Analysis of the German Federal Government's National Renewable Energy Action Plan

Short study for the Green European Foundation

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1 Introduction

Within the framework of its energy and climate policy, the EU has committed to reducing its greenhouse gas emissions by 20 percent compared to 1990 levels and to an increase in the share of renewable energies to 20 percent of total energy consumption – both by 2020 ("20 - 20 by 2020"). In its climate and energy package the EU has partially separated these overall targets into individual targets for each of the member states. In the area of renewable energy, the EU directive 2009/28/EG (hereafter referred to as RED) has set a target for Germany of 18 percent. The specific measures and targets to be adopted in each individual area (electricity, heating/cooling, transport) in order to achieve the overall target is – with the exception of the transport sector – left to the discretion of the German government. However, every Member State must outline their sectoral targets and objectives, as well as the proposed measures to achieve these targets, in a national action plan for renewable energy according to a template provided by the European Commission. These action plans, with a submission deadline of 30th June 2010, not only provide the European Commission with a tool to evaluate the implementation measures prescribed by the Member States but also represent a "roadmap" for every Member State that is of great interest to stakeholders (Howes 2010).

The time frame of the action plans is limited to the national targets up to 2020. Nevertheless, a course must also be set within this time frame for the restructuring measures necessary to achieve a low carbon economy and society by 2050. According to the EU's agreed negotiating position for the climate summit in Copenhagen, the industrialised countries must reduce their greenhouse gas emissions by 80 to 95 percent by the middle of the century. The majority of experts assume that this will only be possible if the supply of electricity is completely or almost completely decarbonised (Kirchner, Matthes 2009; SRU 2010, ECF 2010). This restructuring process will also require an increasing level of cooperation among the EU Member States. Therefore, this study examines firstly, to what extent the German action plan affects the long-term composition of the electricity sector and secondly, to what extent the plan makes full use of the potential for European cooperation up to 2020 and beyond. The analysis of the action plan is supplemented by proposals for exemplary measures that could enable both of these aspects to be (better) accommodated.

The subject of this study is the "National Action Plan for Renewable Energies" from 4 August 2010. In addition, reference is also be made to the German federal government's "Energy Concept" from 28 September 2010. Most of the Energy Concept's ideas are not reflected in the Action Plan because the Concept was still under preparation when the Action Plan was adopted. However its content is highly pertinent to the issues under consideration in this study.

Overview of the German action plan

1.1 Measures for the electricity sector

The centrepiece of the measures introduced for achieving the required renewable energy targets within the electricity sector is the Renewable Energy Sources Act (EEG). This law, which has been in force since 2000, guarantees facilities generating electricity from renewable energy immediate and priority connection to the electrical grid and obligates grid operators to purchase, transmit and distribute the renewably-produced electricity. In addition, the EEG sets technology specific tariffs to be paid by grid operators for the regenerative electricity fed into the grid over a period of 20 years, including the year in which the facility is commissioned. These feed-in tariffs are based on the costs of generating the electricity so that any costs incurred by investors are covered. Every year the tariffs are reduced by a previously determined rate (degression). The EEG also prescribes that the costs incurred for the required optimisation and strengthening of the electricity network are to be carried by the network operators. The costs borne by these operators in the expansion of the network and for the feed-in tariffs are to be spread across the electricity consumers. This instrument is, therefore, independent of the public budget. In the national action plan, the federal government announced that this law will be revised in 2012, following previous amendments in 2004 and 2009. The law is to be revised at least every four years in the future in order to adapt the level of support to the market situation and technological developments. The basis for these revisions will be the EEG progress reports.

As part of the 2009 EEG revision, the federal government also implemented the requirements contained within the EU's renewable energy directive that serves to ensure the sustainability of biofuels and bioliquids. In the electricity sector, the ordinance on sustainability of biomass-based electricity (Biomassestrom-Nachhaltigkeitsverordnung) was issued to comply with this requirement.

