Federal Ministry for Economic Affairs and Energy

Energiewende Switch to the Future

An electricity market for Germany's energy transition

White Paper by the Federal Ministry for Economic Affairs and Energy

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Contents

Foreword

Germany's power supply must remain cheap and reliable, especially as increasing amounts of wind and solar power come onto the market. This is because the general public, small businesses and industry rely on electricity being available as and when they need it, and on receiving an affordable electricity bill at the end of the month. A sustainable electricity supply, that is a supply which is economical, environmentally friendly and secure in the long term, is the foundation for jobs and prosperity.

That is why we immediately started work on revising the Renewable Energy Sources Act in 2014, interrupting the cost dynamism for the first time. And that is why we published the Green Paper "An Electricity Market for Germany's Energy Transition" and invited a broad public debate on it last October. The electricity market design is the foundation of the electricity supply. It is where electricity is bought and sold. It is where the price is set, thus determining the economic viability of our electricity supply. It is also where the question of whether sufficient electricity is always available is decided, thus determining the reliability of our electricity supply.

The electricity market design can deliver an economic electricity supply if it permits fair and European competition between all power producers and consumers. Thanks to the consultations on the Green Paper and the many events, we have been able to attain a large degree of consensus in the German public, our neighbouring countries and the European Commission that barriers which impede this competition should be removed. We will develop the electricity market into an "electricity market 2.0" so that it is equipped to meet the challenges of the future. We are making it fit for the energy transition. In this White Paper, we now set out the various measures which will transform the electricity market 2.0 into reality. We will set the new Electricity Market Act, which will cast these measures in legislative form, in motion before the end of the year.

If the electricity market design incentivises sufficient investment in secure capacity, it provides the foundation for a secure electricity supply. At present, we have more than enough power stations and secure capacity in Europe and Germany for us always to be able to cover demand. Germany has one of the world's most secure electricity supplies. So that this can remain the case, we do not necessarily need more power stations, but rather flexible capacity. Flexibility is the answer to the weather-dependent renewable energy sources. By introducing the electricity market 2.0, we are permitting fair competition between all flexibility options. These include flexible power stations and flexible consumers, CHP, storage and European electricity trading. And we are making it possible for these flexible capacities to be financed by the market. Further to this, the White Paper sets out key elements for a capacity reserve. This is to provide additional "belt and braces" security for the electricity market 2.0.

After weighing up many arguments in a highly intense debate over the last few months, we clearly advocate an electricity market 2.0 in the White Paper, backed up by a capacity reserve, and oppose the introduction of a capacity market. It is quite clear that capacity markets can make a contribution to energy security. Nevertheless, they preserve existing structures rather than making the electricity market fit for the challenges of the future and for the energy transition. Capacity markets can also result in a cost dynamic which we need to avoid if we want affordable electricity prices.

We are grateful for the lively and constructive debate, approximately 700 answers to the Green Paper consultation, and the many good discussions on the electricity market design. The contributions made in this process provided invaluable input for the energy transition. Let us continue to work together in this way, because the energy transition can only succeed if we speak and work together frankly and honestly.

Your
Federal Ministry for Economic Affairs and Energy

Summary

The Federal Ministry for Economic Affairs and Energy has undertaken a broad consultation process regarding the future electricity market. The process focuses on the question, which electricity market design will be able to guarantee a secure, low-cost and environmentally compatible electricity supply when a large share of the power is derived from renewable energy sources. To prepare for this debate, the Federal Ministry for Economic Affairs and Energy published a Green Paper in October 2014 and consulted it until March 2015. This transparent procedure encountered a high level of interest: government authorities, associations, trade unions, companies, research establishments and individual citizens participated in the consultation process. In total, the ministry received some 700 comments on the Green Paper.

The Federal Ministry for Economic Affairs and Energy evaluated the consultation thoroughly. The White Paper contains a detailed evaluation of the consultation. The contributions reveal clear trends: the participants express broad agreement with the no-regret measures proposed in the Green Paper and the capacity reserve. Regarding the fundamental decision on an additional capacity market, the participants took different stances. However, they share three goals: the future electricity market design should ensure security of supply, limit costs and enable innovations and sustainability.

The existing electricity market is being developed into an electricity market 2.0. This fundamental decision is based on the Green Paper's consultations, on existing expert reports and on numerous discussions with stakeholders. The Federal Ministry for Economic Affairs and Energy rejects a capacity market and is committed to the liberalised, European electricity market.

The electricity market 2.0 ensures security of supply. The necessary capacities in the electricity market 2.0 can be remunerated via the market mechanisms. Various expert reports commissioned by the ministry arrive at this finding. The remuneration requires two preconditions: firstly, electricity pricing must remain free; secondly, electricity suppliers must have strong incentives to meet their supply commitments.

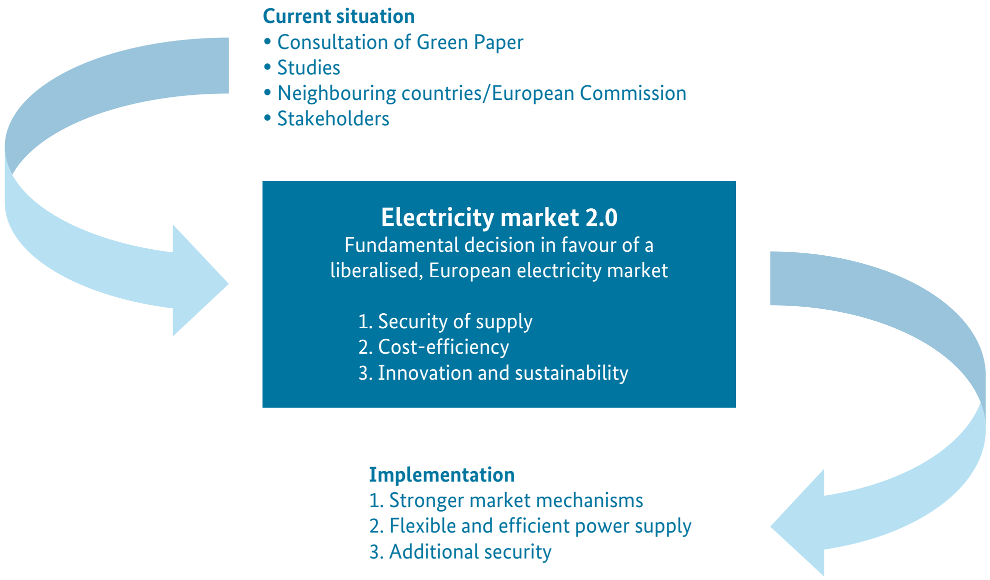
The electricity market 2.0 is cheaper than an electricity supply system with an additional capacity market, and it enables innovation and sustainability. Capacity markets are susceptible to regulatory failure and make it more difficult to transform the energy system. An electricity market 2.0 does not require any intervention in the market mechanism and is thus less susceptible to regulatory failure. A competitive system will bring out the cheapest solutions for the integration of renewable energy sources. As a result, the electricity market 2.0 creates incentives for new fields of business and sustainable solutions.

Twenty measures implement the electricity market 2.0. Free pricing on the electricity market is anchored in the Energy Industry Act. At the same time, market players get stronger incentives to meet their supply commitments. These measures strengthen the existing market mechanisms. As a consequence, the electricity market is able to remunerate the necessary capacities. A number of further measures ensure a flexible and efficient electricity system. These include new fields of cooperation for the European electricity markets, the further development of balancing markets and the design of the grid fees in order to allow for more market-based demand-side management. A capacity reserve safeguards the electricity market 2.0. It is designed to exist on a stand-alone basis, separate from the electricity market. A monitoring of security of supply gives additional security.

The energy transition will keep posing challenges to the electricity market 2.0. The integration of the European internal market for electricity will be continued. An appropriate policy framework can reduce the amount of funding needed for renewables. Fossil-fuel power plants acquire a new, central role as partners of renewables. In future, there will be a greater linkage between the sectors of electricity, heat and transport. As a consequence, the perspective on electricity market design shifts: the design must take account of other goals of the energy transition, such as boosting energy efficiency. Good coordination can enable markets and grids to meet the challenges posed by the energy transition.

The Federal Ministry of Economic Affairs and Energy will discuss the White Paper with the relevant stakeholders. The Ministry will discuss the White Paper in the context of the Electricity Market Platform this summer. In particular, the deliberations will focus in more detail on the measures for the electricity market 2.0. Also, the Ministry will discuss the White Paper with the parliamentary groups in the Bundestag, the Länder, the neighbouring countries and the European Commission. The necessary legislation will then follow. The proposals for the relevant legislative changes (laws and ordinances) will be put forward before the end of this year.

Figure 1: Electricity market 2.0 at a glance



Source: Own chart

Introduction

The Green Paper "An Electricity Market for Germany's Energy Transition", of October 2014 launched a structured debate on the future design of the electricity market. The Green Paper presents the tasks and functions of the electricity market and points to options for how these can be securely fulfilled in future. The following three overarching goals apply: the electricity supply is to be secure, cost-efficient and environmentally compatible.

The electricity market must synchronise power production and power consumption at all times. The electricity market will pass through a transition phase in the coming years. Renewable energy sources will be expanded further and will take on a greater role in the electricity supply; the use of nuclear energy will end in 2022 in Germany; and the European electricity markets will grow closer.

The electricity market will also have to reliably bring together generation and consumption in the forthcoming transitional phase. It must ensure that sufficient capacity is available to balance supply and demand at all times (reserve function). Furthermore, this capacity must be used at the right time and to the extent necessary (dispatch function). In order to optimise the dispatch function, the Green Paper presented a number of "no-regret" measures. These are measures which make good sense in every scenario and are important for the changing electricity market.

The Green Paper has prepared the ground for a fundamental decision. The question here is whether the price signals from the electricity market set the right incentives so that sufficient capacities can be maintained. The Green Paper sketches out two options for the future electricity market design: a further developed electricity market (electricity market 2.0) or an additional market which exclusively remunerates the maintenance of capacity (capacity market).

Having weighed up all the arguments, the Federal Ministry for Economic Affairs and Energy has decided to develop the existing electricity market into an electricity market 2.0. It will create a credible legal framework which investors can rely on and which allows electricity consumers to independently determine through their demand how much capacity is maintained.

This White Paper explains, justifies and details the decision in favour of the electricity market 2.0.

- **Part I presents the main findings of the consultation** (Chapters 1 – 2): The Federal Ministry for Economic Affairs and Energy does not claim that its work has been exhaustive. A separate consultation document (in German) contains the detailed evaluation.

- **The decision in favour of a further developed electricity market (Electricity Market 2.0), backed up by a capacity reserve, is explained and justified in Part II** (Chapters 3 – 4). Three components develop the existing electricity market into the electricity market 2.0:
  1. **The "stronger market mechanisms" component:** It strengthens the existing market mechanisms so that the electricity market is able to refinance the necessary capacities endogenously and ensure security of supply.
  2. **The "flexible and efficient electricity supply" component:** This ensures that the market players will use the capacities in a cost efficient and environmentally compatible manner. This is determined not by the electricity market design in the narrower sense, but by the entire regulatory framework for the electricity sector.
  3. **The "additional security" component:** This backs up the electricity market 2.0 with a capacity reserve and a monitoring of security of supply.

- **Part III provides the details of the three components for the electricity market 2.0.** Chapter 5 presents the central measures to further develop the electricity market which are to be taken in the short term. Chapter 6 presents further-reaching measures required in the medium term. It also provides a look ahead to the main fields of action for the future.

The Federal Ministry for Economic Affairs and Energy will discuss the White Paper with the relevant stakeholders. In the Electricity Market Platform and in other meetings, the Federal Ministry for Economic Affairs and Energy will continue and deepen the dialogue with the stakeholders.

Part I: Outcome of the consultations on the Green Paper

Part I summarises the outcome of the consultations on the Green Paper. The majority of the 696 comments welcome the no-regret measures proposed in the Green Paper and the capacity reserve (Chapter 1). Regarding the fundamental decision, there are different positions but common interests: the future electricity market design should ensure security of supply, limit costs and enable innovations and sustainability (Chapter 2).

The evaluation of the consultation

The Federal Ministry for Economic Affairs and Energy has carefully evaluated the consultation. By means of this comprehensive evaluation, the Federal Ministry for Economic Affairs and Energy is continuing the transparent process to design the future electricity market which it launched in the Green Paper. Furthermore, various institutions listed in the annex supported the Federal Ministry for Economic Affairs and Energy as it evaluated the comments.

Part I summarises the outcome of the consultation. The Federal Ministry for Economic Affairs and Energy does not claim that its work has been exhaustive. This is particularly true of the categorisation of the positions. Furthermore, individual statements are inevitably simplified and abridged in this summary. For the sake of readability, the names of those participating in the consultation are shortened. A list of abbreviations can be found on pages 97ff.

A separate consultation document provides a more detailed evaluation of the consultation. The document can be downloaded from the Federal Ministry for Economic Affairs and Energy's website[1]. The Federal Ministry for Economic Affairs and Energy's website also provides a full citation of the comments where the authors have agreed to this[2].

The evaluation takes account of all the comments submitted. However, the White Paper only cites from comments which were allowed to be published. Citizens have not been cited by name.

The consultation was characterised by brisk and broad participation

696 parties commented on the Green Paper. 484 citizens and 212 organisations submitted comments setting out their stance on the future electricity market (cf. Figure 2). 592 out of the 696 parties submitting comments consented to the publication of their comments on the website of the Federal Ministry for Economic Affairs and Energy.

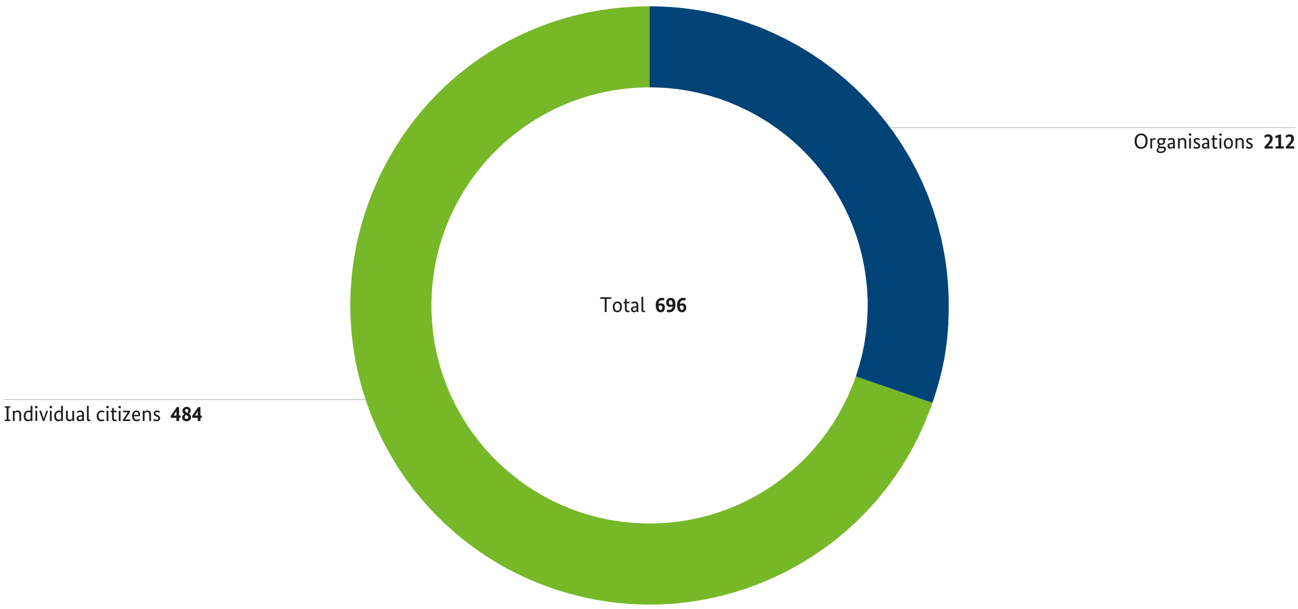
The participants come from Germany and other European countries. In addition to citizens, various organisations commented on the Green Paper: associations, trade unions, companies, research institutions, government authorities and citizens' initiatives (cf. Figure 3). These include European stakeholders like the Swiss Federal Office for Energy SFOE, the Danish Ministry of Climate, Energy and Building, the Czech Ministry of Industry and Trade, Energie-Control Austria and the Finnish company Wärtsilä Power Plants.

