relevant estimates from Table 9 of the NREAP and Table 7 of the 1st Progress Report are presented in italics for information purposes in Table 7. This original estimate of the excesses for 2015-2020 is based on the 'EFF' scenario ('scenario with additional energy efficiency measures') of the NREAP. As already explained in the NREAP, corresponding scenarios are subject to the unavoidable uncertainties of the economic, demographic, technological, political and social basic assumptions. Like all scenarios, the 'EFF' scenario is therefore also not to be regarded as a binding forecast but as a possible development trajectory that is inherently consistent and plausible, taking into account all of the uncertainties of the framework parameters. Also on account of the recent robust economic growth and a population growth that cannot be predicted in this way, the actual progress with regard to energy efficiency lagged behind the expectations at that time. The real development of the GFCE is thus at present closer to the 'REF' scenario ('reference scenario') of the NREAP. If this 'REF' scenario is taken as a basis for the calculations, a significantly lower excess of 423 ktoe would be expected to result by then for 2020.

[68] Please use actual figures to report on the excess production in the two years preceding submission of the report, and estimates for the following years up to 2020. In each report Member States may correct the data of the previous reports.

[69] When filling in the table, for deficit production please mark the shortage of production using negative numbers (e.g. –x ktoe).

[70] Please distinguish per type of renewable energy and per origin/destination of import/export.

[71] The figures in italic are based on the 'EFF' scenario of the NREAP from 2009. The actual development of the GFCE is however currently closer to the 'REF' scenario of the NREAP. If this is taken as a basis, a lower excess would by then result for 2020 of 423 ktoe.

11.1. Please provide details of statistical transfers, joint projects and joint support scheme decision rules.

In the 4th quarter of 2016, Denmark and Germany held pilot calls for tender in respect of ground-mounted photovoltaic installations (ground-mounted PV installations) that were open to participation by both countries. PV installations in both Germany and Denmark were able to participate in these first cross-border tenders in Europe. In Germany, an open tender with a volume of 50 MW was conducted, in which five projects situated in Denmark submitted successful bids.

Extensive preparations were required in order to implement this pilot project. For example, in 2015 and 2016 the Federal Government worked intensively to create detailed concepts for the implementation of cross-border tenders. The outlines of the Federal Government's concept were published in a Key Issues Paper in March 2016 and presented for discussion. On the basis of this concept, in July 2016 the Cross-Border Renewable Energies Regulation (GEEV) was enacted. This forms the legal basis for the conducting of cross-border tenders. The concepts moreover influenced the cooperation agreement on the pilot tenders that was concluded with Denmark in summer 2016. As the plants that were awarded contracts in the reporting period have not yet been constructed and started up, the reciprocal tenders have not yet led to a statistical transfer between the partner countries.

The EEG 2017 that entered into force on 1 January 2017 provides for 5 % of the annual capacity to be installed to remain open to participation by plants in other Member States (around 300 MW per year), provided that a corresponding cooperation agreement exists with the partner countries concerned, the opening of the tenders to cross-border participation is consistent with the principle of reciprocity, and the 'physical import' of electricity to Germany, or a comparable effect on the German electricity market, can be demonstrated. In summer 2017, the GEEV, which previously only applied to PV installations, was revised and expanded to include cross-border tenders for onshore wind power plants.

In line with the provisions of the EEG 2017, the Federal Government is striving to open up tenders to participation by plants in other Member States to the extent of approx. 300 MW per year. At present, there are no plans to continue the cooperation with Denmark, as Denmark has only committed to a one-off opening-up of calls to tender with respect to the European Commission. However, the Federal Government is holding in-depth discussions with other Member States to conclude further cooperation agreements. Since

summer 2017, the possibility of cross-border tenders has been discussed with France, among other Member States.

12 PLEASE PROVIDE INFORMATION ON HOW THE SHARE FOR BIODEGRADABLE WASTE IN WASTE USED FOR PRODUCING ENERGY HAS BEEN ESTIMATED, AND WHAT STEPS HAVE BEEN TAKEN TO IMPROVE AND VERIFY SUCH ESTIMATES.

(Article 22(1)(n) of Directive 2009/28/EC)

To determine the contribution of biodegradable waste to electricity and heat production, it is generally[72] assumed that 50 % of the waste processed in waste incineration plants is biodegradable. This value comes from a study (UBA, 2011) which examines the waste flows from selected treatment methods in detail. Municipal wastes (residual waste, bulky waste, biowaste, cardboard, paper, paperboard, light packaging, scrap wood and sewage sludge) and industrial waste similar to household waste were examined. The proportion of biodegradable material for each waste category was determined. The quantities for the different waste categories can be used to calculate the average energy-related biogenic fraction of all the waste used for incineration. The methods of determining the biogenic fraction are being constantly improved and tested for practical viability (e.g. C14 method).

[72] In the HKNR, the Federal Environmental Agency, which maintains the register, uses differentiated values: http://www.umweltbundesamt.de/sites/default/files/medien/372/dokumente/nutzungsbedingungen_fuer_das_herkunftsnachweisregister.pdf, Section 9.4.

13 PLEASE PROVIDE THE AMOUNTS OF BIOFUELS AND BIOLIQUIDS IN ENERGY UNITS (KTOE) CORRESPONDING TO EACH CATEGORY OF FEEDSTOCK GROUP LISTED IN PART A OF ANNEX VIII TAKEN INTO ACCOUNT BY THAT MEMBER STATE FOR THE PURPOSE OF COMPLYING WITH THE TARGETS SET OUT IN ARTICLE 3(1) AND (2), AND IN THE FIRST SUBPARAGRAPH OF ARTICLE 3(4).

Under the feedstocks listed in Part A of Annex VIII to Directive 2009/28/EC, in the reporting period oil crops (rapeseed, oil palm, sunflower and soya), which, in accordance with Annex VIII are associated with by far the greatest estimated emissions as a result of indirect changes in land use, represented the predominant share of biofuels and bioliquids based on common arable crops (68 % in 2015 and 64 % in 2016). In 2015 approx. 27 % and in 2016 approx. 31 % came from the category of 'Cereals and other starch-rich crops', which includes maize, wheat, triticale, rye and barley, among others. In 2015 only 5 % and in 2016 6 % of biofuels and bioliquids based on common arable crops came from sugars (sugar beet and sugar cane).