In addition to the EEG, the national action plan announces a series of other instruments that are meant to help achieve the targets set in the RED. These include:

- Low-interest loans from the state-owned KfW (Kreditanstalt für Wiederaufbau) development bank, which are issued within the framework of the "Renewable Energy" development programme;
- The National Climate Initiative, comprising a variety of information and promotion measures for improving energy efficiency and for the development of renewable energy across the board;
- The EnWG (Energiewirtschaftsgesetz) energy market law that establishes a framework for the development of the electricity and gas networks, as well as the relevant market regulations;
- The EnLAG (Gesetz zum Ausbau von Energieleitungen) law for the development of power lines, which is designed to help accelerate power grid extension by identifying urgent requirements for individual power lines. It also establishes a pilot scheme for laying underground cables as an alternative to overhead power lines.

Alongside the financial incentives and regulations included in the EEG and the EnWG, regional planning laws obligate the federal and state governments to encourage environmentally-friendly energy provision and energy network development, particularly the development of renewable energy sources. However, planning and approval of projects is under the jurisdiction of local authorities or individual states.

All of the measures listed above are already in force. Apart from regular monitoring and further adjustment of these instruments, particularly the EEG, the action plan does not contain any proposals for new measures.

1.2 To what extent does the action plan propose measures for cooperation on a European scale or cooperation with Germany's neighbouring countries?

The federal government declared in the action plan that Germany will not only achieve its national target for 2020 without exploiting the flexible cooperation mechanisms (Art. 6-12 RED) but is also expected to exceed them. Nevertheless, it confirms Germany's interest in common projects and its willingness, in principle, to participate in them. In particular, Germany could transfer the surplus levels above and beyond the indicative targets in the years 2011-2019 to other Member States through the flexible cooperation mechanisms. In principle, it is also possible to tap into the additional potential of common projects.

According to its own statements, the federal government is still investigating opportunities for carrying out common projects within Germany or for German participation in other Member States. There are plans to publish a guide on utilising the flexible cooperation mechanisms and to set up an information agency for answering enquiries on the subject. In addition, the action plan points out that Germany has already conducted two international workshops about the cooperation mechanisms and will continue to support further exchanges between Member States. One example is the IEA "Concerted Action" project for the implementation of the 2009/28/EG directive where Germany serves as the co-chair of the working group on flexible cooperation mechanisms. According to the draft European Law Alignment Act for Renewable Energy (Europarechtsanpassungsgesetz Erneuerbare Energien - scheduled for December 2010), the implementation of flexible cooperation mechanisms will be postponed until the issues raised in this process have been conclusively clarified.

Regarding electricity infrastructure upgrading (Art. 16 RED), the federal government indicates that the expansion of joint capacities with neighbouring countries is planned and will be included in a variety of documents (Transmission Development Plan of the ENTSO-E, EnLAG, TEN-E guidelines). In its energy concept, the federal government confirms its commitment to supporting the setting up and development of a European-wide electricity grid and proposes a series of measures to achieve this goal. Amongst other things, the government - together with other countries on the North Sea – is pursuing the idea of an offshore grid in the North Sea.

The energy concept assumes that Germany will import a considerable proportion of its electricity supply from renewable sources in the long term, for example, from solar thermal power plants in North Africa. The responsible Ministries will formulate an overall strategy for the EU's Mediterranean region solar plan for this purpose and also identify, in particular, the necessary framework conditions for the implementation of the "Desertec" concept. According to the energy concept, the federal government seeks to harmonise the promotion of renewably-produced electricity with the exploitation potential of the various RE technologies and at the same time to further develop this economic sector in Germany. On this basis and building on the experiences gained through the implementation of the flexible cooperation mechanisms contained in the RED, the federal government plans to investigate the extent to which promotion systems for renewable energy can be further coordinated and harmonised among more Member States.

1.3 To what extent are measures proposed to enable the restructuring of the electricity sector to such an extent that all electricity can be supplied using renewable energies?