In parallel to this, the Federal Ministry for Economic Affairs and Energy engaged in intensive discussions on the Green Paper. The stakeholders discussed the Green Paper in the Electricity Market Platform. The Federal Ministry for Economic Affairs and Energy engaged in ample talks with the Länder and the Bundestag parliamentary groups. In 2014, the Ministry launched and deepened a dialogue on issues of the Green Paper with the neighbouring countries and the European Commission. Proposals were discussed and common positions drawn up in this framework. Also, the Federal Ministry for Economic Affairs and Energy exchanged ideas with associations.

1 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/konsultationsdokument,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

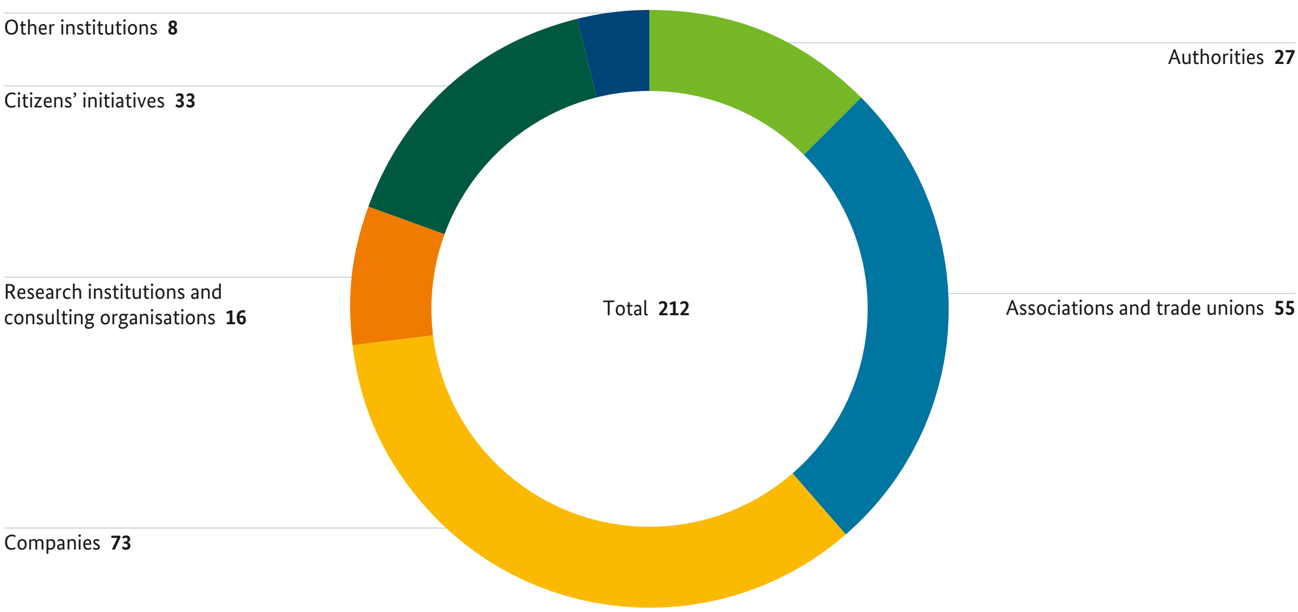
2 http://www.bmwi.de/DE/Themen/Energie/Strommarkt-der-Zukunft/Strommarkt-2-0/stellungnahmen-gruenbuch.html

Figure 2: Participation of individual citizens and organisations in consultations on Green Paper



Source: Own chart

Figure 3: Spectrum of participating organisations



Source: Own chart

Chapter 1: No-regret measures and capacity reserve meet with high level of approval

There is a fundamental consensus about the need for the no-regret measures (1.1), although some of the participants in the consultation go into more or less detail (1.2). A very large number of participants in the consultation advocate the introduction of a capacity reserve (1.3).

1.1 The participants welcome the no-regret measures in principle

A very large number of participants in the consultation advocate in principle the no-regret measures. Both the majority of the Länder and government agencies, trade unions, business and environmental associations, companies, citizens' initiatives and citizens welcome them. This includes, for example, Baden-Württemberg, the Trade Union Federation, and the Federal Environment Agency. The participants disagree as to whether the no-regret measures are sufficient to ensure a secure power supply. For example, BDEW believes that the no-regret measures are "largely correct", but unable to solve the "security of supply problem of an EOM with a large proportion of renewables". Several players like BDI, E.ON and Thuringia call for the measures to be described in more detail.

Measures to flexibilise the electricity system meet with great approval across the groups of participants. In particular, several participants agree that, in the face of rising shares of renewables in the electricity system, making the supply and demand side more flexible is a key challenge. Some participants like EFET and Evonik also state that, irrespective of the fundamental decision, it is necessary to make the electricity system more flexible.

Many participants call for technology-neutral competition between flexibility options. Free competition between the flexibility options, according for example to BKartA and e-control, is more cost-efficient than a centrally planned approach. Many participants like 8KU and Next Kraftwerke point out that this competition requires undistorted price signals. For this reason, many participants from the Länder, government agencies, trade unions, business and environmental associations and companies call for a reduction in current barriers to flexibility. They make specific proposals for this (cf. Chapter 1.2).

There are many options to flexibilise the electricity system

The technical potential of the flexibility options is much greater than the actual need. There are numerous options to synchronise production and consumption in a secure, cost-efficient and environmentally compatible way (known as "flexibility options"). This is true for times of maximum and minimum residual load[3]. For this reason, precedence can be given to the most favourable options amongst the large availability of flexibility. Furthermore, the market is developing more solutions.

The participants in the consultation refer to many different options in order to flexibilise the electricity system. The options can be placed in the following groups (AG Interaction 2012):

- **Flexible conventional and renewable generation:** Thermal conventional and bioenergy power plants can adapt their electricity production to fluctuations in consumption and in the generation of wind and solar facilities. Wind energy and solar installations in turn can reduce their output when there is a very low residual load or limited grid capacity.

- **Flexible demand:** Some industrial, commercial and residential consumers can reduce their electricity consumption in times of high residual load and shift it to times with low residual load if this reduces their electricity purchase costs and thus boosts their economic viability. For example, it is possible to store heat, cold or intermediate products or to adapt production processes. In times of low residual load, electricity can also generate heat directly, thus saving fuel oil or gas. Also, batteries of electric cars can be charged up increasingly in times of low residual load.

3 The residual load is the demand which needs to be covered by the rest of the power plant fleet after deducting generation from wind and solar power.

- **Storage facilities** like pumped storage reservoirs and batteries can also contribute to balancing generation and consumption. So far, additional storage has generally tended to be more expensive than other flexibility options. A first economic field of application for novel storage facilities could be found in ancillary services. Pumped storage reservoirs traditionally provide balancing capacity. This is also a possible business model for battery storage units. Additional novel long-term storage installations which can offset seasonal fluctuations are only required when there are very high shares of renewable energy.

- **Efficient grids:** Well-developed electricity grids are crucial for a secure and low-cost supply of electricity. Electricity grids make it possible to offset fluctuations in demand, wind and sun on a supra-regional basis. Furthermore, where there are coupled markets, the various available technologies can be used more efficiently (e.g. wind and sun in Germany, hydro-electric storage installations in the Alps and Scandinavia). Overall, substantially few reserve power plants or grid-supporting ancillary services are needed; the total costs are reduced.

1.2 The consultation participants make wide-ranging proposals for the details of the no-regret measures

The consultation participants make wide-ranging suggestions for the details of the no-regret measures. The Federal Ministry for Economic Affairs and Energy has taken account of these proposals in the elaboration of the measures in Part III. Chapter 1.2 summarises the comments and extracts the main points made in the consultation for the no-regret measures.

Strengthen market price signals for generators and consumers

A very large number of consultation participants welcome the strengthening of competition on the spot markets. BASF, NABU and other players share the view that the spot markets support the short-term market integration of renewables. The Federal Network Agency, associations and businesses welcome the introduction of the quarter-hour products on the intraday market. The EEX stresses that the quantities traded on the intraday markets have risen rapidly. Some consultation participants like BDI and IG Metall believe that the exchange should introduce quarter-hour products on the day-ahead market too. Looking ahead, the transmission system operators think that the spot markets should make trade in quarter-hour products possible on a European basis (cf. box on the activities of the electricity exchanges, pp. 51f.).

According to the transmission system operators and some business associations and companies the gate closure on the spot markets should move closer to the delivery period. In their view, this is true for the intraday market (e.g. BEE, VIK) and the day-ahead market (e.g. VDMA, VIK). The transmission system operators stress that system stability must also be maintained. With regard to the maintenance of system stability, they call for at least 15 minutes between gate closure and time of delivery (cf. box on the activities of the electricity exchanges, pp. 51f.).

A very large number of consultation participants are in favour of further developed balancing markets. For example, BDI, EnerNoc and Berlin aim to facilitate participation on the balancing markets for new providers like flexible demand, renewable energy or storage facilities. They say this would boost competition and thus cut costs. The transmission system operators and associations like BDI and BEE in particular stress that the opening up of balancing capacity markets to new competitors also makes sense in order to reduce the minimum conventional feed-in. Other participants like VCI and VGB Power Tech point out that the further development of the balancing markets must take place in an economically sensible way. For example, EWE and VGB PowerTech stress that complexity and work involved in clearing processes should be limited. For the transmission system operators, system stability should remain the priority (cf. measure 5).

Selection of specific proposals from the consultation participants regarding the further development of the balancing markets

1. Shorten time between contract and delivery and/or reduce size of products (e.g. ARGE Netz, DIHK, DIW)

2. Adapt prequalification requirements (e.g. BDEW, BDI, BEE, BNE)

3. Promote European harmonisation (e.g. e2m, E.ON, EFET)

4. Tender bids for positive and negative primary balancing capacity separately (e.g. BEE, Evonik, Statkraft)

5. Adapt tendered quantities to situation (e.g. BNE, BWE, EFET)

6. Introduce secondary markets for capacity or balancing energy markets (e.g. DIW, Statkraft, ZVEI)

The incentives to uphold balancing group commitments should be scrutinised and strengthened where necessary. This assessment is common to several Länder, the transmission system operators, many environmental and business associations, and numerous companies. Effective incentives for balancing between the balancing groups are important for system stability. Whenever possible, market participants should aim to ensure a balanced balancing group themselves (e.g. Rhineland-Palatinate and TenneT). The consultation participants have differing views as to how greatly the incentives to uphold the balancing group commitment need to be optimised: some of them argue in favour of a substantial strengthening (e.g. GVSt, Lower Saxony, ver.di); others say that the impact should first be reviewed and they should only be strengthened where needed (e.g. BDEW, DIHK, E.ON). Some consultation participants regard the existing incentives as sufficient (e.g. EFET and RWE).

Many consultation participants make proposals for an improvement in the obligation to uphold balancing group commitments. A further developed balancing energy system should strengthen responsibility for the balancing groups. One possibility, according to a proposal made e.g. by the transmission system operators, is that the costs of maintaining balancing capacity should be shared around the balance responsible parties in addition to the costs of the use of balancing capacity (cf. measure 3). Some participants like BNE, VCI and VIK do not want any higher penalties resulting from the balancing energy system. Instead, BNE for example proposes that the standard load profiles be reviewed and the incentives for grid operators to actively manage their own balancing groups be increased. Also, the forecasts of the feed-in from renewables should be improved (e.g. VCI and VIK).

Right across the participants, there are calls for examination and further development of the state-induced price components and the grid charges. For example, the transmission system operators, and also Next Kraftwerke, stress that these price components currently substantially restrict the development of flexibility options. The aim should be to allocate costs appropriately (e.g. Bavaria) and to take account of new requirements of the energy transition (e.g. BDEW). The consultation participants disagree as to whether privileges should be adapted, abolished or added to (cf. measure 7).

Numerous Länder, agencies, business associations, research establishments, citizens' initiatives and private individuals are in favour of greater coupling between the sectors of electricity, heat and/or transport. Sector coupling, as is stressed e.g. by Fraunhofer IWES, should enable more renewable electricity to be used in the heat and transport sector. It is said (e.g. by ChemCoast) to support the market and system integration of renewables and to cut emissions. Surplus renewable electricity could also be used in the event of grid congestions (e.g. EUROSOLAR). In the view of Hamburg, too, support for the construction of infrastructure could make sense in the case of new forms of energy which are in principle economic but are reliant on appropriate infrastructure. According to some participants like BWP and Fraunhofer IWES, bivalent installations which combine an electricity-based heat generator with a second, fossil-based heat generator, could respond particularly well to market price signals in the various sectors. But monovalent installations, says BWP, could also be used as a flexibility option on the electricity market (cf. field of action 4).

Many consultation participants raise the issue of dynamic price components. According to Hamburg, for example, making individual price components dynamic could be a way to reduce barriers to flexibility. In particular, it could link autoproduction closer to electricity price signals and facilitate efficient sector coupling, according e.g. to Fraunhofer IWES. Discussion focuses particularly on the possibility of a dynamic EEG surcharge (e.g. BDEW, WWF) and dynamic grid charges (e.g. BWE, ZVEI). However, the transmission system operators and several associations and companies want to precisely or critically examine the impact of dynamisation. For example, some participants like VGB fear repercussions on the competition between flexibility options. In a first step, partial dynamisation might make sense, e.g. according to BEE and ChemCoast. Some consultation participants like BNE and DIHK reject dynamic price components.

Alternatives to dynamic price components are also indicated. UBA regards a fuel-based surcharge as a possible alternative to the dynamic EEG surcharge in order to avoid wrong incentives for an inefficient use of flexibility options and inefficient construction of additional generation capacity. The electricity tax could also be successively reduced (e.g. BVMW, Lower Saxony). Also, an abolition of the electricity tax could make sense if it takes place in parallel to a rise in the energy tax in the heat sector (e.g. BWP, Fraunhofer IWES). Overall, the burden should be placed in the same way on electricity, oil and gas in the heat and electricity sector (e.g. ZVKKW).

Consultation participants from all groups of participants call for a further development in the grid charges. Network costs should be distributed more in line with the user-pays principle, say e.g. BASF, Bavaria and Mecklenburg-Western Pomerania. Furthermore, barriers to flexibility should be reduced as the grid charges are developed further in order to give a greater reward to conduct which serves the needs of the market and/or the grid (e.g. BDI, Saxony and WWF). At the same time, grid stability must be ensured (e.g. E.ON, EnBW and EWE) (cf. measures 8 and 9).

Selection of specific proposals from the consultation participants regarding the further development of grid charges

1. Special grid charges should be adjusted in the interest of greater demand side flexibility
   - Permit flexibility serving the needs of the market and/or grid (e.g. BDI, BEE, BNE)
   - Permit provision of balancing capacity (e.g. DIHK, IG Metall, Next Kraftwerke)
   - Define times of peak load more flexibly (e.g. BDEW, VCI, VIK)

2. Abolish special grid charges – if possible (e.g. BEE)

3. Review/adapt the system of capacity and energy components (e.g. North Rhine-Westphalia, RWE, Thüga)

4. Abolish so-called “avoided grid use fees” for weather-dependent renewable energy sources (e.g. Mecklenburg-Western Pomerania, Saarland, Saxony-Anhalt)

Expand and optimise power grids

Consultation participants from the Länder, trade unions, business associations, and the transmission system operators, companies and citizens’ initiatives emphasise the central importance of the expansion of the transmission systems. It is stressed several times that the grid capacities in central Germany are not currently sufficient to transport the electricity from the generation centres in the north and the east to the centres of demand in the south of Germany. In order to rapidly tackle grid congestions and to limit expensive redispatch measures, the electricity grids should be rapidly expanded. The grid expansion is not only a favourable flexibility option; it is also the precondition for functioning electricity trading and important for the continuation of the single price zone, say e.g. the transmission system operators and EPEX SPOT. They and other participants like AmCham Germany stress that the dimensions of the grids must meet the need for the grids.

Consultation participants from many groups of participants, such as Länder, business associations and companies, stress that the European internal market needs cross-border transport capacities. The pan-European expansion of the power grid is – as is stressed e.g. by companies like Evonik and Wacker – a precondition for cross-border electricity trading and – say e.g. DIHK and EEX – a cost-efficient way to ensure security of supply. In particular, it allows offsetting of fluctuations in demand, wind and sun on a supra-regional basis – e.g. via the planned submarine cable between Germany and Norway. Statnett says that when there is little feed-in from wind, hydropower can be imported from Norway; in times of strong wind , north German wind energy can help to supply Norway with electricity.