Table 13: Amounts of biofuels and bioliquids in energy units (ktoe[73]) corresponding to the categories of feedstock groups listed in Part A of Annex VIII

Feedstock group	2015	2016
Cereals and other starch-rich crops[74]	623	607
Sugars[75]	115	111
Oil crops[76]	1 548	1 268

[73] Conversion of TJ to ktoe using the conversion factor specified in the NREAP.

[74] Biofuels and bioliquids based on maize, wheat, triticale, rye and barley that were placed into circulation in Germany in 2015 and 2016 and certified as sustainable according to the BLE (2017).

[75] Biofuels and bioliquids based on sugar beet and sugar cane that were placed into circulation in Germany in 2015 and 2016 and certified as sustainable according to the BLE (2017).

[76] Biofuels and bioliquids based on rapeseed, oil palm, sunflower and soya that were placed into circulation in Germany in 2015 and 2016 and certified as sustainable according to the BLE (2017).

Reporting outside the progress report template

14 REPORT PURSUANT TO THE BIOMASS ELECTRICITY AND BIOFUEL SUSTAINABILITY REGULATIONS (BIOMASS SUSTAINABILITY REGULATIONS)

In Section 64 of its Biofuel Sustainability Regulation [Biokraft-NachV], Germany has stipulated that the progress report pursuant to Article 22 of Directive 2009/28/EC to the European Commission should report on the fulfilment of the requirements laid down in the Biofuel Sustainability Regulation and the impact on sustainability of producing the biofuels placed in circulation in the Federal Republic of Germany. The report must assess whether the use of biofuels is socially acceptable. Because liquid biomass is treated in the same way in terms of content, sustainability aspects relating to the biofuels placed into circulation and the bioliquids used to generate electricity in Germany will be reported on jointly below. The report is based partly on the evaluation and progress reports from the Federal Office for Agriculture and Food (BLE) for 2015 (BLE, 2016) and 2016 (BLE, 2017).

14.1. Fulfilment of the requirements of the Biomass Sustainability Regulations

The Biomass Sustainability Regulations entered into force at the end of 2009 and have been applicable without any restrictions since 1 January 2011.

The Biomass Sustainability Regulations stipulate that evidence of compliance with the sustainability requirements (sustainability certificates) must be provided with the aid of private certification systems and certifying bodies. The provisions of the Biomass Sustainability Regulations are mainly implemented by the BLE. The BLE recognised two certification systems (ISCC DE and REDcert DE) as early as 2010, so economic operators could join these certification systems at an early date in order to produce the sustainability certificate required in Germany from 1 January 2011. In 2010, a total of four applications for recognition of certification systems had been filed with the BLE; this number of applications had not changed by the end of 2016. Of these applications, the two systems mentioned above were recognised, one application for recognition of a certification system was rejected and the recognition of one system was withdrawn (BLE, 2017). In addition to these national systems in Germany (German systems), European Commission Directive 2009/28/EC also creates the possibility for approval of voluntary national or international schemes for sustainability certification, which according to German Biomass Sustainability Regulations are likewise recognised in Germany as proof of sustainability

('voluntary schemes'). 19 of these voluntary schemes had been approved by the European Commission by the end of 2016, one of which is a greenhouse gas calculation tool (Biograce GHG calculation tool). The approval of the voluntary schemes is in each case valid for 5 years, and consequently in three cases the approval has been granted again and in three other cases the approval had expired by the end of 2016 and has not already been granted again (BLE, 2017). In addition, European Member States can introduce national systems (equivalent to the German system of sustainability certificates) that meet the requirements of Directive 2009/28/EC with respect to evidence of compliance with the sustainability criteria. National systems of this type have been set up in Hungary, Slovenia, Slovakia and Austria as of the end of 2016. Interfaces to these national systems are contained within the web-based national 'Sustainable Biomass Systems' database (Nabisy) and the sustainability certificates issued by those systems can also be copied across to the German system.

For a certain volume of biomass, certifying bodies perform the task of certifying their sustainable origin in keeping with the requirements of the Sustainability Regulations. The BLE had recognised 25 certifying bodies on a permanent basis and one on a provisional basis by the effective date of 31 December 2016. A total of 51 applications for recognition were submitted, of which six were rejected and 19 permits were withdrawn or cancelled because the certifying bodies ceased to operate (BLE, 2017). The BLE essentially conducts an annual 'office audit' on the premises of each certifying body. This checks a sample of cases handled by the certifying body. Depending on the results, office audits may take place at shorter intervals. Also, depending on a risk assessment of the certifying body, the BLE carries out 'witness audits', where the BLE accompanies the auditors to the various interface points and observes their procedure ('checking the checkers'). However, these witness audits can only be carried out by the BLE if the countries have agreed to the accompanying assessment on their territory. Once a year, the certifying bodies are obliged to report to the BLE on their experience with the certification systems that they use.[77]

Worldwide, in 2015 a total of 121 companies and in 2016 99 companies were certified by the certifying bodies accredited by the BLE in accordance with the requirements of the German systems, and the majority of these certificates (91 certificates in 2015 and 76 certificates in 2016) were issued to companies located in Germany. A further 29 and 19 companies have been certified in other EU countries and 1 and 4 in third countries, respectively (BLE, 2016; BLE, 2017). 2 certificates were withdrawn in 2015; no information in this respect is available

[77] Along with comments on the feasibility of the system specifications, this report also contains facts relevant to the assessment as to whether the certification systems are calculated to meet the legal requirements.

for 2016. Compared to 2014, the number of companies certified in accordance with the requirements of German systems in 2015 fell by 65 % and in 2016 decreased by a further 18 % as compared to 2015. The downward trend in certifications in accordance with the systems recognised by the BLE is thus continuing. In parallel to the decrease in certifications in Germany, there is also an increase in the number of companies certified in accordance with the requirements of voluntary schemes (BLE, 2016). If the certifying body providing certifications in accordance with the requirements of voluntary schemes has its headquarters or place of business in Germany and the certification decision was made in Germany, the certificates also have to be sent to the BLE. In 2015, 2 342 of these first certifications and re-certifications were notified to the BLE (BLE, 2016), and 2 448 in 2016 (BLE, 2017). Thus, only 5 % in 2015 and only 4 % in 2016 of companies were certified by certifying bodies recognised by the BLE in accordance with the requirements of German systems and 95 % and 96 % respectively, in accordance with the requirements of voluntary schemes.