Although the measures in the action plan naturally refer to the fulfilment of the targets for 2020, the federal government is also committed to continuing implementation of the existing instruments for renewable energy development – particularly the EEG – beyond 2020. In order to sustain the previously observed growth in renewable energy within the electricity sector, it is crucial that the rule for priority access contained in the EEG be "maintained over a longer period". The feed-in tariffs for the individual technologies should also be maintained – in an adapted form – until these technologies become competitive without financial support

and the assistance provided by the EEG can be gradually removed. In this respect, the federal government clearly signals its intention to promote the development of renewable energy in the electricity sector above and beyond 2020.

It can be assumed that financial incentives and the priority access rule will not be sufficient on their own to achieve the complete restructuring of the electricity system. A decisive factor is also the expansion and restructuring of the electricity grid not only does the physical infrastructure need to be adapted but new regulations must also be introduced in the electricity market in order to account for the much more decentralised and volatile supply of electricity in the future.

The action plan lists a number of instruments that will at the very least prepare the way for the technical restructuring of the electricity grid. These include:

- The EEG ordinance for system services by wind energy installations (SDLWindV), which stipulates that wind turbines have to contribute to maintaining grid stability;
- The ordinance for offshore power plants in German territorial waters, which regulates the planning process for offshore wind power plants in the exclusive economic zone (EEZ);
- The National Development Plan for Electric Mobility which provides research funding for the further development of electric vehicles and funding for establishing the necessary infrastructure. The target is the registration of one million electric vehicles (including hybrid vehicles) by 2020;
- The research project “E-Energy – Smart grids made in Germany” (E-Energy – IKT-basiertes Energiesystem der Zukunft) for the promotion of pilot projects, which is designed to investigate the development of smart grid technologies in practice.

All of the measures named above have already been approved and are currently being implemented. However, the action plan contains hardly any mention of further additional measures planned by the federal government to pave the way for the restructuring of the electricity system, allowing 100 percent use of renewable energy. An exception is the government’s intention to utilise innovative technologies, e.g. solar thermal power plants or offshore parks, within the framework of European cooperation projects.

One reason for this reluctance to propose new measures is certainly the fact that the federal government had been working on its energy concept for the time period up to 2050 in parallel to the action plan – the results of which were not able to flow directly into the action plan itself.

In contrast to the action plan, the energy concept – approved by the federal cabinet on 28 September 2010 – contains a series of proposed measures whose goal is to restructure the electricity sector in such a way that electricity can be generated – at least predominantly – from renewable sources. According to the energy concept, the federal government aims to cover 80 percent of gross electricity production with renewable sources by 2050.

In order to achieve this goal, a variety of measures are sketched out in the energy concept that are designed to address the following challenges:

- The expansion of wind energy (offshore and onshore) through a KfW funding programme, potentially supplemented by loan guarantees as well as by adapting the approval process to counteract any backlogs in the issuing of approvals.
- Promoting the sustainable use and generation of bioenergy through considering the expansion of the existing sustainability criteria and potentially making them more rigorous, promotion of second-generation biofuels and exploitation of the potential of waste materials.
- Ensuring the cost-efficient development of electricity generation from renewable energy through further development of the EEG, examination of the bonus payment

system[1] and an investigation of the promotion of offshore wind energy plants by tender;

- Ensuring strong demand-oriented generation and utilisation of renewable energies through the further development of consumption regulations in the EEG. This measure seeks to ease the burden on the grid by revising metering regulations (MessZV) to create the conditions required for the nationwide use of smart meters, and to improve the conditions for load management;
- Better integration of renewable energy into the energy system by considering a market premium concept in order to encourage renewable electricity producers to trade their product on the open energy market; accelerating the development of the network at both the German and European level, including the North Sea network; increasing the acceptance of grid expansions; extending energy storage capacities; and integrating renewable energy into the load management and reserve energy markets (particularly biogas plants).