Many consultation participants stress the relevance of the distribution grids for the energy transition. They point out that the distribution grids make up 98 percent of the length of the entire electricity grid and that approx. 90 percent of all installations covered by the Renewable Energy Sources Act are connected to the distribution grids. The point is made that cost-efficient integration of renewables requires investment in distribution grids and the use of innovative equipment, such as voltage regulated distribution transformers. This is indicated e.g. by BDEW and BUND. Some consultation participants like 8KU and Brandenburg call for the incentive-based regulation to be adapted in response to this. EnerNoc also stresses that this should incentivise flexibilisation of demand at distribution grid level.

Some consultation participants suggest that the electricity market should take greater account of regional grid congestions. The Czech Industry Ministry and Schleswig-Holstein believe that the price signals on the electricity markets do not reflect regional scarcities in the electricity grid. For this reason, say BEE and BNE, it makes sense to link up the signals from the electricity markets with congestion management. The consultation participants formulate various proposals to tackle this. For example, Baden-Württemberg proposes an auction model for demand side flexibility and BNE an additional market for flexibility at distribution grid level – a "flex-market".

There is a widespread consensus that the grid reserve should be prolonged or developed further. This is because the need for redispatch increases without a wide-ranging expansion of the grid. This point is made by DIHK, TenneT and Trianel. The consultation participants make comprehensive proposals for the future design of the grid reserve. In particular, for example, DIHK says that consideration should be given to whether reserve power plants should be selected via the current procedure or via a new auction procedure. In the view of Saarland, EnerNoc and Next Kraftwerke, greater consideration should be given to conditions under which innovative concepts like virtual power stations and flexible demand can participate. With regard to ascertaining the need for a reserve, the transmission system operators believe that the analysis of the need by BNetzA should continue to form the basis (regarding the dovetailing ofthe grid reserve and the capacity reserve cf. measure 19).

Various participants see a need to further investigate the use of back-up power systems for redispatch. Back-up power systems might also be suitable for alternative uses, such as marketing on spot and balancing markets or the management of grid congestions (redispatch). This point is made by BEE, DIHK and TenneT. It makes technical, operational and commercial sense to provide back-up power systems for redispatch. However, the transmission system operators see a need to study the feasibility of this proposal (cf. measure 12).

Smart meters should be gradually introduced. Some participants call for this, including some private individuals. The principles of the Federal Ministry for Economic Affairs and Energy published in February 2015 on the "smart grids" regulatory package (BMWi 2015a) provide an overview of the development of the technical and legal framework for the roll-out of smart metering systems. Even though the Federal Ministry for Economic Affairs and Energy is carrying out a separate, more detailed consultation procedure on these principles, some comments on the Green Paper also contained points about the roll-out plans. For example, some stakeholders criticised the smart meter roll-out. They said that the cost-benefit relationship for the customer should be upheld when the smart meters are installed. This is an important point e.g. for BNE, as well as Caterva and Fraunhofer IWES. Also, Baseload feels that an obligation to introduce smart meters could cause conflicts between distribution system operators and customers. On the other hand, BNE calls for a retention of the obligation to install smart meters, even for customers with an annual consumption of less than 100,000 kWh. Furthermore, clear statutory rules should be established so that users can themselves opt to install smart meters and the meter operators (Baseload). Berlin believes that pilot projects for multi-dwelling buildings could facilitate the transfer of the experience already made by large consumers to groups of small consumers (cf. measure 13).

Many consultation participants assume that it could make economic sense not to expand the grids to cope with the "last kilowatt-hour generated". A moderate curtailing of feed-in peaks from renewable energy installations (peak shaving) could reduce the need to expand the grids. The grid operators want to be able to take account of this curtailing, and are backed in this by Länder like Bavaria or associations like ZVEI, in their grid planning alongside grid expansion and the use of modern operating equipment.

The consultation participants take differing views of the degree of the curtailing. Here, a distinction must be made between taking into account curtailing in grid planning and the actual curtailing of the renewable energy installations when they are in operation. The distribution grid study of the Federal Ministry for Economic Affairs and Energy (IAEW et al. 2014) had recommended to restrict the quantity of electricity curtailed each year to a maximum of 3 percent in grid planning (BMWi 2014a). Many consultation participants like BNetzA and WWF support this idea. However, some participants, like Bavaria and IG BCE, propose raising the figure.

Various participants believe that grid operators should be able to implement curtailing as flexibly as possible. For example, BEE and EWE believe that, depending on the situation in their grid, they should be able to decide whether to deploy curtailment or not. The transmission system operators also want to continue to be able to decide which installations they curtail in which order.

Financial compensation should continue to be paid for the volume of energy subject to the curtailment. The BNetzA also feels that the compensation provides reliable investment conditions for the installation operators. Furthermore, as is pointed out by BDEW and BEE, it is not possible in operational terms to curtail installations for grid-related reasons and at the same time to deliver full non-discrimination. Finally, curtailment without compensation would discriminate against installations covered by the Renewable Energy Sources Act compared with conventional installations. However, some consultation participants like BI Vernunftkraft and WVM also take a critical view of (full) compensation for curtailment (cf. measure 14).

A certain level of conventional minimum generation is, in the view of some of the consultation participants, necessary for system stability and security of supply. Some consultation participants warn against underestimating the importance of conventional installations in the current energy system. As MIBRAG stresses, conventional power stations like lignite-fired plants make a substantial contribution towards security of supply, particularly when the feed-in from renewable energy installations is low. For economic reasons, power plant operators – according e.g. to E.ON, RWE and Saxony – already try to keep minimum generation as low as possible.

Other participants in contrast stress that minimum conventional generation makes it harder to integrate renewables. The minimum generation must therefore be reduced, says Schleswig-Holstein, in order to minimise the curtailment of renewable energy installations. The consultation participants see several possibilities for this. Minimum generation in the narrower sense – i.e. the minimum conventional generation needed for system stability – can also be reduced, according to BVES, DGB or e2m, if renewable installations and storage facilities provide more ancillary services. Whereas wind power and PV installations could primarily be used for negative balancing energy, biomass installations with storage units could also provide positive balancing capacity, says TenneT. The market-related minimum generation as defined in the Green Paper, i.e. the generation which cannot sensibly respond to the price signals, includes – according to BNetzA – heat generation in subsidised CHP installations and self-supply installations, which are fenced off from the market by the self-supplier privilege. In the eyes of participants like E.ON, Greenpeace or BNetzA, the further flexibilisation of CHP installations could therefore partially reduce minimum generation. Biomass installations can also contribute to minimum generation due to their funding system. This minimum generation could, according to the Energy-related Biomass Use research project, be reduced by extending the flexibility premium to power generated from liquid and solid biomass (cf. measure 15).

Retain a single price zone

The majority of consultation participants wish to retain the single price zone in Germany. The single price zone is, according e.g. to EPEX SPOT, Saxony-Anhalt or VDMA, of outstanding importance for a low-cost electricity supply. For this reason, many consultation participants stress the disadvantages of a split price zone: if Germany were divided into two price zones, according e.g. to Brandenburg and DIHK, there would be two electricity prices on the exchange and two EEG surcharges. This would create great disadvantages for the economy, and particularly for industry, and would exacerbate existing regional disparities. This point is important to, for example, IG Metall and VDMA. Many participants believe that a split price zone would make the market less transparent and reduce liquidity. The costs for the market participants would – as is stressed by the EEX und EPEX SPOT exchanges – rise and create market-entry barriers which could impair the ability of the market to function. Also, according to EFET and VKU, for example, a split in the German price zone would strongly countervail the efforts to complete the European internal market.

Grid expansion is urgently needed to maintain the single price zone. This is stressed in numerous comments. If grid congestions remain in place in the long term, says e.g. BNetzA, it would be impossible to maintain a single price zone. For this reason, the grid expansion must be realised quickly.

Intensifying European cooperation

The electricity market is already European. This is asserted by very many consultation participants from all the groups of stakeholders. Security of supply is already a European issue, according e.g. to e-control, the Austrian regulatory authority. The EEX exchange and other participants stress that a European internal market offers benefits to all countries and could cut energy costs across Europe to an economically efficient level.

European cooperation should be intensified. Once again, there is a large degree of consensus. The transmission system operators stress that they are already actively involved in the development and completion of the European internal market. The need for a rapid implementation of the European network codes is repeatedly stressed. Also, as highlighted e.g. by RWE, TenneT and VKU, common rules should be put in place for times when there are simultaneously high electricity prices or simultaneous scarcity situations. The technical price limits on the electricity exchanges[4] should in the view of EFET be harmonised with the neighbouring markets so that load flows are not distorted by price differentials.

Security of supply should be seen and monitored in European terms. This is a widespread consensus amongst consultation participants in all the stakeholder groups. This includes – say not only the transmission system operators but also e.g. the Austrian regulatory authority e-control – a common definition of security of supply and also – say e.g. BfE Switzerland and others – a strengthening of the European internal market. Deeper analyses – as undertaken in the Pentalateral Forum and planned by ENTSO-E – should be included in this (cf. measure 5).

Attaining the climate targets

European emissions trading should be reformed. This is also a widespread call. If designed properly, emissions trading would ensure – assert e.g. Lower Saxony and Saxony-Anhalt – an efficient and precise implementation of the climate policy targets. Various participants, particularly amongst the environmental associations, but also energy utilities like EnBW or Statoil, point out that because of excess certificates the carbon price incentives are currently too small. In the short-term, a market stability reserve should be introduced. Certificates removed from the market – known as “backloading” – should be moved into this market stability reserve. This is an interest expressed by Baden-Württemberg and Trianel. A number of companies, trade unions, business associations and Länder stress that energy-intensive companies should continue to be protected via the carbon-leakage rules.

4 There are no regulatory price ceilings on the electricity exchange today, only very high technical limits. These can be adjusted by the exchange where necessary. Within the technical limits, the prices on the spot market can already rise to several thousand euros.

The national and European climate change mitigation target should be complied with. This call also meets with broad support from the Länder, the trade unions, environmental and business associations, as well as individual companies. The attainment of these targets, say BEE and UBA, is important for sustainable development. If the national climate target is to be met, says e.g. IASS, structural change is required in the German power plant fleet. Also, says BWP, a joint approach should increasingly embrace different sectors. Some of the consultation participants, particularly from the ranks of the environmental associations, but also amongst the Länder, SRU and companies like Statoil and Trianel, call for further national climate mitigation action, since emissions trading reform cannot provide efficient short-term incentives to cut carbon emissions. Others, such as IG BCE, MIBRAG, Wacker und WVM, reject additional national measures in the electricity sector – e.g. due to overlapping with European Emissions Trading. As specific proposals for national climate change mitigation, the Pirate Party, Schleswig-Holstein and Statoil, for example, suggest a minimum price of 15 – 20 euros/t CO^2 or emissions ceilings for power stations. Negative repercussions on emissions trading should certainly be avoided in the view of EFET, SRU and UBA.

The important role played by CHP for the transformation of the power plant fleet is stressed several times. CHP is deemed to be a flexible generation technology which is a good complement to the expansion of renewables. In order to combat climate change, according to a widely held view, preference should be given to it over non-combined conventional generation. Furthermore, CHP is also a major component of the integration of the electricity and heat sectors in urban areas (e.g. EUROSOLAR). The precise role for CHP in the restructuring of the power plant fleet still requires clarification, e.g. according to Bavaria and Lower Saxony.

There are divergent views regarding the future subsidies for CHP. Some consultation participants such as Hamburg and Schleswig-Holstein particularly want gas-fired CHP installations on the public grid to be funded where these make a contribution towards combating climate change in the heat sector; other stakeholders, e.g. North Rhine-Westphalia, Saarland, Saxony, Saxony-Anhalt and Thuringia, want funding for existing and new CHP installations nationwide for technologies in all fields of application. Some consultation participants call for incentives for the flexible deployment of CHP installations.

1.3 There is broad support for the introduction of a capacity reserve

A very large number of consultation participants share the view that the electricity market should be backed up by a reserve. On the one hand, the reserve serves to safeguard the electricity market. This is the view taken by the Länder, for example, but also by many companies, business and energy associations, and the transmission system operators. On the other hand, participants who are not in favour of an electricity market 2.0 – such as Baden-Württemberg, E.ON and RWE – do advocate the reserve as a transition instrument. Some consultation participants, e.g. VIK, ZVEI or Brandenburg, do not deem the introduction of a reserve to be necessary (at present) and fear extra costs. VKU is afraid that if the reserve is too small, it would not be able to provide the requisite back-up. At the same time, some consultation participants like BDI and vzbv find it important not to set up too large a reserve.

The capacity reserve should not impair the electricity market. There is broad support for this stance. The capacity reserve should be established separately from the electricity market. The transmission system operators should procure the reserve power plants and deploy them following the conclusion of all market transactions. This should avoid market distortions, say e.g. BfE Switzerland and others, BKartA, e-control and the transmission system operators.

The relationship with the existing grid reserve is a key discussion point. The capacity reserve – possibly as a "grid reserve 2.0" – can, say e.g. Hamburg and Berlin, assume some of the functions of the grid reserve and, says e.g. TenneT, cover the need for redispatch in southern Germany. Many participants in the energy sector and Bavaria believe that it can also contain a regional component for this. Not least the transmission system operators stress that attention would have to be given to the respective deployment purposes, the procurement, the prequalification conditions, the sites and a possible simultaneous deployment of installations for both purposes.

Many consultation participants welcome competitive procurement of the capacity reserve. A market-based instrument ensures that procurement will be cost-efficient. An adequate preparation period is necessary for the procurement so that any necessary construction of new generation installations can be possible, say e.g. the transmission system operators. BNE and TransnetBW ask whether, in view of the small number of potential bidders, competitive prices can actually be achieved.

Some consultation participants point out that, if the capacity reserve is dovetailed with the grid reserve, competitive procurement is only possible to a limited extent. Firstly, say the transmission system operators, there is low availability of capacity in southern Germany; secondly, the grid reserve installations are very heterogeneous, so that there is limited scope to design a standardised product for an auction. For this reason, BNetzA could imagine a two-stage procedure. In a first step, there could be a nation-wide auction for the capacity reserve, in which grid reserve installations could also participate. In a second stage, installations which are lacking but which are needed for grid stability in southern Germany could be secured as before via Section 13a of the Energy Industry Act.

Selection of specific proposals from the consultation participants regarding conditions for participation in the reserve

1. Technology-neutral instrument (e.g. BDI, GEODE, IG BCE)

2. No flow of money or additional yields to high-emission power stations (e.g. BUND, NABU, WWF)

3. Cross-border participation (e.g. BfE Switzerland and others, e-control, Oesterreichs Energie)

Specific proposals are made regarding the financing of the deployment of the capacity reserve. In order to distribute the costs of the deployment of the reserve as far as possible on a user-pays basis, all the transmission system operators and BNetzA agree that the deployment costs should be refinanced via balancing energy and not passed on to the grid charges. TenneT advocates that the balance responsible parties which cannot meet their supply commitments and make use of the reserve should pay at least a surcharge equivalent to the highest balancing energy price (cf. measure 19).

Chapter 2: Regarding the fundamental decision, there are different positions but common interests

The consultation participants adopt divergent positions on the fundamental decision. Some of the consultation participants call for the introduction of a capacity market, but favour various models. Other consultation participants advocate an electricity market 2.0, possibly with a reserve. Some want the electricity market 2.0, possibly with a reserve and a capacity market if this really becomes necessary (2.1). Beyond these differences, however, it can be seen that the advocates of both options have common interests: the future electricity market design should ensure security of supply (2.2); it should also limit costs (2.3) and enable innovations and sustainability (2.4).

2.1 Regarding the fundamental decision, there are different positions

The fundamental decision: electricity market 2.0 or capacity market

The Green Paper raised a fundamental question: Are we relying on the liberalised electricity market or do we want regulatory intervention to establish a second market in which companies receive additional revenue flows for maintaining capacity?

The answer to this question determines the direction taken. The electricity market 2.0 differs substantially from an electricity supply system with an additional capacity market. On capacity markets, payment goes exclusively to the maintenance of capacity. This results in costs on top of the costs of procuring the electricity on the electricity market. The power suppliers bear the costs and pass them onto the consumers. In the electricity market 2.0, capacity is paid for implicitly on the electricity markets and explicitly on the balancing markets and in option contracts (for an overview cf. Table 1)[5].