The BLE is responsible for managing data on the sustainability of biofuels and bioliquids through Nabisy. The figures[78] for the sustainability biofuels and bioliquids that are relevant to the German market have to be entered into Nabisy by the economic operators concerned. They are then documented and validated by Nabisy. The German main customs offices and the biofuel quota office have direct access to Nabisy, along with the relevant competent authorities in other Member States of the EU. The main customs offices can use the data from Nabisy to perform their tasks of fiscal supervision under the Energy Tax Act and monitoring of the biofuel quota obligation under the Federal Emissions Control Act. The exchange of data on sustainability between the competent authorities in the Member States is necessary to prevent the economic operators from claiming unlawful relief in multiple Member States for the same goods. Nabisy provides the necessary institutional basis for this exchange, and the BLE is in contact with other Member States in order to ensure the required data reconciliation.

A possible exclusion or the non-recognition of certificates is the only indication that the requirements of the sustainability system are not met for a given raw material in the cases reviewed and this is subsequently penalised through exclusion from the system. It is not currently possible to make a statement about the reasons leading to an exclusion or the geographic breakdown on the basis of the information available. Following its audit of the EU system for certification of sustainable biofuels in 2015, the European Court of Auditors (ECA) reported a

[78] The data include the type of raw materials used, the quantity, the energy content, the country of cultivation, classification as waste or residue, the supplier chain and the potential GHG reduction.

lack of transparency and lack of checks of voluntary schemes (ECA, 2016a). In this connection it was pointed out for example that even after the publication of guidelines on the transparency of voluntary schemes in March 2015 (2015c) some gaps in information regarding the functioning of these schemes continued to exist, the management structures of some schemes conceal the risk of conflicts of interest and the functioning of recognised voluntary schemes and compliance with sustainability criteria (for example the EU environmental requirements) are not monitored by the Commission. Increasing the transparency of the overall certification and evidence system is, however, essential in order to boost its credibility and increase its acceptance by market participants. With the aim of increasing transparency and improving supervision of voluntary schemes by the Commission, to that end Directive (EU) 2015/1513 accordingly requires regular reporting on activities in the context of voluntary schemes. None of these reports have as yet been published.

14.2 Impact on sustainability of the production of bioliquids used in Germany to generate electricity and of biofuels brought into circulation

In transposition of Directive 2009/28/EC, the Biomass Sustainability Regulations cover aspects of sustainable biomass production in the form of minimum ecological criteria that have to be met (13.2.2). Other sustainability aspects are not covered by the Regulations (13.2.3).

14.2.1 Origin of bioliquids used in Germany to generate electricity and of biofuels brought into circulation

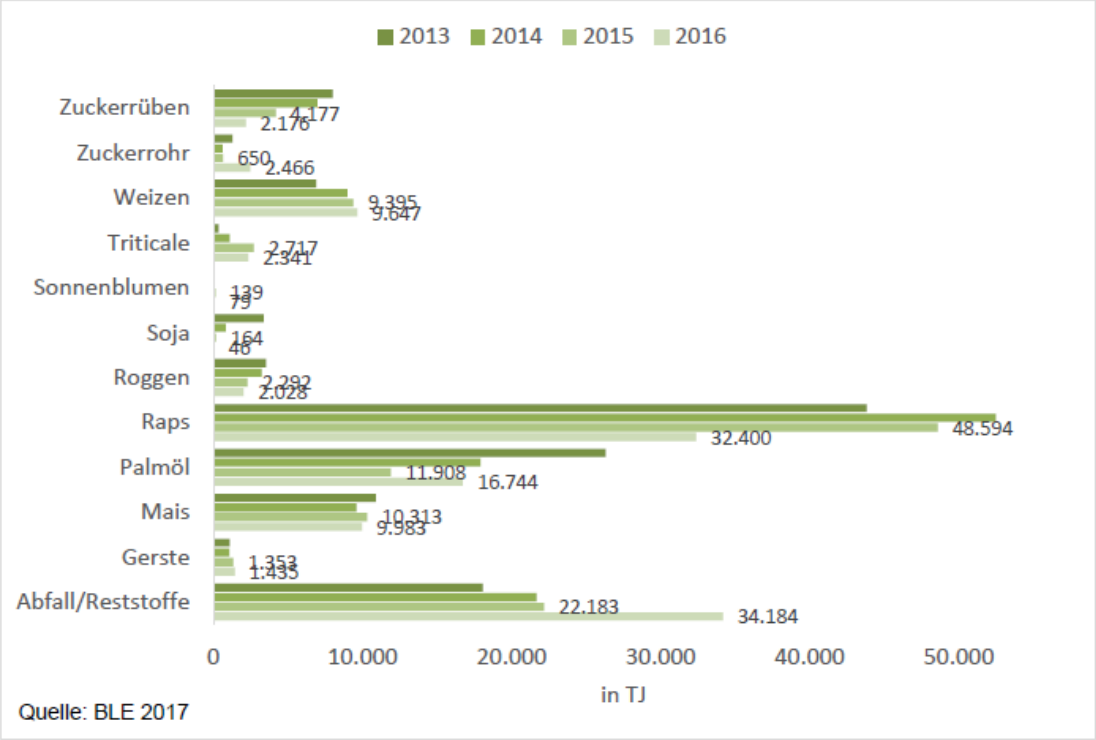
Biofuels

The amount of biofuels noted for inclusion in the quota obligation or tax relief at the BLE decreased up to 2014 as compared with previous years and in 2015 reached 113 884 TJ (BLE, 2016) and 113 527 TJ in 2016 (BLE, 2017) (see also Chapters 1 and 8). One significant reason for the continuing downward trend can be found in the change to the greenhouse gas (GHG) quota[79] and achievement of the goal by means of biofuels with a particularly high potential for GHG savings (BLE, 2016). Accordingly, changes in the raw material basis used for biofuels can also be seen. For example, in comparison to previous years, inter

[79] Up to the end of 2014, the key funding instrument for biofuels was the biofuel quota. Since 2015, instead of this quantity target in accordance with Section 37a BImSchG a GHG reduction target (‘GHG quota’) is applicable. Thus, since 2015, obligated parties must ensure that the GHG emissions from the fuels that they place in circulation (petrol, diesel and biofuels) in total are reduced by 3.5 % with respect to the fossil reference value.

alia the use of wastes and residues again increased slightly in 2015, and considerably in 2016. The use of rapeseed and sugar beet declined in Germany, however. In 2015, the use of palm oil decreased again but in 2016 followed the EU-wide trend of further increasing use of palm oil as a feedstock for production of biodiesel (Silhvonen, 2016). In Germany, the share of palm oil as feedstock for all types of biofuel rose from 10.5 % to 14.5 %. This corresponds to an increase of 41 %.