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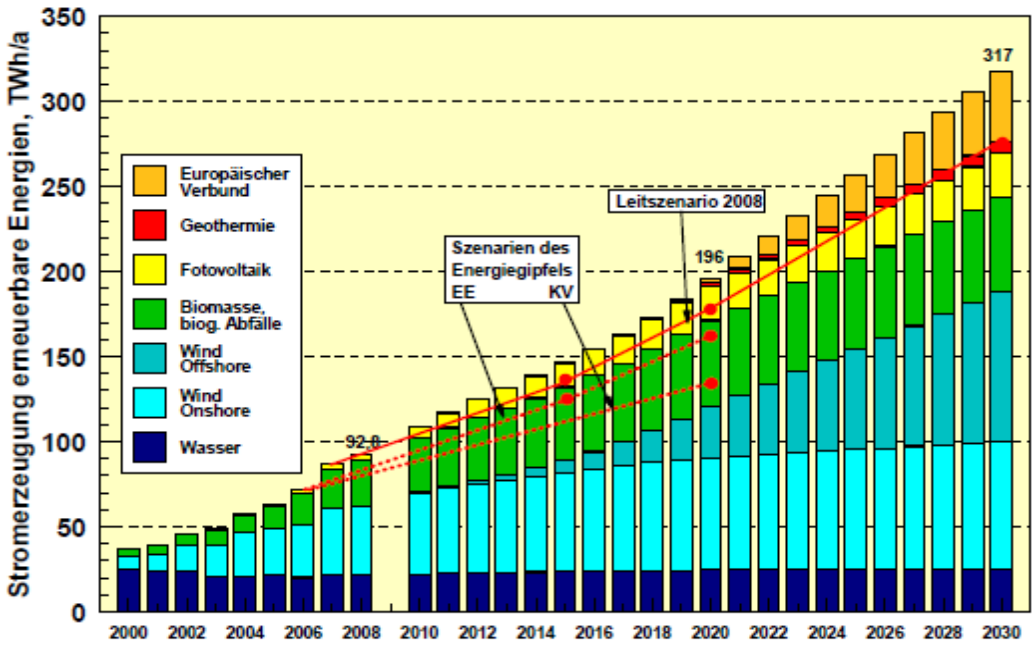
Analysis

1.4 Are the proposed measures sufficient to achieve the targets set for 2020?

The action plan anticipates that Germany will achieve its target of 18 percent by 2020 and – provided additional efficiency measures are realised – even exceed this level by 1.6 percent. In the electricity sector, the share contributed by renewable energy would then be between 35 and 38 percent – depending on the success of the efficiency improvements. Questions have been raised, particularly regarding heating and cooling, as to whether the instruments announced up to now will be sufficient to meet the targets. However, the likelihood of achieving the renewable energy targets in the electricity sector can be classified as highly probable. The prerequisites for achieving these targets are the retention of the fundamental principles of the EEG – meaning that neither the priority access rule nor the cost-covering feed-in tariffs are abolished – and the continuation of the accompanying measures for grid expansion and planning regulation improvement.

Since the introduction of the EEG in 2000, electricity generation from renewable energy sources has more than doubled and the current trend indicates this rate may continue (see Figure 1). It has been possible up to now to achieve the development targets before the relevant target years. Should there be, contrary to expectations, a weakening in these developments then regular examination and revision of the laws and regulations will provide the opportunity for necessary readjustment. This ability to adjust the framework has been put into practice in the past, for example, to provide greater impetus for the installation of offshore wind plants. The target of increasing the share of electricity produced by renewable energy to at least 30 percent by 2020 and to continually increase this figure in subsequent years is stipulated in article 1, paragraph 2 of the EEG.

Figure 1: Development of electricity production through renewable energies according to the reference scenario published in 2009



Source: Nitsch, Wenzel 2009, P. 38.