Table 1: The functioning of the electricity market 2.0 and the capacity market differs

Electricity market 2.0 Option *"An optimised electricity market guarantees security of supply"*	**Capacity market Option** *"The state must take action to ensure security of supply"*
How it works	**How it works**
• The electricity market provides incentive for the maintenance of capacity. The necessary maintenance of capacity is remunerated through the electricity market. • The state sets the rules of the market. Through their specific demand, the electricity customers are independently responsible for determining the capacity level. • Implicit payment for capacity on the electricity market and explicit payment on the balancing market and in options and delivery contracts, for instance.	• The capacity market provides incentive for the maintenance of capacity. The necessary maintenance of capacity is refinanced through an additional capacity market. • The state ensures a higher level of capacity than the electricity market. • Explicit payment for capacity on the capacity market.

Source: Own chart

5 The Green Paper provides a more detailed depiction of both options: An Electricity Market for Germany's Energy Transition, Chapter 9.

Some of the consultation participants support the introduction of a capacity market. These particularly include Bavaria and Baden-Württemberg, as well as companies and associations of the energy industry. Some of these consultation participants, e.g. BDEW and VKU, are in favour of introducing a reserve in addition to introducing a capacity market.

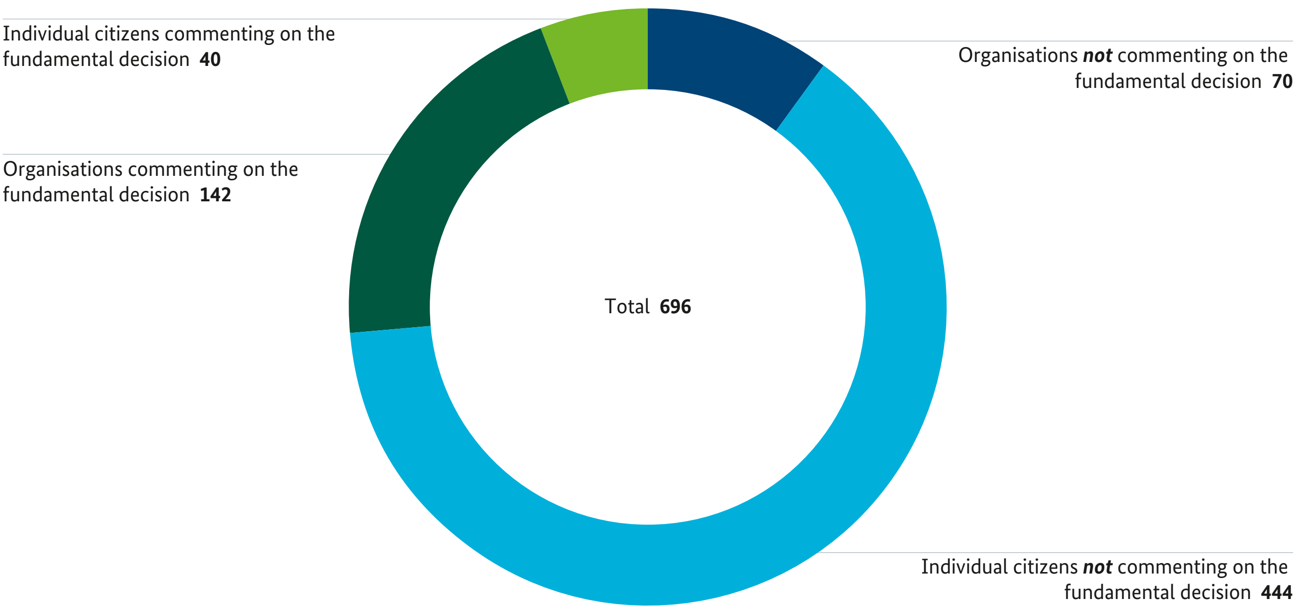
Some specific models for a capacity market are proposed. Mainly, two models are advocated: many representatives of the energy industry are in favour of a decentralised capacity market; in contrast, the aforementioned Länder and also the Öko-Institut and WWF would like a focused capacity market. Other comments, e.g. from the trade union community, are not explicitly in favour of a particular model, but stipulate criteria for the design of a capacity market. For example, a capacity market should be technology-neutral and market-based. Overall, says e.g. GDF SUEZ, it should deliver a transparent and predictable environment for new investment and should be coordinated on a European basis.

Quantitative evaluation of the comments

Well over half of the organisations participating in the consultation commented on the fundamental question. 142 of the 212 organisations participating in the consultation comment on the fundamental question. In contrast, 444 of the 484 private individuals do *not* comment on the fundamental decision (cf. Figure 4).

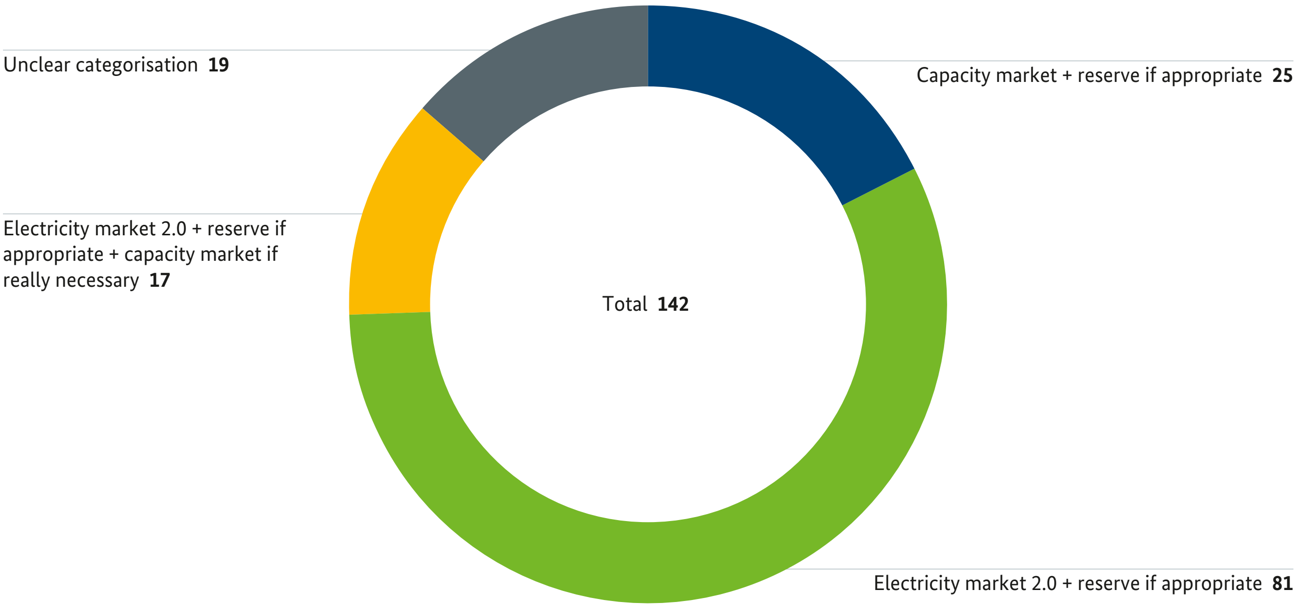
Many of the organisations participating in the consultation took a clear stance on the fundamental decision: 81 organisations are in favour of an electricity market 2.0, if appropriate plus a reserve. 17 organisations are in favour of an electricity market 2.0, if appropriate plus a reserve and a capacity market if this really becomes necessary. 25 organisations are in favour of a capacity market, if appropriate plus a reserve. 19 comments do not take a clear stance (cf. Figure 5).

Figure 4: Comments on the fundamental decision



Source: Own chart

Figure 5: Positions taken by the organisations on the fundamental decision[1]



1 Positions taken by organisations which commented on the fundamental decision

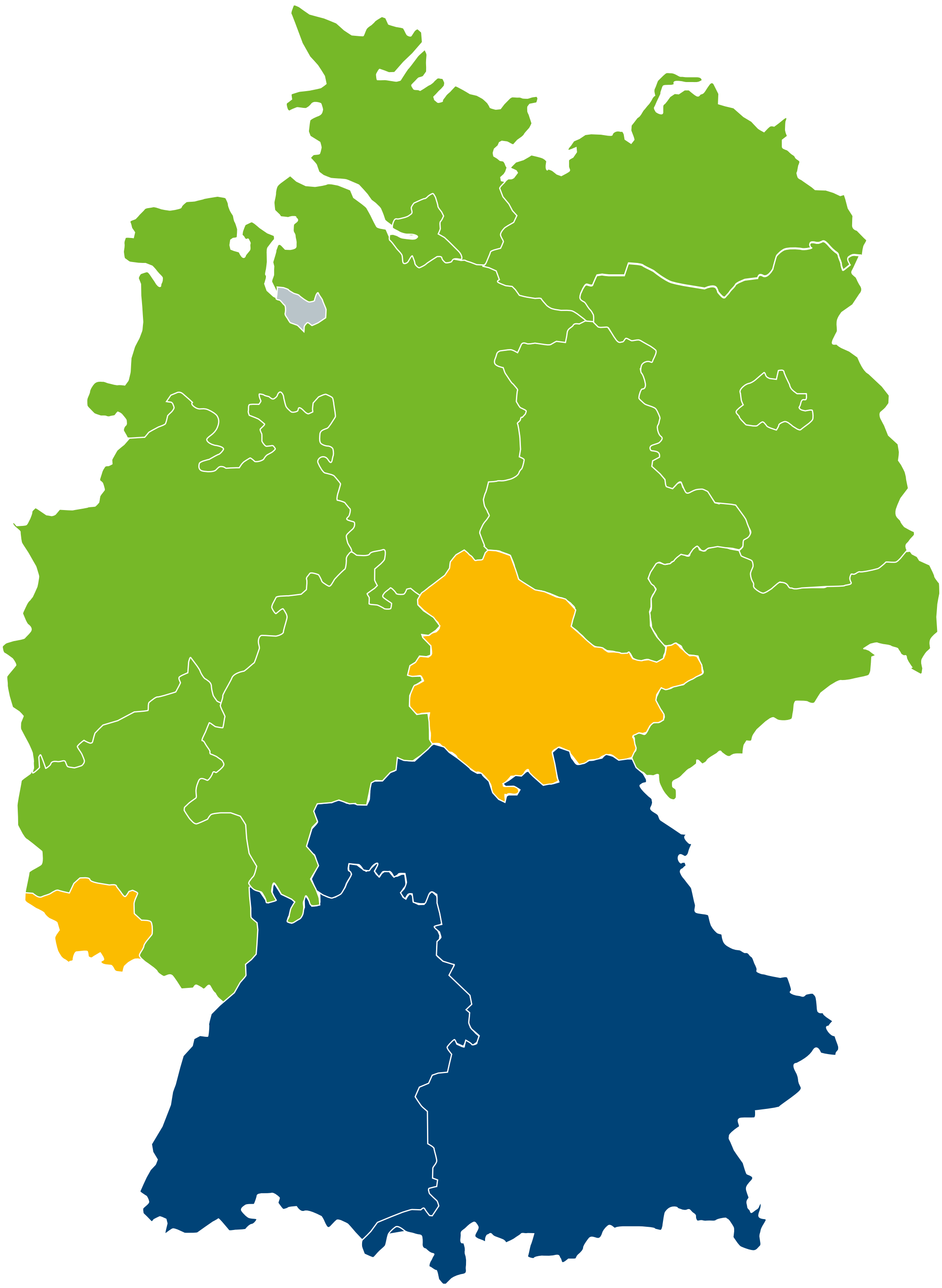
Source: Own chart

The majority of the Länder are in favour of an electricity market 2.0. 15 of the 16 Länder submitted comments on the Green Paper and took a stance on the fundamental decision. 11 Länder – Berlin, Brandenburg, Hamburg, Hesse, Lower Saxony, Mecklenburg-Western Pomerania, North Rhine-Westphalia, Rhineland-Palatinate, Saxony, Saxony-Anhalt and Schleswig-Holstein – are in favour of an electricity market 2.0, if appropriate with a reserve. Saarland and Thuringia are in favour of an electricity market 2.0, if appropriate plus a reserve, and a capacity market if this is really necessary. Thuringia regards "the introduction of a capacity market as a feasible option solely if further measures prove necessary in order to safeguard security of supply in future". Saarland speaks of a "third way", in which "a capacity market would not be introduced until risks to security of supply are apparent". Baden-Württemberg and Bavaria are clearly in favour of the introduction of a capacity market, if appropriate plus a reserve (cf. Figure 6). Both prefer the model of a focused capacity market.

Some private individuals have also taken a position on the fundamental decision. Of these, 17 are in favour of an electricity market 2.0, possibly plus a reserve. 23 private individuals commented on the fundamental decision without taking a specific stance.

The quantitative evaluation permits important conclusions to be drawn, but is only one part of the broader evaluation of the consultation results. All of the comments on the Green Paper are important for the evaluation of the consultation. Some comments represent entire branches of industry or the Länder governments. It is therefore not possible simply to directly compare the comments.

Figure 6: Positions taken by the Länder on the fundamental decision



■ Capacity market + reserve if appropriate ■ Electricity market 2.0 + reserve if appropriate ■ Electricity market 2.0 + reserve if appropriate + capacity market if really necessary

Source: Own chart

The advocates present three key arguments for the introduction of a capacity market:

1. **The electricity market does not provide sufficient incentives to invest in capacity.** This argument is particularly to be found in the comments from the energy industry, but also from Bavaria, Baden-Württemberg and the WWF. According to, for example, DGB and RWE, the electricity market will probably fail to incentivise the necessary investments in generation capacities and demand side management potential. The consultation participants cite various reasons for their stance: on an electricity market 2.0, capacities would have to be refinanced via high price peaks. This is a problem firstly because high price peaks could easily be attacked in the media and market power problems could arise. Governments would therefore be unable to withstand this pressure, according to the view of consultation participants like Stadtwerke Duisburg and Trianel. On the other hand, price peaks would not provide sufficient incentives to invest in capacity, storage and demand side management. They would come too late and would be too difficult to forecast. The refinancing of capacities on the basis of market mechanisms would privatise security of supply and thus make it less secure. A further problem – according e.g. to Thüga and VKU – is the introduction of a capacity market in France. A French capacity market would weaken the price peaks in Germany.

2. **Capacity markets do not have to result in unnecessary and very high costs.** This is repeatedly stressed by the advocates of capacity markets. In particular, say some trade unions for example, the effects of uncertainties on investors and possible abuses of market power on the costs of electricity market 2.0 should be taken into consideration. Also, criticism comes for example from Baden-Württemberg and VKU that the expert reports commissioned by the Federal Ministry for Economic Affairs and Energy fail to take account of uncertainties in their models and cost assessments. Bavaria and Baden-Württemberg argue that a focused capacity market does not involve very high additional costs. Advocates of a decentralised capacity market also assert that it does not have to result in extra costs.

3. **Capacity markets do not have to delay the flexibilisation of the whole system.** In particular, a focused capacity market, say its advocates, paves the way to new financing structures for flexible generation facilities and demand side flexibility. Flexible and low-emission generation capacity and demand side management should be explicitly promoted in a focused capacity market. Advocates of a decentralised model see this differently: in a decentralised capacity market, flexibility is fostered by the central role given to suppliers and balance responsible parties. The model is based on demand and fosters flexibility.

In contrast, the majority of consultation participants basically place their faith in a further developed electricity market (electricity market 2.0). This is a large group of consultation participants, including most of the Länder and companies in the energy industry, energy industry associations, industrial associations and business associations, representatives from neighbouring countries and environmental associations. Many of these consultation participants want to back up the electricity market 2.0 with a reserve. In some cases, e.g. Thuringia or business associations, the introduction of a capacity market is regarded as a last resort should the electricity market 2.0 fail.

The consultation participants make three key arguments in favour of a further developed electricity market (electricity market 2.0):

1. **A further developed electricity market could continue to deliver security of supply in future.** This argument is widely shared by the advocates of the electricity market 2.0. In an electricity market 2.0, say e.g. BEE, BKartA and Wärtsilä, power plants and flexibility options would be refinanced via the market mechanisms. BASF, TenneT and FÖS for example stress that the current low prices are a normal market response to overcapacities. The remuneration of capacities is, says e.g. BKartA, possible in the electricity market 2.0 because the market mechanisms reward not only the energy generated but also the provision of capacity via price signals – e.g. the futures markets. It is therefore important, e.g. for Österreichs Energie, that pricing remains free in future and price peaks are permitted on the wholesale market. The repercussions on consumers due to occasional price peaks would remain small. This is the view of business associations, Länder and consumer advocates. If necessary, consumers can hedge via a wide range of secure futures contracts, says WV Stahl. Also, strong incentives to uphold balancing group commitments in an electricity market 2.0 would boost investment in flexibility, say e.g. Repower and TenneT.