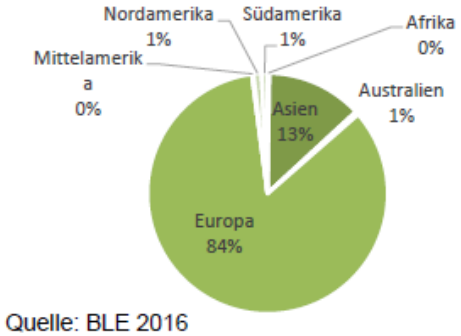
Figure 14.1: Feedstocks used for biofuels



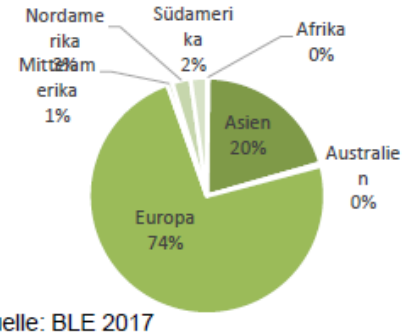
German	English
Zuckerrüben	Sugar beet
Zuckerrohr	Sugar cane
Weizen	Wheat
Triticale	Triticale
Sonnenblumen	Sunflower
Soja	Soya
Roggen	Rye
Raps	Rapeseed
Palmöl	Palm oil
Mais	Maize
Gerste	Barley
Abfall/Reststoffe	Waste/residues
in TJ	in TJ
Quelle: BLE 2017	Source: BLE, 2017

Since 2013, sustainability certificates also have to include information relating to the producer country. After a transition period, during which (partial) sustainability certificates[80] were still validated in Nabisy without referring to the origin, since 2015 it has been possible to indicate the assigned origin of all sustainability certificates so that the biomass cultivated in accordance with the requirements of the sustainability systems can be assigned to the relevant countries of origin without any gaps.

Figure 14.2: Origin by continents



Quelle: BLE 2016



Quelle: BLE 2017

German	English
Nordamerika	North America
Mittelamerika	Central America
Afrika	Africa
Südamerika	South America
Asien	Asia
Australien	Australia
Europa	Europe
Quelle: BLE 2016	Source: BLE, 2016
Quelle: BLE 2017	Source: BLE, 2017

The largest proportion of raw materials again came from Europe in 2015 (84 %) and 2016 (74 %), primarily from the EU (82 % and 72 %). Whilst the proportion in 2015 rose in comparison with the previous years, the absolute amount actually scarcely altered (97 490 TJ in 2014, 96 038 TJ in 2015); both the proportion and the absolute amount of biofuels based on biomass from Europe placed into circulation in Germany 2016 fell considerably to 83 636 TJ. With a proportion of 13 % in 2015 and 20 % in 2016, raw materials from Asia moreover made a crucial contribution to the provision of biofuels used in Germany. Compared to 2014, the amount of biofuels produced from feedstocks from Asia (palm oil and

[80] Partial sustainability certificates may arise in the course of the biofuel supply chain if the quantities of sustainable biofuels being traded are split or pooled based on demand. Sustainability certificates may be split or grouped together with others in order to document this process.

waste for biodiesel production) decreased by 29 % in 2015, but rose by 57 % in 2016 compared to 2015. The amounts of biofuels placed into circulation in Germany that were based on feedstocks from Australia decreased further (388 TJ in 2016), those based on feedstocks from North and South America decreased in 2015 but increased again in 2016 (2 876 TJ from North America and 2 515 TJ from South America in 2016). A slight increase was observed for raw materials from Central America and Africa but in each case this made up only a very small proportion of the total amount in 2015 and 2016 (BLE, 2017).

The rise in use of palm oil, as described above, as a feedstock for biofuels in 2016 after a decline in 2015 is reflected in the rise and fall of raw materials from Asia – 98 % of the palm oil for biofuels placed into circulation in Germany comes from Asia. In 2015 69 % and in 2016 93 % originated from Indonesia and 31 % and 7 % respectively from Malaysia. Indonesia therefore contributes the largest proportion of palm oil for energy purposes, with the associated known ecological and social problems relating to palm oil cultivation (Knoke and Inkermann, 2015). In 2015, the use of biofuels represented around 45 % of the amount of palm oil consumed in Germany (Hawighorst, 2016) and thus was around 15 percentage points below the EU average (2014a). However, the import of palm oil to Germany for a range of purposes (fuel and food sectors, chemicals industry and technical use) remained steady in 2015 and 2016 at 1.3 million tonnes each year (OVID, 2017). As only 15-79 % of the palm oil used in Germany in other sectors is certified as sustainable (Hawighorst, 2016) and in the main producer countries the proportion of oil used for energy purposes is only in single figures, the question must be raised as to whether the fluctuating demand in the fuel sector for palm oil that is certified as sustainable has a significant effect on the sustainable development of overall production. The assumption suggests that it is primarily the companies that are in any case able to comply with the requirements of the Sustainability Regulation that are endeavouring to obtain certificates.

The amount of soya used, which now comes solely from South America, has fallen in the reporting period with respect to 2014. Whilst the use of South American sugar cane fell in 2015, it increased six-fold in 2016, such that South America provided 50 % in 2015 and approx. 80 % in 2016 of the provision of sugar cane for biofuels placed into circulation in Germany. The countries of origin for South American sugar cane were primarily Peru and Brazil. The origin of sugar cane from Central America, in particular Guatemala and Costa Rica, rose to a total of 253 TJ in 2015 and 464 TJ in 2016.

Rapeseed from Australia recorded a sharp decline (by 82 % from 2014 to 2016). The use of rapeseed from Europe fell slightly in 2015 compared to 2014, and significantly in 2016. Rapeseed represented approx. 50 % and 38 % of all feedstocks originating from Europe in 2015 and 2016, respectively, of which approx. 65 % came from Germany, followed by France, the Czech Republic and Poland. The proportion of sugar beet in the feedstocks originating from Europe fell in 2014 to 2015 by 40 % and in 2016 still only represented approx. 3 %. The increase in maize from Europe in 2015 overcompensated for the reduction in maize from North America (in 2015 no amount was recorded) (BLE, 2016).