Several studies confirm the feasibility of the federal government's planned development path for renewable energy in the electricity sector (Nitsch 2009, Kirchner and Matthes 2009). Sector associations even anticipate that more rapid development is possible, with renewable energy able to cover 47 percent of the total demand for electricity by 2020 (BEE 2009). In

contrast, a study from the research institutes IER, RWI and ZEW forecasts that the share of electricity production produced from renewable sources will reach 27 percent in 2020 (Fahl, Frondel, Löschel etc. 2010). In comparison to the reference scenario described above, the authors of the study anticipate a slightly lower rate of increase in the use of renewable energy. However, the main reason why the target will not be met in this scenario, is the assumed increase in the consumption of electricity: While the reference scenario assumes a slight decrease in gross electricity consumption in comparison to 2007, the study from the IER, RWI and ZEW forecasts an increase of 6 percent in the period between 2007 and 2020. This comparison underlines the importance of efficiency and energy saving measures for the achievement of renewable energy targets.

Bottlenecks in achieving these targets will most likely occur in grid expansion and in the construction of offshore wind power plants (see section 3.2 of this report). Bottlenecks in the development of the electricity grid are not only to be expected in the area of high-voltage and extra high-voltage power lines, but in regional distribution networks at low and medium voltage levels due to the growing number of photovoltaic systems.

There has also been public debate, related to the federal government's energy concept, over the effects an extension to the lifespan of Germany's nuclear power plants by an average of twelve years will have on investment in renewable energy. Renewable energy sector associations and environmental groups argue that an extension in the lifespan of these nuclear plants will cement the power of the four large energy providers[2] as well as deterring public utilities and other smaller investors from investing in renewable energy, cogeneration plants and gas power plants. Another concern is that a larger share of renewably-produced electricity generation does not mix well with increasing reliance on nuclear power plants. The technical ability to start-up and shut-down nuclear plants is limited and is accompanied by high costs, thereby building inflexibility into the electrical grid which would make further utilisation of renewable energy difficult. Several cases in which short term negative prices for surplus electricity developed at the Leipzig power exchange underline the importance of these problems. However, it should be noted that the development of renewable energy will still primarily be driven by the EEG. As long as the priority access and feed-in tariffs are preserved, it can be assumed that the dynamics for expansion in this sector will also be maintained. Therefore, it is imperative that the resulting challenges of grid integration, electricity savings and energy fluctuations be tackled swiftly. It is also important in this context that the German population accept and support the EEG even if the EEG levies increase.

1.5 Is the distribution between the different sources of renewable energy for the achievement of the targets set for 2020 appropriate and sensible? Are all sources treated equally?

The central instrument for the development of electricity provision through renewable energies is the EEG, which was revised in 2009. This law is designed to support the use of all renewable energy technologies. The levels of the feed-in tariffs for the electricity fed into the grid are individually determined for every type of renewable energy according to the principle of covering production costs. In this way, all energy sources compete on a level economic playing field.

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[2] In Germany, nuclear power plants are exclusively operated by the country's four largest utilities RWE, E.ON, EnBW and Vattenfall. These four companies together operate the predominant number of electricity power plants in Germany, retain holdings in many smaller utilities and – until recently – also controlled 100 percent of the electricity distribution network. However, E.ON sold its distribution network – when placed under pressure from the EU Commission - to the Dutch operator TenneT in February 2010.

According to the action plan, the share of electricity production from renewable energy will be split in 2020 as follows: wind energy 48%, biomass 23%, photovoltaic 19% and hydro power 9%. The largest increase in the installation of renewable energy plants will take place in the areas of wind and solar energies. Geothermal energy will likely play a larger role by 2020, but tidal, wave and other marine energy are not likely to contribute significantly by that time.

In general, the targeted distribution of the different renewable energy technologies for the national 2020 targets appears to be both appropriate and sensible. The most problematic issue is likely to be the anticipated share provided by offshore wind energy plants. As the action plan itself emphasises, this implies the successful installation and commissioning of the first wind parks, as well as the timely development of electricity networks and infrastructure on the coast, which from today's perspective represents a relatively optimistic scenario (see also Nitsch und Wenzel 2009). Therefore, the actions proposed by the federal government's energy concept focus on increasing support for this technology.

1.6 What other measures would be necessary to achieve the transformation to a 100% renewable energy system?

As described in section 2.3, it can be expected that the instruments named in the action plan for the electricity sector, particularly the EEG, will support the transformation of the electrical grid beyond 2020. In addition, the recently announced energy concept tackles other central fields of activity, such as the integration of renewable energies into the grid and the development of offshore wind energy, through additional measures.