2. **A capacity market would be a substantial intervention in the competitive electricity market and would entail high (cost) risks.** This argument can be found in very many comments from the advocates of electricity market 2.0. An electricity market 2.0 is – says e.g. BVMW – the cheaper alternative way to ensure security of supply. Many consultation participants stress that capacity markets would in contrast represent a substantial and irreversible intervention in the market. They would entail considerable costs, overcomplexity, market power problems, risks and side effects. Right across the stakeholder structure, consultation participants refer to various such risks. Not least, participants such as BfE Switzerland and others and e-control consider them as being incompatible, or difficult to make compatible, with the European internal market.

3. **A capacity market would hamper the necessary transformation of the energy supply system.** This view is taken by the advocates of the electricity market 2.0, again across all stakeholder groups, and in particular several Länder and the representatives of renewables and environmental associations, as well as UBA und BKartA. Different participants cite different reasons for this: an electricity market 2.0 is the more sustainable alternative way to ensure security of supply. Capacity markets would have negative effects on the market and system integration of renewable energy, would increase carbon emissions, would not be ecological and would delay the energy transition and the renewal of the power plant fleet. They would weaken the price signals of the electricity markets and thus impede the necessary flexibilisation of the electricity system.

Further to this, many consultation participants call for a more detailed study of the potential of demand side management. This call is made both by consultation participants in favour of an electricity market 2.0 and consultation participants arguing for a capacity market. Effects on industry should – say the business community and certain Länder – be studied in greater depth. Also, Brandenburg and EnerNoc, for example, call for a study into whether further steps are needed to support demand side management.

Despite differing positions, many participants have shared, key interests. The Federal Ministry for Economic Affairs and Energy has taken account of these interests, discussions with stakeholders in society, and various reports and studies in its stance on the electricity market (cf. Part II).

Common interests: Reducing risks, realising opportunities

A fundamental decision on the electricity market design is needed. The many years of debate as to whether Germany needs a capacity market or not has created uncertainty amongst producers and consumers. Investment decisions require a clear policy framework. A clear decision on the future electricity market design is therefore necessary.

The consultation provides important input into the fundamental decision. The Green Paper – White Paper process enables a decision which is as transparent, clear and open as possible. In addition to the consultation, expert reports and assessments feed into the fundamental decision, along with a large number of discussions with government authorities, businesses, stakeholders in society and neighbouring countries.

The stakeholders take different positions on the fundamental decision. There is no clear assessment shared by all relevant stakeholders. Some are in favour of, and some are against the introduction of a capacity market (cf. Chapter 2.1).

The fundamental decision requires a weighing up of risks and opportunities. The fundamental decision should limit the main risks and at the same time open up as many opportunities as possible for the stakeholders involved so that the future can be shaped in a positive manner.

The consultation participants show which risks and costs are most important to them. The main interest of the consultation participants is that security of supply should remain ensured. This should be the main criterion for the future electricity market design. Furthermore, the costs should be limited, German business should benefit from the opportunities of the energy transition, and a sustainable electricity system should be made possible.

The Federal Ministry for Economic Affairs and Energy takes up the interests cited by the consultation participants. Chapter 3 shows how the fundamental decision takes account of the interests of the consultation participants.

2.2 Interest 1: Ensuring security of supply

The consultation shows that security of supply is the overriding criterion for the future electricity market design. This view is a consensus across all the stakeholder groups. The security of energy supply is one of the overriding goals of energy policy, say for example VDMA and VKU. Security of supply should – as is stressed e.g. by MIBRAG – therefore be maintained at the current high level. Only if the standards of security of supply remain high, say e.g. EWE, Lower Saxony and North Rhine-Westphalia, will public acceptance of the energy transition remain high.

Many parties stress that security of supply is a central aspect of how attractive Germany is for investors. This view is particularly to be found in the comments by business associations and trade unions, as well as by Bavaria and North Rhine-Westphalia. The secure supply of electricity, say e.g. BDEW and ver.di, is the foundation of the Germany's success as a base for industry and technology. Not least, BDI stresses that the high quality of security of supply is a clear advantage for Germany in the international comparison.

Some stakeholders call for monitoring of the security of supply. The aim of the monitoring, say e.g. Baden-Württemberg and WWF, is to study security of supply with a view to the next several years. TenneT proposes the use of new approaches and methods. When considering this, say the transmission system operators, BDI, Baden-Württemberg and North Rhine-Westphalia, account should also be taken of the European perspective (cf. measure 18).

Security of supply should be defined. In the view e.g. of BDI, it is crucial to understand what is meant by security of supply, and what level is to be attained. Various concepts are feasible for a definition of security of supply. In addition to the SAIDI index, which provides information about grid-related interruptions to supply, other countries use probabilistic methods which describe security of supply as a probability variable. These indicators could be used to stipulate a security-of-supply target or standard (cf. measure 18).

2.3 Interest 2: Limiting the costs

The majority of consultation participants call for the costs to be limited. For many consultation participants, cost efficiency is the key goal of the new electricity market design alongside security of supply. Unnecessary costs for companies and consumers should, as is stressed e.g. by BASF, be avoided. Electricity prices for private households and industry should cease to rise, says e.g. IG BCE. BEE, FÖS and Hamburg call for account to be taken here also of external costs, and e.g. BDI and RAP would like to see account taken of the impact on energy efficiency.

In the view of various stakeholders, costs play a role in the various aspects of the electricity market design. For example, a European internal market offers smoothing effects and therefore reduces costs. This is pointed out e.g. by business associations, DGB and RAP. A technology-neutral competition between flexibility options, which is also a widely held position, reduces costs because the cheapest flexibility options win through competition.

Many consultation participants believe it is vital for the international competitiveness of German industry to be maintained. As stressed e.g. by BDI, BASF and WV Stahl, competitive electricity prices are of crucial importance for Germany's industrial future. The new market design must, says BDI, "ensure sufficient secure capacity at the lowest possible total costs, taking account of climate change mitigation and the integration of renewables into the market – at competitive electricity prices for industry". BASF, for example, believes that this particularly applies to energy-intensive industry.

Substantial and unnecessary additional costs for consumers should be prevented. This view is supported across all the stakeholder groups. Honest consideration must be given to additional costs for consumers when all the instruments and options to secure the electricity market are evaluated, say VKU and BDEW. Falling prices on the electricity exchange, says Saxony-Anhalt, should be increasingly passed on to consumers. Consideration should also be given to distribution effects between consumers and producers (says e.g. vzbv) and between energy-intensive industry, commerce, trade and private households (says e.g. IASS). In the eyes of FÖS, costs should not merely be minimised, but also distributed fairly.

Costs due to new subsidies and regulatory risks should be avoided. This is another call which enjoys widespread support. Politically induced cost increases and subsidy-driven increases in electricity costs should be avoided, says e.g. EIKE. Amongst others, North Rhine-Westphalia stresses that new subsidies which are no longer required after the existing grid congestions have been removed, should be avoided. Decisions should be reversible wherever possible. UBA and Berlin attach importance to this point. Also, risks due to market power and parameterisation should be avoided, says e.g. BKartA.

2.4 Interest 3: Making innovation and sustainability possible

Decisions on the electricity market design should take into consideration repercussions on the transformation of the electricity supply system. This point is raised by all sorts of stakeholders, from BDI to BUND, from BWE to e2m and from IG Metall to BITKOM. Several Länder also call for this. Many stakeholders want not only a cost-efficient, but also a sustainable and environmentally compatible security of supply. A structural change in the German power plant fleet is necessary, particularly in the view of environmental associations, IASS, SRU and Hesse, but in the view of BDI, IASS and Saxony should not stipulate any specific technologies in advance.

A holistic approach must be taken to the electricity market design. This is a widespread call. The goals of the energy transition and the expansion of renewables, the new electricity market design and the Federal Government's climate change mitigation strategy must be coherent. An isolated consideration of renewables on the one hand and of conventional energy on the other, says e.g. AmCham Germany, is not helpful. The BDI concurs: A "holistic perspective" is needed. Only this results "in a solution which is efficient in terms of total costs". For some private individuals, as well as Lower Saxony, social acceptance of the energy transition is another important factor.

Many stakeholders stress the opportunities deriving from the transformation of the electricity supply system. RWE stresses that the energy transition entails risks and opportunities for the parties involved. BEE and Klima-Bündnis stress that the Renewable Energy Sources Act itself has generated innovation, advances in technology and jobs. According to Saxony, further export opportunities for German firms are to be found in an environmentally compatible use of conventional energy if the energy transition in Germany combines renewable energy with an environmentally compatible use of conventional energy. BNE stresses that business opportunities could also derive from digitisation.

The energy transition offers the opportunity to develop innovations and to modernise the industrial society. Trianel regards the energy transition as a driving force for innovation for efficient technologies which cut or prevent carbon emissions and ensure the necessary flexibility in the electricity sector. According to BEE, the further development of the electricity market offers the prospect for many different innovations. The key innovations for the energy transition include, says e.g. EnerNoc, storage, demand side management and the construction of highly flexible, environmentally friendly power stations. Here it is important for the BDI that industry should provide demand side management only on a voluntary basis and in line with the attractiveness for individual business operations.

Innovation requires market-based structures and free competition. Various stakeholders right across the spectrum cite this aspect. Innovation should be incentivised via market design and not via artificial price limits. This is important e.g. for VG PowerTech and BKartA. The market will itself develop new solutions for the energy transition. For example, a technology-neutral competition for flexibility options will boost the necessary innovation, says e.g. Schleswig-Holstein. Hamburg also stresses that the greatest possible internalisation of external costs stimulates innovation.

A stable long-term policy environment is crucial for a successful transformation. This viewpoint is important to many business and Länder representatives in particular. The market design must function in the long term; strategy decisions must be viable in the long term (e.g. VDMA, ZVEI).

The electricity market should be developed further in line with renewable energy. This call is made by participants in all groups of stakeholders. Wind and PV are the new lead technologies, according to BEE, representatives of science, Rhineland-Palatinate and the Danish Energy Ministry. Saxony-Anhalt stresses that renewable energies will set the pace for the technical system and the market design. For this reason, renewable energies must also become more market-oriented. The BDEW feels that their market integration should be addressed in the context of the Green Paper. Also, the energy markets must themselves develop further in line with the requirements of the transformation process, say several private individuals and e.g. several Länder.

Part II:
The fundamental decision: electricity market 2.0

Having weighed up all the arguments, the Federal Ministry for Economic Affairs and Energy has decided to develop the electricity market into an electricity market 2.0. It will propose a reliable legal framework that investors can rely on and which allows electricity consumers to independently determine through their demand how much capacity is maintained. This fundamental policy decision is based on the existing expert reports, the consultations on the Green Paper, and numerous discussions with the Länder, parliamentary groups of the Bundestag, neighbouring countries, the European Commission, and businesses and associations, e.g. in the Electricity Market Platform. In taking this decision in favour of the electricity market 2.0, the Federal Ministry for Economic Affairs and Energy is making an explicit commitment to the liberalised, European electricity market. The decision is driven by three justifications: the electricity market 2.0 firstly ensures security of supply, secondly is cheaper, and thirdly enables innovation and sustainability (Chapter 3). This means that it meets the interests of the consultation participants. Measures from three components develop the existing electricity market into the electricity market 2.0 (Chapter 4).

Electricity market 2.0 instead of capacity market: a fundamental decision

The decision on the future electricity market design determines the fundamental direction of policy. It determines the conditions in which the electricity market will develop in the coming decades.

The decision will determine the development of the electricity market in the coming decades. The debate on the electricity market design has led to uncertainty amongst the market players. Power plant operators have not decommissioned capacities because they hoped for new payments for these power stations; market players have withheld investment in capacity because they were unsure how the market would develop in future. For this reason, the decision to opt for an electricity market 2.0 or a capacity market is a fundamental decision. The proposal by the Federal Ministry for Economic Affairs and Energy creates a reliable basis for planning by investors.

Having weighed up all the arguments, the Federal Ministry for Economic Affairs and Energy has opted for a further developed electricity market (electricity market 2.0). In taking this fundamental decision, the Ministry has taken account of key studies and expert reports on the electricity market design. These include four expert reports on the electricity market design commissioned by the Ministry (Frontier, Formaet 2014, Frontier, Consentec 2014, r2b 2014, Connect 2014) and the Leitstudie Strommarkt 2015 (Connect 2015a). The Ministry has also considered the outcome of the consultation (cf. Part I), the dialogue with the participants in the Electricity Market Platform, and numerous discussions with stakeholders in society.

In taking this decision in favour of the electricity market 2.0, the Federal Ministry for Economic Affairs and Energy is making a commitment to the liberalised, European electricity market. Until 1998, electricity utilities had fixed supply areas. The electricity supply and the grid were generally owned by the same party. These monopolies were broken up. Since then, competition has ensured a more efficient electricity supply. In parallel, the coupling of national markets has meant that electricity is generated and traded more efficiently today and that less capacities are needed nationally in order to ensure security of supply. This brings down the cost of the electricity supply. The electricity market 2.0 builds on the liberalised, European market and continues this development.

Chapter 3:
Reasons for the electricity market 2.0

Having weighed up all the arguments, the Federal Ministry for Economic Affairs and Energy has opted for a further developed electricity market (electricity market 2.0). The decision is mainly based on three reasons: firstly, the electricity market 2.0 ensures security of supply (3.1); secondly, the electricity market 2.0 is cheaper (3.2); thirdly, the electricity market 2.0 permits innovation and sustainability (3.3).

3.1 Reason 1: The electricity market 2.0 ensures security of supply.

In an industrialised country like Germany, security of supply is of very great importance and must not be imperilled. The Federal Ministry for Economic Affairs and Energy is convinced that a further developed electricity market can deliver security of supply. The existing capacity (generators or flexible consumers) is sufficient for the next few years. Also, the necessary capacities can be remunerated via the market mechanisms. Capacities can adequately cover the fixed costs e.g. on the short-term spot markets, the long-term futures markets, the balancing markets and in option or hedging contracts. In order to ensure that this remuneration functions via market mechanisms, price formation must remain free. Also, the balancing group and balancing energy system provides the electricity suppliers with strong incentives to balance the balancing groups and to meet their supply commitments.

The electricity market 2.0 ensures a secure supply of electricity

Security of supply on the electricity market exists when supply and demand can match at all times. Consumers can then always obtain electricity when their willingness to pay (benefit) is higher than the market price (cost). In other words, there must be sufficient capacity available even in times of the highest level of demand (which is not covered by wind or PV). Capacity includes conventional power stations, renewable energy installations, and also flexible consumers and storage facilities. Contracts must be agreed and used for the necessary quantity of such capacity. Security of supply is the key interest of the consultation participants in the fundamental decision (cf. Chapter 2).

Security of supply must be approached from a European angle. Germany is located at the heart of Europe. The German electricity market is already closely linked to the electricity markets of its neighbouring countries (cf. Figure 7). The currently available transport capacity amounts to approx. 20 GW and permits cross-border trade in electricity (r2b 2014). Thanks to large-scale smoothing effects, particularly for maximum peak loads and the feed-in from renewables, security of supply can be achieved more cheaply in the European internal market. The joint peak load is smaller than the sum of the national peak loads. As a consequence, less capacity (conventional and renewable power plants demand side management and storage) has to be maintained.

Two new reports show that, in the market area of relevance to Germany, the capacity for the coming years is adequate. At present, there is 60 GW of overcapacities in the German and European electricity market (TSOs 2014, ENTSO-E 2014). There will continue to be adequate capacity in this area in the coming years. This is confirmed by two current reports on the development of security of supply based on the best-guess forecasts of capacity development by the European transmission system operators – i.e. the most likely development in the view of the European transmission system operators.[6] They look at Germany, France, Austria, Switzerland and Benelux for the period up to 2021 (Pentalateral Energy Forum 2015) as well as Germany and its "electrical" neighbours for the period up to 2025 (Consentec, r2b 2015). Both reports are milestones in the monitoring of security of supply on electricity markets.