The further increase in the use of waste and residues as a feedstock for certified biofuels can be observed not only in Europe (17 711 TJ in 2015, 23 889 TJ in 2016), but also in particular in Asia (2 755 TJ in 2015, 6 641 TJ in 2016), North America (1 211 TJ in 2015, 2 876 TJ in 2016), South America (279 TJ in 2015, 467 TJ in 2016) and Africa (191 TJ in 2015, 252 TJ in 2016). The largest share of waste and residues from Africa in 2015 came from South Africa and consisted solely of biodiesel from used cooking oils (BLE, 2016). A similar picture emerged in 2015 for Asia, with Malaysia being the main country of origin for waste and residues, which for the most part were used cooking oils of plant origin. In total, 93 % of waste and residues were processed into biodiesel in 2015. In 2016, too, 95 % of waste and residues in the form of biodiesel were placed into circulation; in this case also it is to be assumed that used cooking oils were the basis. The second most common biofuel based on waste and residues was biomethane in the reporting period; in 2016 the feedstocks for this came solely from Germany. Further information on the type of waste and residues used to produce the biofuels that were certified as sustainable and placed into circulation in Germany can be found in Chapter 8. The secondary role of raw materials in accordance with Part A of Annex IX to Directive 2009/28/EC in comparison with used cooking oil is also striking.

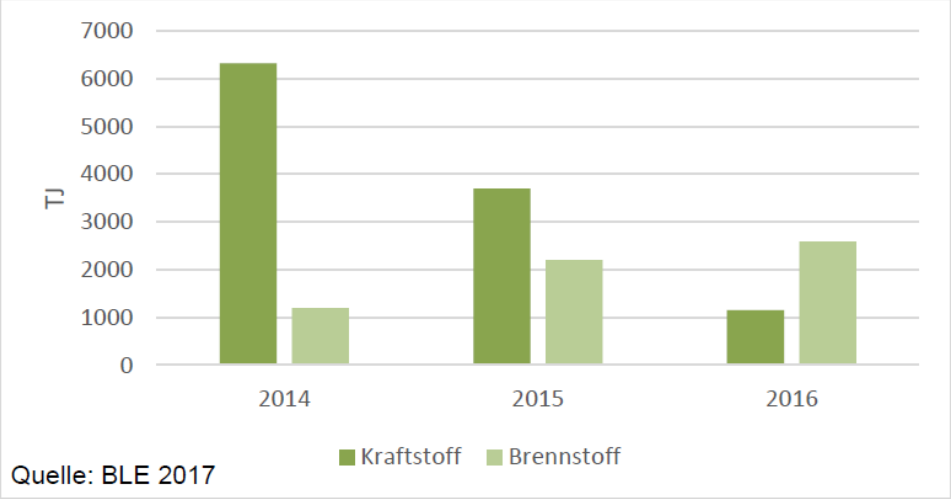
Combustible biofuels

In 2015, according to the BLE 32 994 TJ of biofuels for generation of electricity and feed-in were registered under the EEG; in 2016 the figure stood at 32 010 TJ. The most important type of biofuel in 2015 and 2016 remained biofuel from the pulp industry (thick waste liquor[81]) (88 %), followed by vegetable oil (12 %). Whilst the use of soya fell to zero and the use of rapeseed increased in 2015 and fell in 2016, the use of palm oil as a feedstock continued to increase significantly (3 069 TJ in 2015, 3 231 TJ in 2016). In particular the generation of

[81] In the energy statistics, thus also in Chapter 1, thick waste liquor is also recorded as solid biomass.

electricity from palm oil from Malaysia increased considerably (compared to 2014 by almost 85 % in 2015 and 117 % in 2016), whilst the use of Malaysian palm oil in the German biofuels sector, where the GHG quota has required the shift to raw materials with the lowest possible GHG emissions since 2015, decreased sharply (see Figure 14.3).

Figure 14.3: Use of palm oil from Malaysia as biofuel and combustible biofuel



German	English
Kraftstoff	Fuel
Brennstoff	Combustible fuel
Quelle: BLE 2017	Source: BLE, 2017

14.2.2 Sustainability aspects addressed by the Biomass Sustainability Regulations

Greenhouse gas emissions. Directive 2009/28/EC provides a defined method for calculating the GHG savings achieved through the use of biofuels promoted by quotas and tax breaks rather than fossil fuels (cf. Chapter 10), which are included in the Biomass Sustainability Regulations. This takes in direct greenhouse gas emissions from growing the raw materials and from transport and processing. Emissions resulting from land-use changes, insofar as they are the direct result of the cultivation of crops for the production of biofuels (or liquid energy sources), are also factored in using this method. As inadmissibly high GHG emissions resulting from direct changes in land use are already at the forefront of a certification for the exclusion of relevant areas, there is no information available about relevant changes in land use. Emissions that are due to global, regional and local relocation effects (indirect effects) are not included in the calculation methodology for the purpose of authorising a biofuel to be

counted towards the quota or for the payment of feed-in tariffs in the case of bioliquids (see 13.2.3). The effects in terms of climate protection therefore cannot be definitively assessed.

As a result of the transition from the quantity quotas to the minimum greenhouse gas reduction quotas in 2015, the significance of the method for calculation of the GHG reduction has increased greatly, as since then not only fulfilment of the minimum reduction of 35 % but also the calculated reduction per se is relevant (see 3.0.13). Reference was already made to the shift in raw material basis that has taken place since then towards those with higher GHG reduction potential (see 13.2.1). At the same time, the number of individual GHG calculations increased (BLE, 2016), as a result of which the complexity of ensuring control in relation to justified emissions calculations increases enormously.

On account of the GHG quota which only exists in Germany, the incentive here is great, to an above-average extent, to primarily use biofuels that were produced in particularly energy-efficient plants (often plants with reduced consumption of electricity and heat, optimised flow of materials, and in part using electricity and heat from biomass CHP plants) and based on raw materials associated with low GHG emissions (cf. also in this respect 13.2.1). Consequently, the biofuels placed into circulation in Germany are by no means typical of the biofuels used in Europe in terms of the level of GHG reduction. Since the introduction of the GHG quota, the calculated THG savings as a result of the biofuels placed into circulation in Germany have increased sharply, although it cannot be assumed that there is an equivalent significant change in the production of biofuels in Europe. For example, the average saving of biodiesel was 70.62 % in 2015 and 78.71 % in 2016 and the average saving of bioethanol was 70.73 % in 2015 and 75.44 % in 2016, and was thus considerably higher than in 2014 (50.65 % and 54.58 % respectively), the last year with the energy quota. The average values for 2015 and 2016 are thus already clearly higher than the minimum requirement of 50 % GHG savings that has existed since 1 January 2017.