In this respect, there is not necessarily a need for further measures but rather the rapid implementation of the existing measures that is required. It is also necessary to clarify how the further development of conventional power plants will be managed. The energy concept does not address the question of whether and to what extent, for example, new coal and gas power plants will be required in Germany in the future. In view of the fact that the opposition parties in the German parliament have announced that they will reverse the decision to extend the lifespan of the nuclear power plants should they win the next election, the question of planning and investment confidence is currently more relevant for conventional power plants than it is for renewable energy plants.

A good level of interaction between the dynamically growing number of renewable energy plants and highly flexible conventional power plants is, however, indispensible for the transformation of electricity production. A consistent strategy for facilitating this transformation would therefore be desirable. This issue highlights the fact that as of yet there has been no consensus among politicians, industry and the public about the best path for developing environmentally-friendly and safe energy provision. One aspect of this lack in consensus is the increasing public opposition to all types of large scale projects, be it the construction of new power plants or power lines. This underlines the importance for clarification and measures for increasing acceptance.

In addition to the promotion of renewable energies, increases in energy efficiency and energy savings will play a decisive role in the achievement of long-term targets. The costs of restructuring the electrical grid and incorporating renewable sources will depend on the total amount of electricity required (SRU 2009). The introduction of electric vehicles will create additional demand for electricity in the transport sector, making it important that energy efficiency increases in other sectors so that total electricity demand is reduced or at least maintained. The action plan contains no information about energy efficiency but rather refers to the energy concept and the future "action plan for energy efficiency" due in 2011. However, it appears further action in this area is needed. The following measures, inter alia, should be taken:

- The dynamic adjustment of efficiency standards for appliances;

- Effective measures for preventing rebound effects, e.g. increase in energy taxes in proportion with efficiency improvements;
- Introduction of effective instruments for exploiting the energy efficiency potential, particularly in companies with high energy costs;
- Improving efficiency of renewable energy production, particularly in the area of biomass energy.

1.7 *Can the targets for 2020 and the aim of covering the total demand for electricity with renewable energies by 2050 be made easier and less expensive through European cooperation and if so, using which measures?*

According to a number of studies (SRU 2010, UBA 2010, Barzantny, Achner and Vomberg 2009) it would be possible for Germany to achieve complete self-sufficiency in the electricity sector through the use of domestic renewable energy. However, there is general agreement that the security of the electricity provision can be increased and the costs reduced through joint European solutions (SRU 2010, UBA 2010, Nitsch and Wenzel 2009, Saint-Drenan, v. Oehsen, Gerhardt etc. 2009, Schlesinger, Lindenberger and Lutz 2010). The development of an interconnected European electricity grid would enable Europe-wide balancing of fluctuations in electricity input from wind and photovoltaic energy, as well as reducing peak input loads. The accompanying reduction in the need for energy storage and energy reserve capacities would lower the overall costs of electricity production. Therefore, the interconnected European electricity grid offers substantial optimisation potential in comparison with only national solutions. This indicates that national solutions for self-sufficiency are not conducive for achieving the desired 2050 targets cost-effectively (SRU 2010).

However, European cooperation is not likely to make the process for achieving the German targets by 2020 significantly easier. The development of the European grid will also initially result in the creation of additional costs, though these initiatives are likely more economically efficient in the long term (SRU 2010, Schlesinger, Lindenberger and Lutz 2010). It appears measures for European cooperation will need to be initiated before 2020 to ensure the mechanisms are in place to reach the 2050 targets (Brodersen and Nabe 2009, UBA 2010).