6 The best-guess forecasts for the European transmission system operators actually neglect the potential of back-up power plants and only take very small proportions of the useful potential for demand side management into account. Flexibility options like back-up power plants and demand side management can however make a greater contribution towards security of supply in future.

Figure 7: Market area of North-Western European market coupling of day-ahead markets

Source: Connect (2015a)

For the first time, the calculations take account of smoothing effects resulting from cross-border trade in electricity. The findings show that these smoothing effects can make a major contribution towards security of supply.

The reports also show that the cross-border trade in electricity will become more important as renewables are expanded. The analyses by Consentec and r2b Energy Consulting looked more deeply into the residual peak load for Germany and its "electrical neighbours". The residual load is the demand which needs to be covered by the rest of the power plant fleet after deducting generation from wind and solar power. The analyses show that in the market area of relevance to Germany, including its "electrical neighbours", the *simultaneous* residual peak load is at least 10 GW lower in 2015 and at least 20 GW lower in 2025 than the total of the respective national residual peak loads in the same area. These cross-border smoothing effects can be used on the electricity market to the extent permitted by available cross-border transport capacity. These cross-border effects can allow to achieve security of supply to be achieved more cheaply because less capacity has to be maintained.

Expert reports for the Federal Ministry for Economic Affairs and Energy say that the electricity market 2.0 can ensure security of supply in the long term. In 2014, the Federal Ministry for Economic Affairs and Energy published four expert reports on the electricity market (Frontier, Consentec 2014, Frontier, Formaet 2014, Connect 2014, r2b 2014). In these reports, the consultants Frontier Economics, Formaet, Connect Energy Economics and r2b Energy Consulting studied whether the electricity market in principle incentivises sufficient capacity to supply consumers reliably with electricity, or whether an additional capacity market is needed. The experts find that a further developed electricity market can incentivise sufficient capacity to ensure a secure electricity supply for consumers. They took account of flexibility options like demand side management and back-up power systems.

Not all capacity, just the required capacity has to be remunerated in order to ensure security of supply. It is likely that hardly any new power stations will be needed in the next ten years. Beyond the power plants currently under construction and the reactivation of a few installations which have temporarily been decommissioned, only a few peak load capacities like internal combustion engines and gas turbines will be needed (r2b 2014). These flexible installations have low investment costs and can be built quickly. Their operation is profitable even if the periods of utilisation are short. At the same time, other flexibility options like demand side management and back-up power systems will become more important.

A capacity reserve safeguards the electricity supply. By creating a capacity reserve, we are providing a further back-up for the electricity market 2.0. Unlike the "capacity market", the capacity reserve consists solely of power stations which do not participate on the electricity market and do not distort competition and pricing. These power stations will be used only if, despite free price formation on the wholesale market and contrary to expectations, supply does not cover demand at a particular time. The capacity reserve ensures that all consumers can still obtain electricity in such a situation.

Functioning of the electricity market[7]

The electricity market consists of various submarkets. Electricity is traded on the electricity exchanges and over the counter. On the exchanges, companies can buy and sell standardised products on short-term spot markets and long-term futures markets. In over-the-counter trading, the parties conclude bilateral non-standardised contracts. Also, the transmission system operators invite bids to supply balancing capacity in order to offset unpredictable deviations.

The submarkets make short-term and long-term trading in electricity possible. The spot market consists of the day-ahead market and the intraday market. On the day-ahead market, electricity supplies for the next day are traded. On the intraday market, the market actors can trade in electricity up to 45 minutes before it is supplied. On the futures markets, companies can trade electricity several years in advance. These products are known as "futures" on the exchange. For example, trading can take place up to six years in advance on the European Energy Exchange (EEX). In over-the-counter trading, people talk of "forwards".

7 The way the electricity market functions is explained in detail in Chapter 1 of the Green Paper.

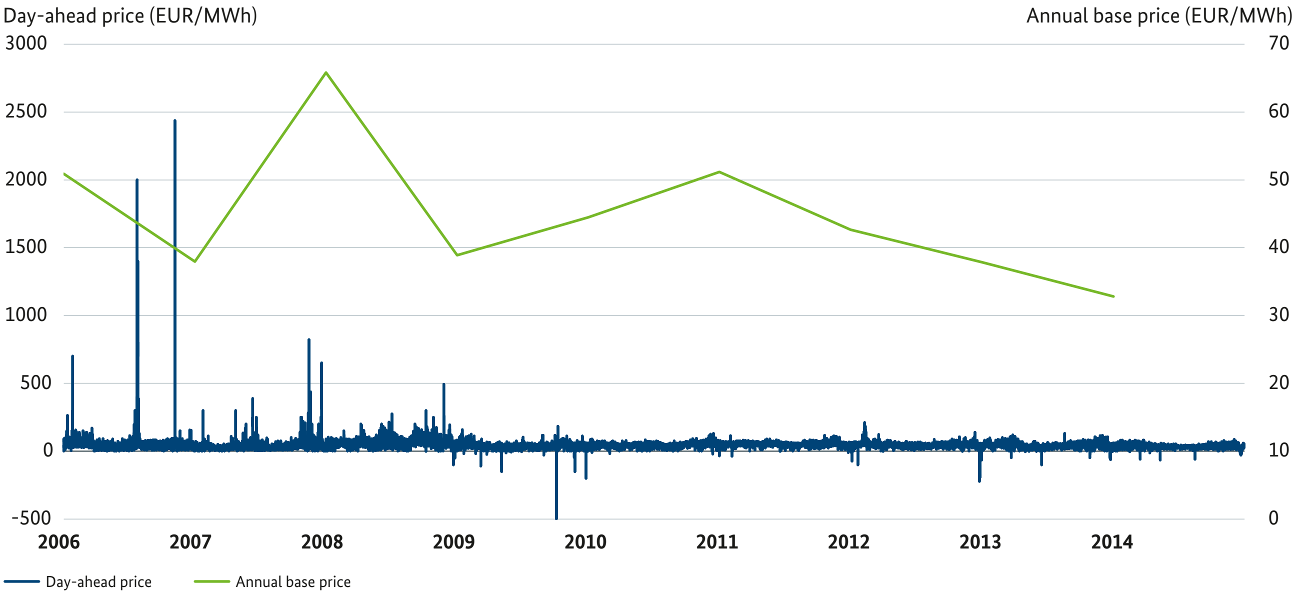
The price on the exchange is set at the point where supply and demand come together. The suppliers with the lowest variable costs are dispatched first on the electricity market (merit order). This minimises the cost of supplying electricity. In a competitive electricity market, the price of electricity on the exchange corresponds to the variable costs of the most expensive generating installation in use. This installation is the "marginal installation"; the price on the exchange is the "marginal cost price". In the event of high electricity demand, flexible consumers can also match supply and demand based on their opportunity costs. In this case, the demand-side sets the electricity price.

The necessary capacities can be remunerated in the electricity market 2.0

The reduction in overcapacities and the expansion of wind and solar power change the market prices but not the market mechanisms. The basic market structures like spot and futures markets, over-the-counter trading and the balancing markets remain in place (cf. box on functioning of the electricity market, pp. 32f.). However, the market prices change. There are two main reasons for this:

- **Firstly, the reduction in overcapacities of conventional power stations results in more scarcity in the electricity system.** Price peaks signal these scarcities. The frequency and the level of the price peaks depends chiefly on the extent and nature of the flexibility options used (Connect 2015a, r2b 2014, Frontier, Formaet 2014). In a flexible market, it can be expected that regular, moderate price peaks will occur on the wholesale markets. In today's market situation, the existing overcapacities are reflected in a lack of price peaks and low prices in long-term contracts (cf. Figure 8)[8].

Figure 8: The current overcapacities are preventing price peaks and are reducing the prices on the wholesale market



Source: Connect (2015a)

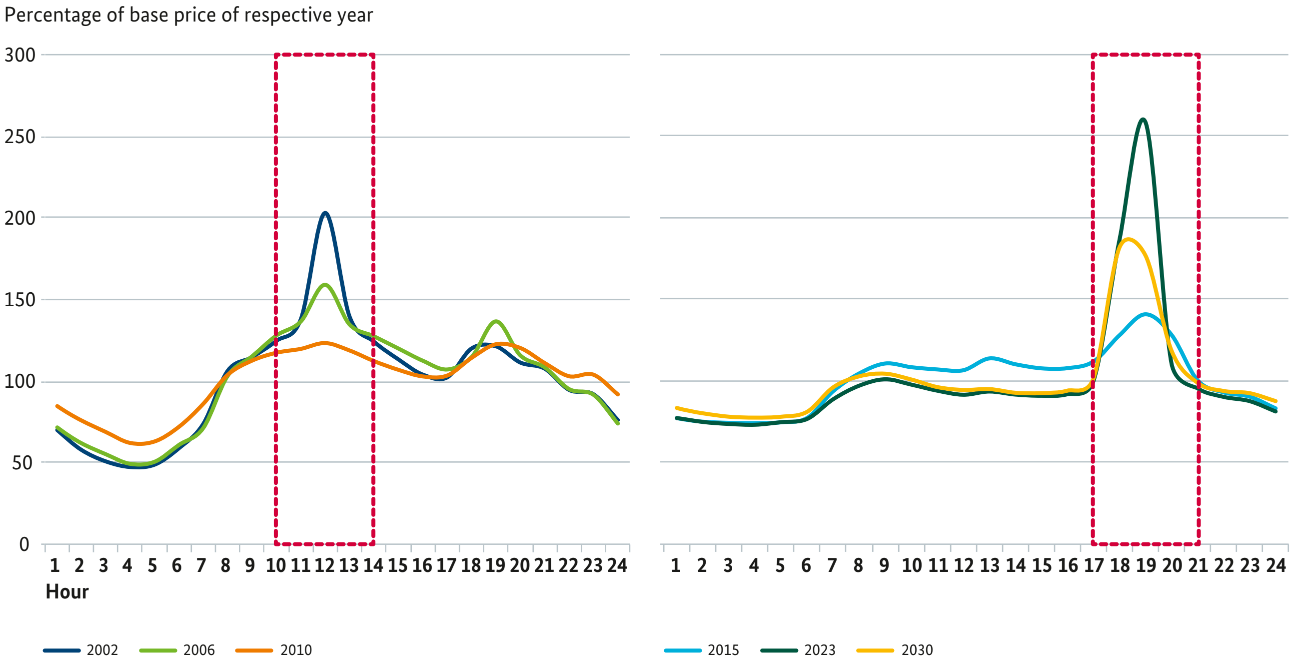
8 Today's prices are comparable to those of the early years of liberalisation, when overcapacities built up in the monopoly years also resulted in a low price level and low price volatility (Connect 2015).

- **Secondly, the expansion of wind and solar power is changing the point at which different capacities set the electricity prices.** Following adjustments to the power plant fleet, the expansion of wind and solar power means that residual demand is being covered more and more by flexible capacity (peak load capacity) than by large power stations (base load capacity). Whilst the variable costs of wind and solar are close-to-zero, the flexible capacities have higher variable costs. As a consequence, the electricity price will fluctuate more strongly and more frequently: in times when there is a lot of wind and sun, it will be low; when there is no wind or it is dark, it will be determined by relatively expensive flexible capacities. Electricity from PV installations reduces the traditionally high midday prices. Instead, price peaks will tend to occur more often in the early evening hours (cf. Figure 9).

The electricity market 2.0 will continue to offer various ways to remunerate the required capacity. Capacities like conventional power stations will still be able to trade electricity on the short-term spot markets and long-term futures markets as well as over the counter. Also, they can obtain further revenues, e.g. by providing balancing capacity (cf. box on remuneration of capacities, p. 37).

The electricity prices will continue to permit contributions towards the fixed costs of frequently needed capacities. The price of electricity on the exchange generally corresponds to the variable costs of the most expensive generating installation needed. Capacities whose variable costs are lower than the variable costs of the most expensive required generating installation needed therefore earn contributions towards their fixed costs: they earn a margin to cover their fixed operating and capital costs, since the price of electricity on the exchange is higher than their variable costs.

Figure 9: In future, higher prices are tending to shift from midday to early evening hours



Sources: Frontier, Formaet (2014) and BET (2015)

Price peaks mean that capacities which are rarely used can cover some of their fixed costs. Positive price peaks mean that all the required capacities can cover more of their fixed costs: at times of very high demand, installations can either attract bids higher than their marginal costs, or the balancing will take place via demand side management. In both cases, the price on the electricity exchange can exceed the variable costs of the most expensive generating installation and thus contribute to the remuneration of fixed operating and capital costs.

Frequent, moderate price peaks suffice for remuneration. In the model calculations of the expert report by r2b commissioned by the Federal Ministry for Economic Affairs and Energy, the price peaks required for the refinancing of investment are well below the technical price limit of the EPEX SPOT day-ahead market. The ten most expensive hours in 2020 are on average less than 200 euros/MWh, and the most expensive hour is approx. 400 euros/MWh. In 2030, the ten most expensive hours in 2020 are less than 700 euros/MWh, and the most expensive hour is approx. 1200 euros/MWh (r2b 2014). If demand side management and back-up power systems are less available than assumed in the expert report, the electricity market 2.0 will still function. The price peaks are then higher but also rarer.

Long-term contracts will continue to offer ways to remunerate dispatchable capacity. Long-term contracts are used by buyers – e.g. electricity suppliers or large users – to hedge against the risk of price volatility on the electricity market. They are willing to pay premiums for this. This opens up further revenue opportunities for the sellers. Long-term contracts, together with price peaks on the spot markets and other remuneration opportunities, therefore incentivise investments in the required capacity in the electricity market 2.0.

Long-term supply contracts already reward capacities for the reliability of their output. On the futures markets, electricity can be traded for individual days, weeks, months and quarters and even entire years. The buyer – e.g. an industrial enterprise – pays an additional premium for receiving a quantity of electricity at a set price known to it in advance. Via these long-term supply contracts, dispatchable capacities can actually profit directly from higher feed-in from renewables. If a power generator has already sold its generating capacity on the futures market, it can design its commercial strategy in a way that it benefits from a high feed-in of wind and solar power. If the electricity prices on the spot market drop below the variable costs of its own installation, it can reduce or switch off its own production, buy electricity at lower prices on the spot market, and thus meet its supply commitments. This enables it to save its fuel costs whilst still meeting its commitments to supply electricity.

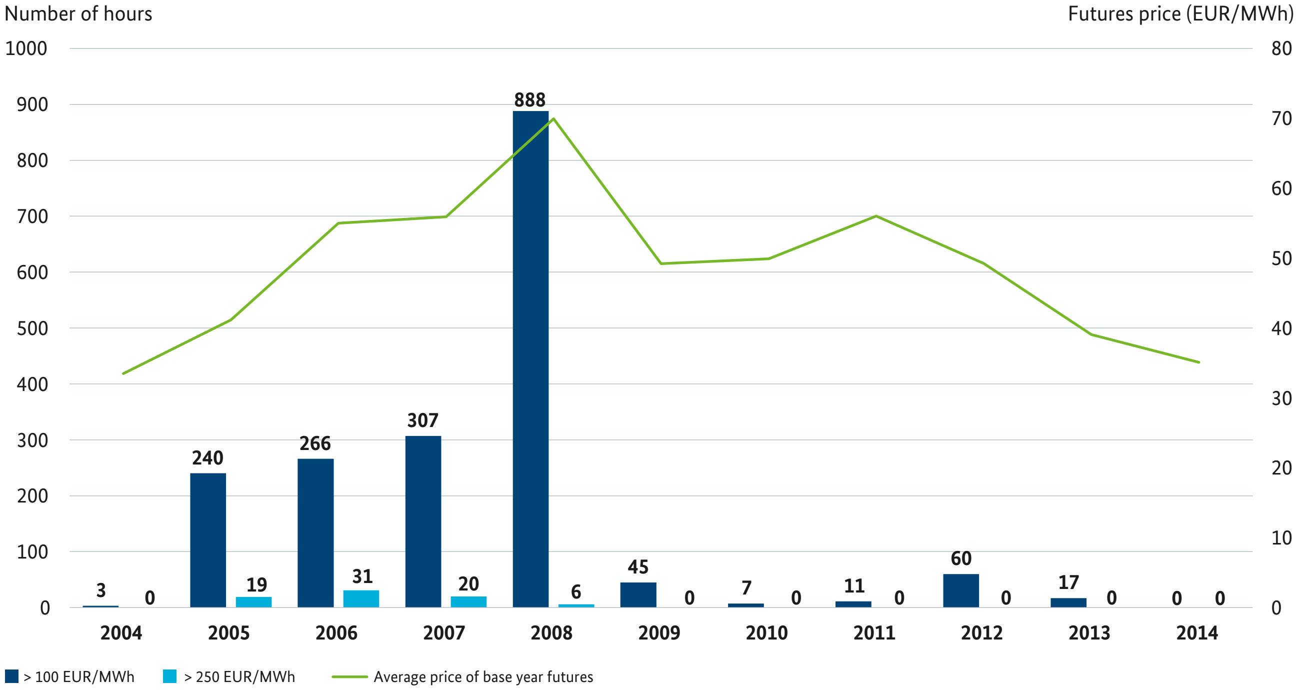
Consumers can hedge against price peaks and profit from their flexibility via long-term contracts. Electricity suppliers offer residential customers tariffs based on the average wholesale prices. Even sharp price peaks lasting a few hours have virtually no influence on the average wholesale price. Residential customers are hedged against price peaks on the wholesale market by fixed tariffs. In contrast, large-scale industrial consumers can actually profit from price peaks via long-term contracts: they hedge their electricity deliveries on a long-term basis at favourable prices. When price peaks occur on the wholesale market, they can then earn additional revenue by selling the electricity they have already purchased at a low price on the wholesale market – to the extent that they are able to shift the timing of their own electricity demand.