In general, it should be noted that in particular in the case of biodiesel, due to the not as yet accurate accounting for methanol for the 2015 and 2016 reporting years, the GHG emission factor for the production, and thus also the total value, have proven to be too high. However, the European Commission has recognised this problem in the interim and implemented a number of relevant solutions (2017b). The high GHG saving in the case of bioethanol is among other things the result of CO_2 credits for the external use of biogenic CO_2 that is formed due to the process. As there are no clear accounting rules in this respect (2017b), it

cannot be ruled out that the substitution of conventional CO_2 will turn out too high.

The cultivation of substrates for the production of biofuels that is taking place in EU countries is typically not accounted itself but usually is accounted on the basis of the NUTS2 values in accordance with Article 19(2) of the Renewable Energies Directive. These are based on input values for the years 2006-2010 and thus do not correspond to the state of the art. At present, the extent to which the base data is up-to-date and an alternative method of calculating the nitrous oxide emissions may lead to different results cannot be definitively estimated and requires more detailed analysis.

The BLE furthermore indicates that the quantities of goods that were booked in 2015 and 2016 to the accounts of other Member States had lower emissions savings (BLE, 2016; BLE, 2017), which also here raises the issue of distribution effects or the effective change in the overall emissions reduction in the use of biofuels in Europe and worldwide.

Conservation areas. The Biomass Sustainability Regulations contain requirements to protect areas of great importance to biodiversity,[82] to protect areas with high stocks of carbon[83] and to protect peat bogs. If the certification is applied effectively and the areas are properly defined, it will largely prevent the direct conversion of recognised conservation areas to be used to produce biofuels and bioliquids. Highly biodiverse grassland was first defined by the Commission in December 2014 and was applicable from 1 October 2015[84]. In the meantime, three voluntary certification schemes were granted 'partial recognition', which expressly excludes the protection of highly biodiverse grassland (2016a). Even though no reason exists any longer for the granting of partial recognitions as the definition of highly biodiverse grassland now exists, the assessment of grassland status still presents a challenge for auditors. In a letter to the voluntary schemes, the Commission states that independent experts are necessary for this (2015a). However, this letter does not correspond to any legally binding requirement. The verification of properly defined areas remains an important condition for compliance with this sustainability criterion for all conservation areas.

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[82] Areas of great importance to biodiversity within the meaning of the regulations are a) primary forests and undisturbed forests, b) nature conservation areas, and c) highly biodiverse grassland.

[83] Areas with high stocks of carbon within the meaning of the regulations are a) wetlands and b) continuously forested areas (> 1 ha and with trees over 5 m high).

[84] Commission Regulation (EU) No 1307/2014 of 8 December 2014 on defining the criteria and geographic ranges of highly biodiverse grassland for the purposes of Article 7b(3)(c) of Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels and Article 17(3)(c) of Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources.

Agricultural operations within the EU. To address any negative impact from agricultural activities on arable land, particularly more intensive cultivation, the Biomass Sustainability Regulations reference the rules on direct payments under the common agricultural policy and the minimum requirements for good agricultural and ecological conditions for land in the Member States of the European Union (cross-compliance). Evidence of compliance must be provided by documentation of agricultural aid received. Other requirements or additional checks in relation to the on-the-spot checks performed each year on approx. 1 % of application (BMEL, 2017) are not the subject of the Biomass Sustainability Regulations.

14.2.3 Sustainability aspects not addressed by the Biomass Sustainability Regulations

Indirect effects. The production of biofuels and bioliquids does not only have a direct effect on the land cultivated for the raw materials. Rather, this concrete demand element is one factor among many that influence global land use as a whole. Hence, even if the sustainability requirements are met, the production of biofuels and bioliquids may still lead indirectly to changes of land use through displacement effects and the associated emissions, ploughing-up of conservation areas, drainage of marshland, etc. The risks of indirect land use changes (iLUC) have been widely discussed among large sections of the professional public and at different political levels for a number of years. With the amendments made to Directives 98/70/EC and 2009/28/EC, various reporting obligations have been introduced in relation to iLUC. In the future, when reporting the GHG emissions per energy unit, among other things, fuel providers will also take into consideration the average preliminary estimates as a consequence of iLUC. In its last progress report 'Renewable Energy Sources', by way of reporting on the targeted GHG emissions savings, the European Commission also referred to the average preliminary estimates in relation to iLUC in Annex VIII to Directive 2009/28/EC. In conclusion, the GHG savings caused by biofuels as reported by the Member States for 2015 decreased between 40 % and 80 % (2017a). In order to limit the indirect effects, an amendment to the Fuel Quality Directive and the Renewable Energy Directive was adopted at EU level in accordance with the precautionary principle in the form of Directive (EU) 2015/1513. By means of the 38th BImSchV[85], a draft of which was published in September 2016, the relevant provisions should be transposed into German law. In order to limit iLUC, the draft from July 2017

[85] Draft bill of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety on the Thirty-eighth Regulation implementing the Federal Emissions Control Act (Regulation laying down further provisions for the reduction of greenhouse gases in fuels – 38th BImSchV).

provides an upper limit for conventional biofuels of 6.5 % (energy purposes) and, from 2020, a minimum share of advanced biofuels (0.05 % in 2020 up to 0.5 % in 2025). However, it should be taken into consideration that advanced biofuels are also only free from indirect effects if the materials are waste in the proper sense and other uses are not being displaced, due to the production of biofuels, and switching to raw materials with higher environmental costs again (Searle, Pavlenko et al., 2017). These kinds of indirect effects are also not addressed by the Biomass Sustainability regulations.

Effects on food prices. Fluctuations in global and local food prices are caused by a complex set of factors. This high degree of complexity makes it hard to quantify exactly the effect of producing the biofuels and bioliquids on global and local food prices and hence on food security. According to estimates from the European Commission of the effects on food prices, the demand for biofuel in the EU had a global price effect of 1–2 % for cereals (bioethanol) in the period 2010/2011 and 4 % for rapeseed, soya and palm oil (biodiesel) in the years 2008 and 2010 (2013; 2015b). A meta investigation of a range of research on this subject clearly shows that there is a demonstrable effect on food prices through the cultivation of raw materials for the production of biofuels, even though it is difficult to quantify the effect with a relatively high level of certainty (2014b, Bentivoglio and Rasetti, 2015).