Potential measures for European cooperation that are particularly worth mentioning are primarily those which encourage the development of the interconnected European electricity grid. Therefore, the federal government's energy concept mentions the development of common technological network standards, improved access to financial resources for grid operators, the development of border substations and the intensification of German cooperation with France and the Benelux nations in a pentalateral energy forum to avoid bottlenecks in the grid. This energy forum is intended to further develop the burgeoning cooperation between the North Sea countries and Ireland as part of the North Sea Offshore Initiative. In addition, there is also great potential for Germany to cooperate with Scandinavian and Alpine countries to utilise their pumped storage hydroelectric capacities – particularly in Norway (SRU 2010, UBA 2010, federal government 2010a). Even greater potential for cooperation, although far more difficult to achieve, exists in the development of a solar partnership between the EU and the states in North Africa, such as in the "Desertec" project (Nitsch and Wenzel 2009, PWC 2010). In this context, the RED includes measures that are specially designed to make common projects with third party countries easier. The debate about this project shows, however, that there is a gulf between those who advocate the use of domestic renewable energy sources through small-scale decentralised structures and those who want to import green electricity into Germany using "large-scale European technology" (Werenfels and Westphal 2010). The two approaches could of course be combined (Nitsch and Wenzel 2009, UBA 2010, Brodersen and Nabe 2009, Werenfels and Westphal 2010).

On the other hand, Germany has remained wary of initiatives for the harmonisation of Member States' national renewable energy policies. This was shown by Germany's position in the debate over the introduction of "Green Electricity Certificates" trading prior to the adoption of the RED. Nevertheless, it is anticipated for the period post-2020 that there will be an increasing focus on identifying which locations and which technologies can produce electricity in a cost effective way utilising European renewable energy sources. (Schlesinger, Lindenberger and Lutz 2010). Against this background, the federal government has signalled its willingness, within the context of the long-term perspectives described in the energy concept, to investigate the extent to which development programmes in different member states can be coordinated and harmonised.

Conclusion

The measures outlined in the German action plan for renewable energy in the electricity sector are not only oriented towards achieving the targets set for 2020. The federal government intends to promote renewable energy technologies until they are competitive with conventional forms of electricity generation. The prognosis for the electricity sector in 2020 shows that the share provided by renewable energy will be between 35 and 38 percent. This currently appears achievable as long as the EEG is maintained and efforts to expand the electricity network are continued.

Aside from the commitment to continue the EEG beyond 2020, the action plan contains relatively few measures with a long-term perspective. This is likely because the federal government produced a strategy paper on energy provision after the action plan had been published which focuses on precisely these long-term measures. This energy concept contains the target of providing 80 percent of the country's demand for electricity through renewable sources by the middle of the century and outlines a variety of measures that need to be implemented to achieve this target. It tackles important topics such as the integration of renewable energy into the electricity grid and the development of offshore wind energy plants. In view of the increasing challenges faced by an electricity system consisting of predominantly decentralised and fluctuating electricity provision, the question of how to further develop conventional power plants remains unanswered – and this is the central weakness of the concept. Furthermore, significantly more ambitious measures for promoting the efficient use of electricity and for saving electricity are necessary.

The potential for European cooperation is recognised in the national action plan but has not yet been utilised. Measures for the utilisation of flexible cooperation mechanisms have only been investigated up to now. Measures for the establishment and development of an interconnected European electricity grid and for cooperation with neighbouring states are primarily dealt with in the federal government's energy concept but are only handled in a very general way. On the whole, the national action plan seeks to achieve the national targets for 2020 using essentially domestic measures, while the energy concept incorporates European cooperation as an important component in achieving the targets for 2050. Measures with long-term impact, such as the development of an interconnected European electricity grid, must be realised as quickly as possible if the desired effect is to be achieved by 2050.

Bibliography

Barzantny, K.; Achner, S.; Vomberg, S. (2009): “Klimaschutz: Plan B 2050. Energiekonzept für Deutschland”. Study carried out by EU Tech on behalf of Greenpeace, Hamburg 2009.

German Federal Government (2010): “Nationaler Aktionsplan für erneuerbare Energie gemäß der Richtlinie 2009/28/EG zur Förderung der Nutzung von Energie aus erneuerbaren Quellen”, 4th August 2010.

German Federal Government (2010a): “Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung”, 28th September 2010.