Long-term option or hedging contracts offer further possibilities to hedge against risks. Alongside long-term supply contracts, there are also long-term contracts which hedge against price and quantitative risks. For example, option contracts give market players the right to buy or sell electricity at a predetermined price. They allow a replacement purchase to be made when the electricity prices on the exchange change unfavourably. For example, if an industrial company only convers part of its electricity demand via long-term supply contracts, it can also purchase a call option: if the prices develop unfavourably, the company uses the option and obtains electricity at a predetermined price. If the prices develop favourably, the company purchase electricity on the spot market and does not exercise the call option. Irrespective of whether the company uses the option or not, the seller obtains income from the sale of the option. To help companies hedge even better against price peaks in future, the electricity exchanges are currently developing new projects (cf. box on the activities of the electricity exchanges, pp. 51f.).

More volatile prices strengthen the possibilities to refinance dispatchable capacities from long-term contracts. Prices for long-term contracts also reflect the anticipated frequency of price peaks and the amount that market players are willing to pay to hedge against these price peaks. In principle, the more that scarcities are reflected in price peaks, the more the average prices rise in the long-term contracts (cf. Figure 10). The strength of this correlation depends not least on how strongly not only the consumers but also the power generators wish to hedge against risks. The result is economically efficient prices which make it possible for the capacities to be refinanced at the lowest possible prices for the consumers.

The reduction in overcapacities in conventional power stations and the expansion of renewables are altering the market players' strategies. Market players optimise the deployment of their capacities between the existing markets. They individually assess their opportunities and risks on the basis of the expected price developments. For example, a flexible power station can hedge against higher price volatility on the spot market. If it was previously mainly active on the spot markets, in future it will be able to sell a large proportion of its electricity output via long-term supply contracts or option contracts. Depending on how the prices develop, it additionally sells a smaller proportion of its production on the spot or balancing markets.

Figure 10: Frequency of price peaks on the day-ahead market and average prices of base year futures in the German-Austrian market zone



Source: Connect (2015a)

Remuneration of capacities via market mechanisms

The electricity market offers many ways to remunerate investments. Capacities like conventional power stations, storage facilities and flexible consumers can participate on various markets:

- on long-term futures markets,
- short-term spot markets and
- balancing markets.

Further to this, they can:

- buy and sell electricity over the counter
- or hedge themselves and other market players via bilateral contracts (option and hedging contracts).

Additional activities generate further revenue opportunities. For example, CHP installations can sell both electricity and heat.

The electricity market pays not only for output but also for capacity. Output means the energy delivered (i.e. kilowatt-hours or megawatt-hours). Capacity means the generation capacity, i.e. the possibility to supply energy (i.e. kilowatts or megawatts). On the spot markets, only electricity output is *explicitly* traded. People frequently call this an “energy-only market”. *Implicitly*, the existing electricity market rewards the provision of capacity via unconditional supply commitments on futures markets, spot markets and in electricity purchase contracts. *Explicitly*, the electricity market rewards capacity, e.g. on the balancing capacity market and in option and hedging contracts.

If they are to refinance themselves, new capacities must earn sufficient amounts to cover their fixed costs. On the one hand, capacities have *variable costs*. The variable costs derive for example from the operation of a power station. In that case, they mainly depend on the fuel costs, the efficiency of the installation or the carbon costs. At the same time, capacities have *fixed costs*. These are mainly capital, maintenance and personnel costs. If new generation capacity is to be able to refinance itself, it needs to cover not only its variable, but also its fixed costs. The market players orient their investment decisions to market price forecasts and long-term price developments.

So that the market mechanisms can function, the electricity market 2.0 relies on free price formation and strong incentives to uphold balancing group commitments.

Electricity prices send important signals to the market players. There are no regulatory price ceilings on the electricity exchange today, only very high technical limits. These can be adjusted by the exchange if necessary. Within the technical limits, the prices on the spot market can already rise to several thousand euros. There are no price limits in over-the-counter trading and in the balancing energy system. Free price formation is important in the electricity market 2.0, since scarce capacities are reflected in price peaks. These price peaks and their anticipation create incentives for generators and consumers to invest in capacity.

For this reason, pricing remains free in the electricity market 2.0. If future price peaks are to be able to incentivise investment in capacity, investors need to be able to rely on government not intervening in the market when there are high price peaks. Component 1 of electricity market 2.0 ensures that prices are formed via competition and that price peaks can occur (cf. Chapter 4). This gives investors a reliable basis on which to plan.

Moderate price peaks can generally be expected when prices are formed freely. The expert report on the electricity market commissioned by the Federal Ministry for Economic Affairs and Energy shows that price peaks in a flexible market can usually be expected to be moderate, e.g. thanks to the use of demand side management and back-up power systems. If a lot of demand side management and back-up power systems can be used at low marginal costs, they can steady the electricity prices (cf. also Green Paper p. 47). In extreme situations, however, higher prices should also be temporarily possible. For example, it is not possible fully to exclude extreme situations in which a sizable amount of generating capacity fails during a period of high demand and low feed-in from renewables. Also, higher price peaks can occasionally occur during the transition period until the market players activate their capacities or adjust their operating and trading processes. In such cases, the price peaks serve as a signal that the market is demanding more flexibility. They are therefore necessary and must be permitted. This has been seen in the past in situations with negative prices. Initially, an increased number of negative price peaks occurred, and then the market players responded. Since then, despite the continued expansion of wind and solar power, the negative prices have remained at a constantly moderate level (Energy Brainpool 2013, Connect 2015a). The price peaks only have a minor impact on the average electricity price, since they only occur in a few hours in total.

Strong incentives to uphold balancing group commitments ensure security of supply. The balancing group and balancing energy system is the key instrument for a secure power supply. Together with the balancing capacity, the balancing group and balancing energy system ensures that at all times just as much power is fed into the electricity grid as is taken from it. This includes the balancing group obligation, the balancing energy system and the obligation to uphold balancing group commitments (cf. box on the balancing group and balancing energy system, p. 39). Component 2 of electricity market 2.0 ensures that incentives to uphold balancing group commitments are strengthened via the balancing energy system (cf. Chapter 4). Balancing energy offsets unpredictable deviations like forecasting errors and power plant failures.

In the electricity market 2.0, greater incentives to uphold balancing group commitments also result in better opportunities to remunerate capacity. In the electricity market 2.0, the reduction in overcapacities and the expansion of renewables mean that price peaks will occur more frequently on the spot markets. These price peaks increase the incentive for the balance responsible parties to hedge via (long-term) supply contracts and option contracts. This is because, if the balance responsible parties rely on purchasing electricity in short-term trading, they will either pay high spot market prices in such situations, or even higher balancing energy prices. For this reason, clear incentives to uphold balancing group commitments via the balancing energy prices will improve the possibilities to remunerate capacities via appropriate contracts.

The rules on the deployment of the capacity reserve increase the incentives to uphold balancing group commitments. The capacity reserve will, if at all, only be used in rare, extreme cases, i.e. when despite free pricing no balancing of supply and demand is possible on the electricity market, and the transmission system operators have already used most of the balancing capacity (cf. measure 19). In these times, the balancing groups will experience very great deviations from their schedules. Then, the balance responsible parties which are responsible for the imbalance will have to bear the costs for the use of the reserve, and an appropriate share of the costs for the maintenance of the reserve. This enhances the effect of the balancing energy prices and provides a further incentive to uphold balancing group commitments.

In future, the role of the distribution system operator will become more important in terms of the upholding of balancing group commitments. Not just the balancing energy prices, but also rules on special balancing groups, are important for efficient balancing group management. For example, distribution system operators are active as differential balance responsible parties.[9] If in future the number of generation installations in households and commercial operations increases, the forecasting of the consumption in the differential balancing groups will become increasingly complex. The Federal Ministry for Economic Affairs and Energy will give greater consideration in future to the question of the obligation to fulfil balancing group commitments in these particular balancing groups (cf. Chapter 6).

9 The majority of small-scale consumers are not capacity-profiled. Standardised load curves approximate their consumption patterns. The differential balancing groups offset the deviations between these load curves and the actual power used by the consumers. The distribution system operators must manage the differential balancing groups, i.e. they offset the anticipated discrepancies between standard load curves and actual power consumption by buying or selling on the electricity market.

How does the balancing group and balancing energy system work?

The balancing group and balancing energy system is the key instrument for synchronising generation and consumption. Together with the balancing capacity, the balancing group and balancing energy system ensures that at all times just as much power is fed into the electricity grid as is taken from it. The balancing group and balancing energy system includes the obligation to include all generators and consumers in balancing groups (balancing group obligation), to report balanced schedules on the basis of demand and generation forecasts (obligation to uphold balancing group commitments), and to offset residual deviations from the schedule using balancing energy (balancing energy system).

The balancing group system makes it possible to account for and bill power generation and consumption. Balancing groups are virtual energy quantity accounts. They register and account for the quantities of electricity fed into the grid by producers and taken from the grid by consumers. This makes it possible to monitor whether contractually agreed supply and take-off commitments have been met. Deviations are systematically registered and billed.

Every generator and consumer in Germany is included in a balancing group (balancing group obligation). A balancing group includes for example the power stations of a power plant operator or the entire generation and demand of an energy utility. Also, there are pure trading balancing groups, which only cover traded electricity. Each balancing group is represented by a balance responsible party (e.g. electricity supplier or trader) in relations with the transmission system operator. In the schedule report, the balance responsible parties report how much electricity they want to feed into or take from the grid for each quarter hour of the following day. The schedules also cover the planned exchange of electricity with other balancing groups in line with the outcome of the electricity market.

The balance responsible parties are obliged to meet their balancing group commitments. Each balance responsible party is responsible for ensuring a balanced quarter-hour account in its balancing group (obligation to uphold balancing group commitments). The schedules must be balanced for every quarter hour, i.e. all the planned take-offs and quantities of electricity which are sold must correspond to the planned feed-ins and the purchased quantities. Deviations from the registered schedule are only permissible for unpredictable deviations. Short-term power station failures and unavoidable forecast errors for demand and renewables cause these unpredictable deviations.

Deviations between generation and consumption are offset physically by the use of balancing capacity. Unplanned power plant failures or erroneous weather and consumption forecasts can result in deviations between generation and consumption. The use of balancing capacity physically offsets these deviations. The balancing capacity thus ensures that the discrepancies between the registered schedules and the actual situation are offset throughout the entire balancing zone.

The cost of balancing energy is the central incentive to synchronise generation and consumption. The costs of the use of the balancing capacity are billed via the balancing energy system. If a balance responsible party causes a need to use balancing capacity, it has to bear the costs of this. The balancing energy costs act like a penalty payment for deviations from the registered schedule. They provide the central incentive to balance the balancing groups. In this way, the balancing group and balancing energy system creates incentives for the balance responsible parties to keep deviations from the reported consumption and generation quantities low.

3.2 Reason 2: The electricity market 2.0 is cheaper.

The Federal Ministry for Economic Affairs and Energy is convinced that a further developed electricity market is cheaper than a power supply system with an additional capacity market. This is the second reason for the decision to opt for an electricity market 2.0: capacity markets are susceptible to design error. These errors can result in substantial costs. The electricity market 2.0 can provide the required capacities and the solutions to integrate renewable energy more cheaply. This requires undistorted competition between the flexibility options. For this reason, the Federal Ministry for Economic Affairs and Energy is successively reducing the barriers to flexibility.

The electricity market 2.0 is cheaper than a capacity market

The export reports commissioned by the Federal Ministry for Economic Affairs and Energy find that an electricity market 2.0 is cheaper than an electricity market with an additional capacity market. In theory, perfectly designed capacity markets with the same level of capacity as an electricity market 2.0 have the same costs. The export reports commissioned by the Federal Ministry for Economic Affairs and Energy show that the models for capacity markets which are currently being discussed in Germany result in a higher level of capacity and thus in higher costs. The reports compare the total costs of an electricity market 2.0 with the costs if various capacity market models were introduced (Frontier, Consentec 2014 und r2b 2014). An electricity market 2.0 leads to the lowest total costs. This remains the case when an additional capacity reserve is introduced.

Due to cost risks, capacity markets can engender substantial extra costs for the whole system. The expert reports commissioned by the Federal Ministry for Economic Affairs and Energy find that the differences between the total costs of the most-discussed capacity market models are moderate if they assume a perfect, well-informed system planner in the simulations (Frontier, Consentec 2014, r2b 2014). However, there are considerable extra costs when the system planner makes mistakes and does not set optimal parameters. A capacity market particularly requires stipulations to be made about the product design and (directly or indirectly) the desired capacity level. These stipulations are prone to error and can substantially increase the system costs.

Due to the complexity, design errors in the development of a capacity market are highly probable. Errors in the design of capacity market are almost unavoidable in reality. This is because the regulator has to make stipulations e.g. about the desired capacity level or product design on the capacity market on the basis of incomplete information and uncertainties. Also, capacity markets are extremely complex. They represent a far-reaching intervention in the market. The repercussions of such an intervention are difficult to predict. A number of failed capacity markets show that the market responds sensitively to errors in the market design (Ockenfels 2011). The greater the intensity of intervention of the mechanisms, the higher the cost risks. Experience gathered abroad shows that it is highly likely that the regulators will have to repeatedly fine-tune. This creates the danger that further state intervention in the market will be needed. The example from the U.S. of PJM shows how the degree of regulation can deepen[10]. The capacity mechanism in PJM started relatively simply, but now embraces a set of rules of 40 guidelines of 600 pages (Frontier, Consentec 2014).

A central cost risk: capacity markets tend to result in undesired overcapacities. In a capacity market, the regulator takes an administrative decision which stipulates the desired level of capacity – either directly as in a central, comprehensive capacity market, or indirectly via a penalty as in a decentralised capacity market. This level of capacity tends to be higher than the level of capacity resulting from an electricity market 2.0. Depending on how willing the regulator is to take risks, or on errors in the design, the administrative requirement quickly results in an unnecessarily high capacity level. The consumers have to bear the costs of the surplus capacities. The expert reports describe this effect as a cost risk and illustrate the additional costs for the individual capacity market models (cf. Figure 11).