Respect for land use rights. Various publications make a connection between the growing need for biomass, some of it for energy-related use, and so-called *land grabbing*. Ethical concerns are raised by the oft-documented expulsion of the rural population who have been cultivating the land but do not possess any rights of use (Goeser, 2011). The huge socio-economic risk associated with such transactions, particularly in developing countries, thus lies in the withdrawal of access to land, water and other natural resources from the local population, which in turn increases the risk of famine and poverty (Ecofys, ISI et al. 2012; Colchester, Chao et al. 2013). With the current state of the data, direct and quantifiable connections between the global phenomenon of ‘land grabbing’ and promotion of biofuels and bioliquids in Germany and in the EU are hard to identify, but there are numerous references to land grabbing in connection with the production of raw materials for biofuels (Nolte, Ostermeier et al., 2014; Oxfam, 2016). According to data from the Land Matrix Global Observatory, by 2016 at least 21 % of all recorded international land acquisitions were made in the context of biofuel projects, primarily in Brazil, Indonesia and Africa (Nolte, Ostermeier et al., 2014). The European Commission regularly commissions studies to investigate the socio-economic problems of biofuel production in the countries where cultivation takes place. On the issue of illegal land grabbing, the

study refers to the considerable difficulties involved in providing consistent and robust evidence of this issue. The methodological problems involved in assigning and conferring a legal status to land are a factor here, and both the availability of reliable data and uncertainties when it comes to identifying the land affected mean that the extent of illegal land grabbing can only be proven with numerous uncertainties. The study concludes that between 60 000 and 600 000 ha of land grabs may be linked to the promotion of biofuel in the EU (Ecofys, 2014). Another study from 2013 identified a total area of 180 000 ha worldwide which might have been subject to illegal land grabbing under European biofuel policy (Ecofys, 2013). It should be noted, however, that these are just the areas acquired directly for the production of biofuels and bioliquids for the European market. The effect triggered by the additional pressure on the land is not included. As large-scale land grabs are a real and relevant problem fraught with serious consequences and high socio-economic risk, and given the lack of transparency, unsatisfactory data and numerous documented cases of displacement, there would appear to be a need for further research.

Labour rights and child labour. Based on the available data, it is impossible to make any specific statement on the impact of the demand for raw materials to satisfy Germany's need for biofuels and bioliquids on the situation in the countries that provide these raw materials. At the EU level, a report has been presented on compliance with eight international Conventions adopted by the International Labour Organization (ILO)[86] in the main exporting countries (Ecofys, International et al., 2013). The report presented to the European Commission finds that there has been no significant change with regard to ratification of the Conventions on workers' rights in the main exporting countries in the last few years. The vast majority of the countries that export biofuels and bioliquids to the EU have ratified the fundamental Conventions, but enforcement is weak, especially in developing and emerging countries. Although the European Commission's most recent study on the sustainability of bioenergy (2016b) does refer to the fact that use of voluntary systems could also have indirect positive social effects, such as protection of workers, only one of the four systems audited by the European Court of Auditors included a review of socio-economic effects, such as respect for labour rights (2016a).

Agricultural operations outside the EU. Imports of biofuels and bioliquids from outside Europe are not covered by the requirements of European agricultural

[86] Conventions on: Forced or Compulsory Labour (No 29), Freedom of Association and Protection of the Right to Organise (No 87), Application of the Principles of the Right to Organise and to Bargain Collectively (No 98), Equal Remuneration of Men and Women Workers for Work of Equal Value (No 100), Abolition of Forced Labour (No 105), Discrimination in Respect of Employment and Occupation (No 111), Minimum Age for Admission to Employment (No 138), Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour (No 182).

policy. This applied to around 16 % of raw materials in 2015, 24 % in 2016, the majority of which was made up of raw materials with high ecological risks associated with cultivation, such as palm oil, sugar cane, soya and maize. The environmental acceptability of cultivating these raw materials therefore depends mainly on the farming rules and agricultural practices in place in the exporting country and on the specific requirements of the relevant certification system for the agricultural cultivation systems.[87]

The Federal Government plays a part in various international bodies addressing known sustainability problems with biofuels and bioenergy as a whole. This particularly includes the Global Bioenergy Partnership (GBEP). Germany's contribution focuses particularly on developing skills and applying a set of sustainability indicators developed by the GBEP[88] in the individual countries. Through its 23 member countries, 14 international partner organisations and 40 observers (countries and organisations), the partnership mainly addresses the level of country-specific political planning for sustainable bioenergy production.

14.2.4 Is the use of bioliquids to generate electricity and the use of biofuels socially acceptable?

Crucial to determining whether the use of biofuels and bioliquids is defensible from a socio-ethical standpoint is a judgment of the risks and benefits for present and future generations that are associated with this use. If biofuels and bioliquids are manufactured from raw materials produced in the EU, it must be assumed that the social requirements for those directly concerned have been met. Other benefits and risks to be considered here are particularly the effects on food and water supplies in endangered countries or vulnerable regions, combating poverty by generating additional income, rural development, jobs, displacing traditional uses of the land (e.g. by expanding areas under cultivation), and the external effects of more intensive production.

The nature, scale and likelihood of the risks and benefits associated with the use of such fuels are heavily dependent on the raw materials used, the scale on which they are used and the context surrounding this use. This includes the regulations applicable to land use and the protection of traditional rights to the land in the countries of origin, and also changes in per capita resource usage and interaction with other sectors of demand (see 13.2). Where biomass is

[87] As most EU certification systems recognise sustainability certificates from participants in other EU certification systems, all or part of the upstream chain may be certified by different systems than the end-product.

[88] Eight indicators for each of the three pillars -environmental, social and economic - with descriptors and a full account of the methods used; see http://www.globalbioenergy.org/programmeofwork/task-force-on-sustainability/gbep-report-on-sustainability-indicators-for-bioenergy/en/.

grown for energy-related use, particularly in some third countries, the established sustainability certification in the EU cannot currently prevent the potential social risks from occurring. Similarly, the benefits are not certain to come out of EU provisions. Indirect effects in particular pose diverse and potentially high risks from the use of biofuels and bioliquids based on an increase in biomass from agricultural production. These arguments support the increased use of residues and waste materials to generate biofuels as envisaged in the amended Renewable Energy Directive 2009/28/EC and the Fuel Quality Directive 98/70/EC, in particular through the introduction of an upper limit for ‘conventional’ biofuels (see also 13.2.3 in this respect).