German Federal Government (2010b): “10-Punkte-Sofortprogramm, Monitoring und Zwischenbericht der Bundesregierung”, 2010.

German Federal Government (2010c): “Entwurf eines Gesetzes zur Umsetzung der Richtlinie 2009/28/EG zur Förderung der Nutzung von Energie aus erneuerbaren Quellen (Europarechtsanpassungsgesetz Erneuerbare Energien)”, Status: 20th May 2010.

BEE (2009): “Ausbauprognose der Erneuerbare-Energien-Branche für Deutschland”, German Renewable Energy Federation 2009.

Brodersen, N.; Nabe, C. (2009): “Stromnetze 2020plus”. Study from Ecofys on behalf of the German parliamentary group “Bündis 90/Die grünen”, September 2009.

ECF et al. (2010): “Roadmap 2050. A practical guide to a prosperous low-carbon Europe”, European Climate Foundation 2010.

Fahl, U.; Frondel, M.; Löschel, A. etc. (2010): “Die Entwicklung der Energiemärkte bis 2030. Energieprognose 2009”, Study on behalf of the Federal Ministry of Economics and Technology (BMWI), Institute for Energy Economics and Rational Energy Use (IER - Institut für Energiewirtschaft und Rationelle Energieanwendung), North Rhein Westphalia Institute for Economic Research (RWI - Rheinisch-Westfälisches Institut für Wirtschaftsforschung) and the Centre for European Economic Research (ZEW), March 2010.

Howes, T. (2010): “The EU’s New Renewable Energy Directive (2009/28/EC)”, P. 117–150, in: Oberthür, Sebastian/Pallemaerts (Hrsg.) and Kelly, Claire Roche, “The New Climate Policies of the European Union”. “Internal Legislation and Climate Diplomacy”. No. 15 of a series of publications by the Institute for European Studies, Brussels 2010.

Kirchner, A.; Matthes F. (2009): “Modell Deutschland - Klimaschutz bis 2050: Vom Ziel her denken”; WWF, Basel/Berlin October 2009.

Nitsch, J.; Wenzel, B. (2009): “Leitszenario 2009 - Langfristszenarien und Strategien für den Ausbau erneuerbarer Energien in Deutschland”, Study on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin, Stuttgart, Teltow, August 2009.

PricewaterhouseCoopers (2010) (with the participation of PIK, IIASA and the European Climate Forum): “100% renewable electricity. A roadmap to 2050 for Europe and North Africa”, 2010.

German Advisory Council on the Environment (2010): “100% erneuerbare Stromversorgung bis 2050: klimaverträglich, sicher, bezahlbar”. Report No. 15, May 2010, Berlin.

Saint-Drenan, Y-M.; von Oehsen, A.; Gerhardt, N.; Sterner, M.; Bofinger, S.; Rohrig, K. (2009): “Dynamische Simulation der Stromversorgung in Deutschland nach dem Ausbauszenario der Erneuerbaren-Energien-Branche”, Study by the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) on behalf of the German Renewable Energy Federation, Kassel, December 2009.

Schlesinger, M.; Lindenberger, D.; Lutz, C. (2010): “Energieszenarien für ein Energiekonzept der Bundesregierung”, Study by EWI/GWS/Prognos for the Federal Ministry of Economics and Technology, Project No. 12/10, Basel/Köln/Osnabrück, 27th August 2010.

Schreyer, M., Mez, L. (2008): “ERENE – Eine Europäische Gemeinschaft für Erneuerbare Energien”, in: Heinrich Böll Stiftung (Hg.): Volume 3 of the “EUROPA” publication series. Berlin 2008.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, “Energieziel 2050: 100% Strom aus erneuerbaren Quellen”, Advance publication for the federal press conference on the 7th July 2010, Dessau-Roßlau, July 2010.

Werenfels, I.; Westphal, K. (2010): “Solarstrom aus Nordafrika. Rahmenbedingungen und Perspektiven”, German Institute for International and Security Affairs, Berlin, February 2010.