15 ANNEX

15.1. List of abbreviations

ACER: European Agency for the Cooperation of Energy Regulators

AIB: Association of Issuing Bodies

APEE: Energy Efficiency Incentive Programme

EEZ: Exclusive Economic Zone *[ausschliessliche Wirtschaftszone – AWZ]*

BAFA: Federal Office of Economic Affairs and Export Control *[Bundesamt für Wirtschaft und Ausfuhrkontrolle]*

BauBG: Federal Building Code *[Baugesetzbuch]*

BauNVO: Regulation on Land Use *[Baunutzungsverordnung]*

BBPlG: Federal Requirements Plan Act *[Bundesbedarfsplangesetz]*

BImschG: Federal Emissions Control Act *[Bundesimmissionsschutzgesetz]*

BImschV: Federal Emissions Control Regulation *[Bundesimmissionsschutzverordnung]*

Biokraft-NachV: Biofuel Sustainability Regulation *[Biokraftstoff-Nachhaltigkeitsverordnung]*

BiokraftQuG: Biofuel Quota Act *[Biokraftstoffquotengesetz]*

BiomasseV: Biomass Regulation *[Biomasseverordnung]*

BioSt-NachV: Biomass Electricity Sustainability Regulation *[Biomassestrom-Nachhaltigkeitsverordnung]*

BMU: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety *[Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit]*

BMUB: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety *[Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit]*

BMVI: Federal Ministry for Transport and Digital Infrastructure *[Bundesministerium für Verkehr und digitale Infrastruktur]*

BMWi: Federal Ministry for Economic Affairs and Energy *[Bundesministerium für Wirtschaft und Energie]*

BNetzA: Federal Network Agency *[Bundesnetzagentur]*

BtL: Biomass-to-Liquid

EAG EE: Act on the implementation of Directive 2009/28/EC on the promotion of the use of energy from renewable sources *[Europarechtsanpassungsgesetz Erneuerbare Energien]*

EE: Renewable energy *[Erneuerbare Energie]*

EEG: Renewable Energies Act *[Erneuerbare-Energien-Gesetz]*

FCE: Final consumption of energy *[Endenergieverbrauch – EEV]*

EEWärmeG: Renewable Energies Heat Act *[Erneuerbare-Energien-Wärmegesetz]*

EKFG-AndG: Act (amending the Act) to establish a special Energy and Climate Fund *[Gesetz (zur Änderung des Gesetzes) zur Errichtung eines Sondervermögens 'Energie- und Klimafonds']*

EmoG: Electro-Mobility Act *[Elektromobilitätsgesetz]*

EnEV: Energy Saving Regulation *[Energieeinsparverordnung]*

EnLAG: Energy Line Expansion Act *[Energieleitungsbaugesetz]*

EnLBRÄndG: Act to Amend Provisions of the Law on Construction of Energy Lines *[Gesetz zur Änderung von Bestimmungen des Rechts des Energieleitungsbaus]*

ENTSO-E: European Network of Transmission System Operators for Electricity

EnVKG: Energy Consumption Labelling Act *[Energieverbrauchskennzeichnungs-gesetz]*

EnWG: Energy Management Act *[Energiewirtschaftsgesetz]*

ESG: Energy Efficiency Strategy for Buildings *[Energieeffizienzstrategie Gebäude]*

R&D: Research and Development

R&I: Research and Innovation

FA Wind: Expert Agency for Wind Energy *[Fachagentur Windenergie]*

GasNZV: Gas Network Access Regulation *[Gasnetzzugangsverordnung]*

GEEV: Cross-Border Renewable Energies Regulation *[Grenzüberschreitende-Erneuerbare-Energien-Verordnung]*

GGEMO: Joint Agency for Electro-Mobility *[Gemeinsame Geschäftsstelle Elektromobilität]*

HVDC: High-voltage direct-current transmission *[Hochspannungs-Gleichstrom-Übertragung – HGÜ]*

HKNR: Guarantee of origin register *[Herkunftsnachweisregister]*

KfW: Reconstruction Loan Corporation *[Kreditanstalt für Wiederaufbau]*

kW_{el}: Electrical power in kilowatts

CHP: Cogeneration (combined heat and power) *[Kraft-Wärme-Kopplung – KWK]*

KWKG: Cogeneration Act *[Kraft-Wärme-Kopplungsgesetz]*

kW_{th}: Thermal power in kilowatts

MAP: Market incentive programme for promoting the use of renewable energies in the heating market *[Marktanreizprogramm zur Förderung erneuerbarer Energien im Wärmemarkt]*

MaStR: Register of market master data *[Marktstammdatenregister]*

MaStRV: Regulation on a register of market master data *[Marktstammdaten-registerverordnung]*

NABEG: Grid Expansion Acceleration Act *[Netzausbaubeschleunigungsgesetz]*

NAPE: National Action Plan on Energy Efficiency *[Nationaler Aktionsplan für Energieeffizienz]*

NawaRo: Sustainable raw materials *[nachwachsende Rohstoffe]*

NEP: Network Development Plan *[Netzentwicklungsplan]*

NOVA: Network Optimisation before Enhancement before Expansion *[Netz-Optimierung vor Verstärkung vor Ausbau]*

NPE: National Platform for Electro-Mobility *[nationale Plattform Elektromobilität]*

NREAP: National Renewable Energy Action Plan

O-NEP: Offshore Network Development Plan *[Netzentwicklungsplan Offshore]*

OWP: Offshore wind farm *[Offshore Windpark]*

PCI: Projects of common interest

PV: Photovoltaic

OE: Oil equivalent

SysStabV: System Stability Regulation *[Systemstabilitätsverordnung]*

Strom-NZV: Electricity Network Access Regulation *[Stromnetzzugangs-verordnung]*

t_{FM}: Tonnes fresh mass

GHG: Greenhouse gas *[Treibhausgas –THG]*

TYNDP: Ten-Year Network Development Plan

UBA: Federal Environment Agency *[Umweltbundesamt]*

UCO: Used cooking oil

TSO: Transmission system operator *[Übertragungsnetzbetreiber – ÜNB]*

WindSeeG: Offshore Wind Energy Act *[Windenergie-auf-See-Gesetz]*

15.2 Lists of figures and tables

List of figures

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Tables in accordance with the European Commission template

Additional tables

15.3 References

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