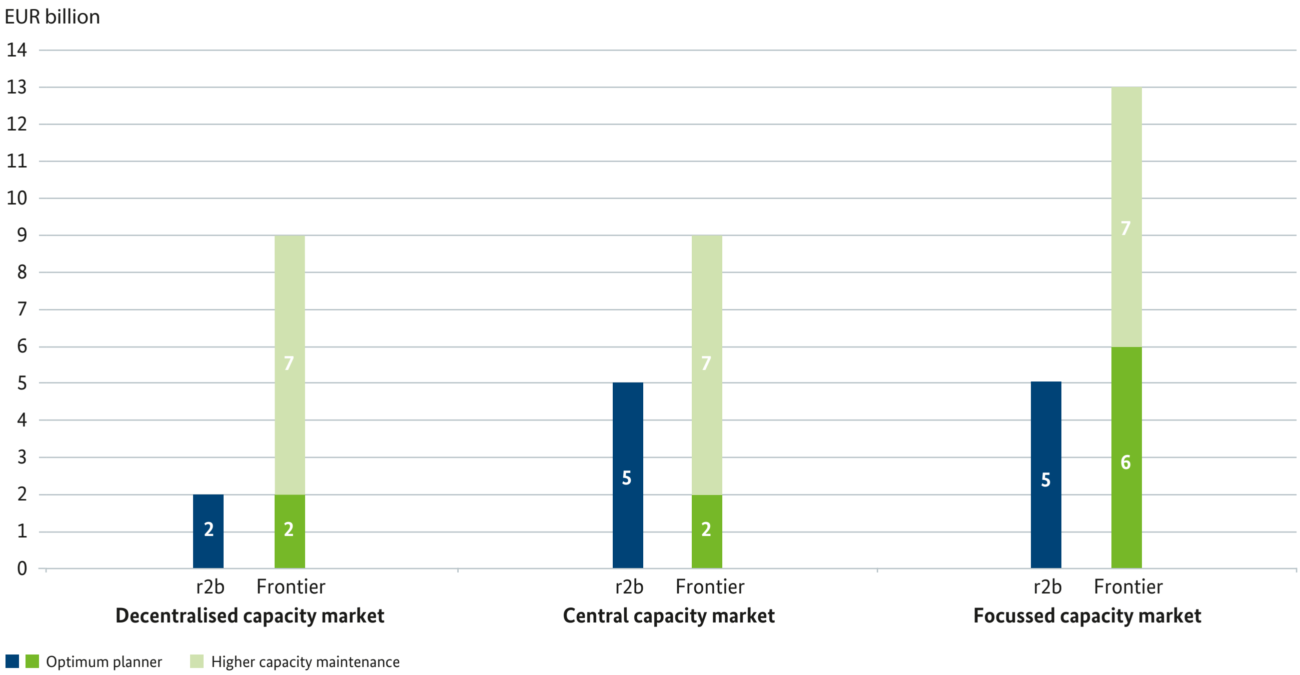
10 PJM ("Pennsylvania-New Jersey-Maryland") is a regional transmission system in the United States. It covers the states of Delaware, Illinois, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and District of Columbia.

Further cost risks: capacity markets can result in market power problems and disrupt the European process of internal market integration. Errors in the design of capacity markets create a danger of misuse, e.g. the exercise of market power. The Bundeskartellamt stresses that the "supervision of abuse of dominant market positions on markets for power plant capacity are [likely to be] considerably more complex" than on the existing electricity market (Bundeskartellamt 2015). If national capacity markets are insufficiently coordinated, they can impede the integration of the European internal market. A further cost risk lies in the fact that capacity markets are not good at determining the cheapest solutions for the integration of renewables (cf. next paragraph).

The electricity market 2.0 develops cost-efficient solutions for the integration of renewable energy

The electricity market 2.0 makes it possible to have a technology-neutral competition between the flexibility options. There are various ways to integrate wind and solar power at low costs. The potential of the flexibility options is diverse today, and is much greater than the actual need (cf. box on flexibility options, pp. 11f.). Very many flexibility options are already economic or will become so with further progress in technology and changed electricity prices. They do not require any special funding. The cheapest solutions win through in a technology-neutral competition. New technologies which are still a long way from their market launch can be supported via research funding and pilot projects. In this way, the number of competitive flexibility options rises in the long term and the costs fall.

Figure 11: Higher system costs of capacity mechanisms compared with the energy-only market (EOM) – for Frontier from 2015 – 2039, for r2b from 2014 – 2030[1]



1 The graphic illustrates the cash equivalent of system costs in the r2b model period spanning 2014 – 2030, and the 2015 – 2039 model period for Frontier. In each case the difference is illustrated compared against the optimised electricity market.

Source: Own graphic based on r2b (2014) and Frontier, Consentec (2014)

The electricity market 2.0 incentivises the cheapest solutions for the integration of renewable energy. In the electricity market 2.0, the cumulated knowledge of the market players determines what happens. If there is undistorted competition between flexibility options, the cheapest solutions for the respective needs are selected. In the short term, the market price signals incentivise the use of the cheapest available flexibility options (static effect). The more frequently the market players anticipate the use of a flexibility option, the more the corresponding investment in disseminating and developing technologies pays off (dynamic effect). In this way, the market price signals also stimulate investment in the development of new solutions in the medium term.

In contrast, it is difficult for the regulator to determine the cheapest flexibility options. The regulator has restricted access to the information of the market players regarding the current and future costs and potential of different flexibility options. If fine-tuning is required, the regulator cannot respond quickly. Rather, it has to set a complex adjustment process in motion. If the regulator determines the products used on the capacity market, there is therefore a high risk of erroneous decisions (r2b 2014, Frontier, Consentec 2014). This is irrespective of whether the capacity market model explicitly promotes certain flexibility options or provides for technology-neutral competition. In both cases, the product design would be oriented to a greater or lesser extent to the existing or favoured capacities.

A technology-neutral competition between the flexibility options requires the reduction of barriers to flexibility (level playing field). At present, various barriers distort the price signal from the electricity market for some consumers and generators. This impedes an efficient use and development of the flexibility options. The barriers to f lexibility thus increase the costs of integration of renewable energy. For this reason, the measures of component 2 of electricity market 2.0 reduce barriers to flexibility (cf. Chapter 4). Flexibility options can then win through against each other in competition and do not require subsidies.

Demand side management – contracts for flexible consumers and economically sensible solutions

Consumers play an increasing role on the electricity markets where this enables them to enhance their economic viability. The electricity market is responding increasingly flexibly to the fluctuations in power generation from renewables. We are transitioning from a power system in which dispatchable power plants follow electricity demand to an efficient power system where flexible producers, flexible consumers and storage systems respond to the intermittent supply of wind and solar power.

Demand side management is a commercial decision. In the electricity market 2.0, companies take their decisions on a commercial basis. They are always at liberty to decide whether and how they wish to use demand side management.

Demand side management can cut companies' energy and production costs. Companies can thus shift their production – where this makes technical and operational sense – to times with low electricity prices. In the electricity market 2.0, the reduction in overcapacities and the expansion of renewables will result in more volatile prices (cf. p. 34). When prices are high, it can be commercially interesting for companies to cut their electricity consumption so that they can sell the electricity they bought earlier at a profit on the wholesale electricity market. In line with their commercial decision, the companies can recoup this electricity consumption at a later point in time, i.e. when electricity prices are lower, or refrain from production. When prices are low or negative, companies can profit from the situation on the electricity market and expand their production. In the medium to long term, flexible companies can optimise their production processes in order to structurally reduce their energy costs and thus to boost their competitiveness.

Very different players can utilise demand side management. Large industrial firms in particular can utilise demand side management and thus reduce their energy and production costs (BET 2015). Medium-sized commercial operations can also utilise demand side management. For example, companies with thermal storage units (e.g. refrigeration units, supermarkets) have proved to be “low-hanging fruits” for demand side management (BMWi 2014a).

Example 1: Paper manufacturer UPM already optimises its electricity costs on the electricity and balancing markets.

UPM, a Finnish company from the forestry sector, has a production capacity of up to 4.3 million tonnes of paper a year at its seven factory sites in Germany. It needs several thousand gigawatt-hours of electricity each year to manufacture the paper. So UPM is a company in an energy-intensive sector. For some years now, UPM has been marketing the flexibility of its production processes and industrial power plants on the balancing market. Also, UPM is active on the EPEX SPOT electricity exchange. Here, it is displaying increasing flexibility in adapting – where possible – parts of its production process to the electricity prices so that it can manufacture profitably. For example, according to its own figures, UPM has been able to reduce its electricity consumption by more than 500 MW for several hours where there are price peaks on the day-ahead market. UPM regards this as its contribution towards a functioning electricity market with competitive electricity prices in Germany.

Example 2: Thuringia and Lower Saxony point the way ahead to smart electric mobility.

The project “sMobiliTy – Smart Mobility Thüringen” is focusing on the technical realisation of demand side management via electric mobility (BMWi 2015e). Typically, electric vehicles spend much of the day connected to the grid. Smart control technology already in use enables them to recharge their batteries mostly at times when the wind and the sun are producing a lot of electricity and the prices are correspondingly low. This demand side management can absorb generation peaks from renewable energy sources without the user of the electric vehicles suffering any limitations. The smart charging technology ensures that the vehicle is ready for use at the desired time. The “Demand Response” research project in Lower Saxony shows that electric vehicles will also be able to provide balancing capacity in future (Schaufenster Elektromobilität 2015). The batteries in the individual electric vehicles are switched together to form a large virtual storage unit, the capacity of which earns revenue on the balancing market. This will result in entirely new business models, and the users will also benefit from this. In future, electric vehicles will even be able to feed the stored electricity back into the grid, e.g. at times when electricity demand is high (regarding the coupling of the electricity and transport sectors, cf. Chapter 6).

Example 3: Berliner Bierfabrik and Grundgrün Energie brew cheap beer.

Small and medium-sized electricity consumers can also benefit already from periods of low prices on the electricity exchanges. For example, the power supplier Grundgrün Energie offers an electricity product tied to the price on the exchange for capacity-profiled customers. If the electricity prices fall because a lot of solar power is being produced, the electricity customer can profit from the price development by deliberately shifting its demand. If the prices pick up again, the customer will at most pay an agreed fixed price. The electricity price derives from the multiplication of the consumption registered for each quarter hour with the hourly price of the day-ahead auction on the EPEX SPOT electricity exchange. With the help of a forecast tool, electricity customers can adjust their consumption flexibly to the price on the exchange. The Berliner Bierfabrik uses this product and deliberately shifts electricity-intensive brewing processes to times when there are low or even negative electricity prices. This is an example of how market processes ensure that electricity from wind and the sun can be optimally combined with flexible consumers.

3.3 Reason 3: The electricity market 2.0 enables innovation and sustainability.

The Federal Ministry for Economic Affairs and Energy is convinced that the electricity market 2.0 enables innovation and sustainability. This is the third reason for the decision to opt for the electricity market 2.0: in the electricity market 2.0, market price signals, the regulatory framework and additional instruments create incentives for new fields of business and sustainable solutions. To this end, the Federal Ministry for Economic Affairs and Energy is implementing the no-regret measures in the Green Paper. In contrast, capacity markets make it more difficult to transform the electricity system and distort the effect of the signals from the market prices. They would impede efficient incentives for flexibilisation on the part of generators and consumers.

In the electricity market 2.0, undistorted market price signals set efficient incentives for innovative and sustainable solutions

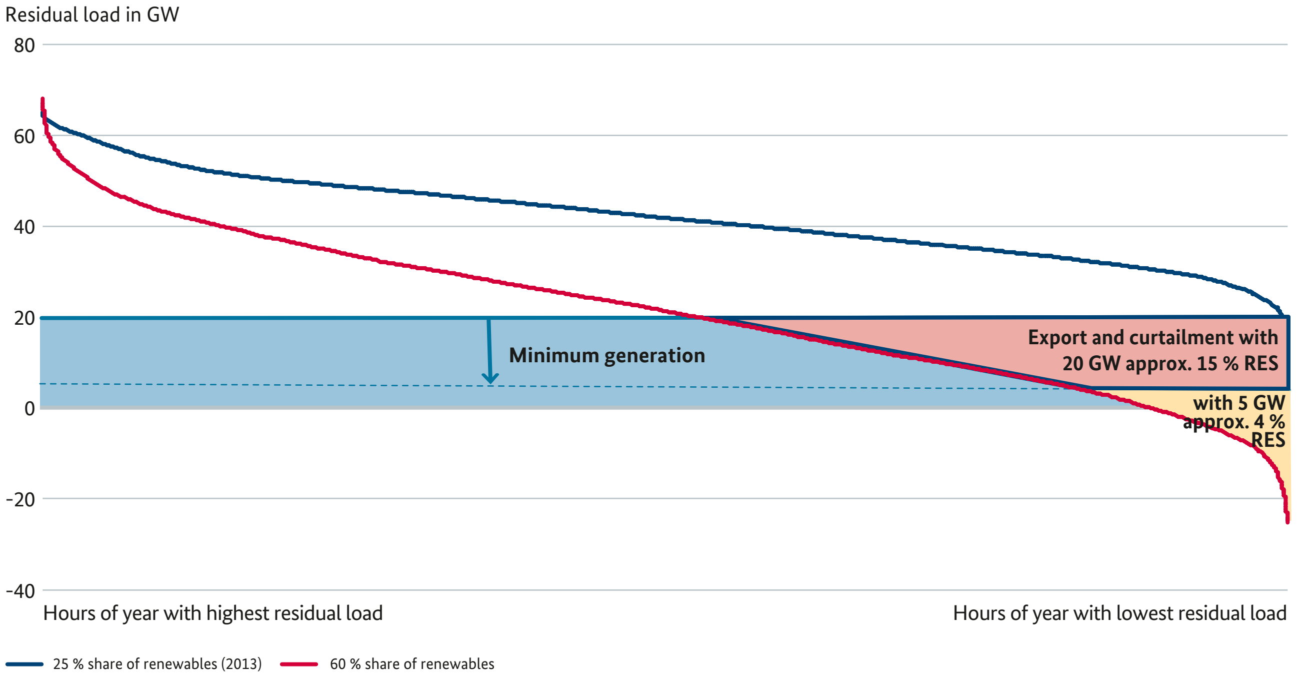
The energy transition is an opportunity to modernise our industrial society. The energy transition provides a stimulus for innovation and new technologies. By using IT-based control technologies, industry can help to integrate renewable energy into the system and to profit from this system. New players like flexible power plants, storage units and flexible consumers are increasingly replacing the traditional power generation system of a few large utilities and inflexible consumers. At the same time, entirely new market opportunities and business models are opening up for companies in the energy industry and for small-scale producers, commercial enterprises and large private-sector consumers as a result of smart grid technologies, e.g. by pooling and marketing distributed generators or by aggregating flexible consumers (BMWi 2014a). The increased use of smart homes also offers a good opportunity for the energy sector (BMWi 2015d). So the energy transition and the digital revolution can mutually stimulate each other and open up new fields of business. This creates new jobs and makes Germany more competitive.

An electricity market organised on the basis of competition relies on the ability of the market players to innovate. Over the last 15 years of liberalisation, the energy markets, their products and the players have already undergone a considerable development. Today, we have a liquid market with effective price signals and professional market players. The previous challenges of the energy transition were tackled with the help of many different innovative solutions. Good examples of this are the introduction of direct marketing (cf. Green Paper, Chapter 6, p. 32) or the activities of the electricity exchanges (cf. box on the activities of the electricity exchanges, pp. 51f.).

The integration of renewable energy sources continues to require innovative solutions. The more the system is dominated by wind and solar power, the more flexibly the electricity system needs to respond to the intermittent feed-in. The price signals from the electricity markets provide the incentives to develop new solutions. These include flexible consumers which raise or lower their electricity consumption in the short term (cf. box on demand side management, pp. 42f.). The market-based use of storage facilities and back-up power systems should also prove increasingly worthwhile in future.

In particular, innovative solutions are needed for times when there is a high feed-in of wind and solar power. Given today's share of approx. 28 percent of renewable energy in electricity consumption, the minimal residual load in Germany is approx. 15 GW. The residual load is the demand which needs to be covered by the rest of the power plant fleet after deducting generation from wind and solar power. The electricity market is thus a long way from experiencing "surplus production" from renewables. However, in 2035 this minimum residual load could amount to minus 25 GW (cf. Figure 12, Fraunhofer ISI 2014). That means that, in national terms, more electricity would be generated from renewables than is consumed. In such situations, the possibilities to export electricity to neighbouring countries will probably no longer suffice. This means that, in such an electricity supply system, flexible consumers could increase their consumption and utilise cheap electricity for their production. Also, new consumers in the heat and transport sectors could make use of low electricity prices in future. Cheap electricity generated from renewables can replace expensive oil and gas in many efficient applications: in the provision of heat (Power-to-Heat), mobility (Power-to-Mobility) and in industrial processes (Power-to-Industry). So the electricity market design will have to take account in future of the efficient use of electricity from renewable sources in the heat and transport sector (cf. Chapter 6).

Figure 12: Effects of minimum generation with an increasing share of renewable energy

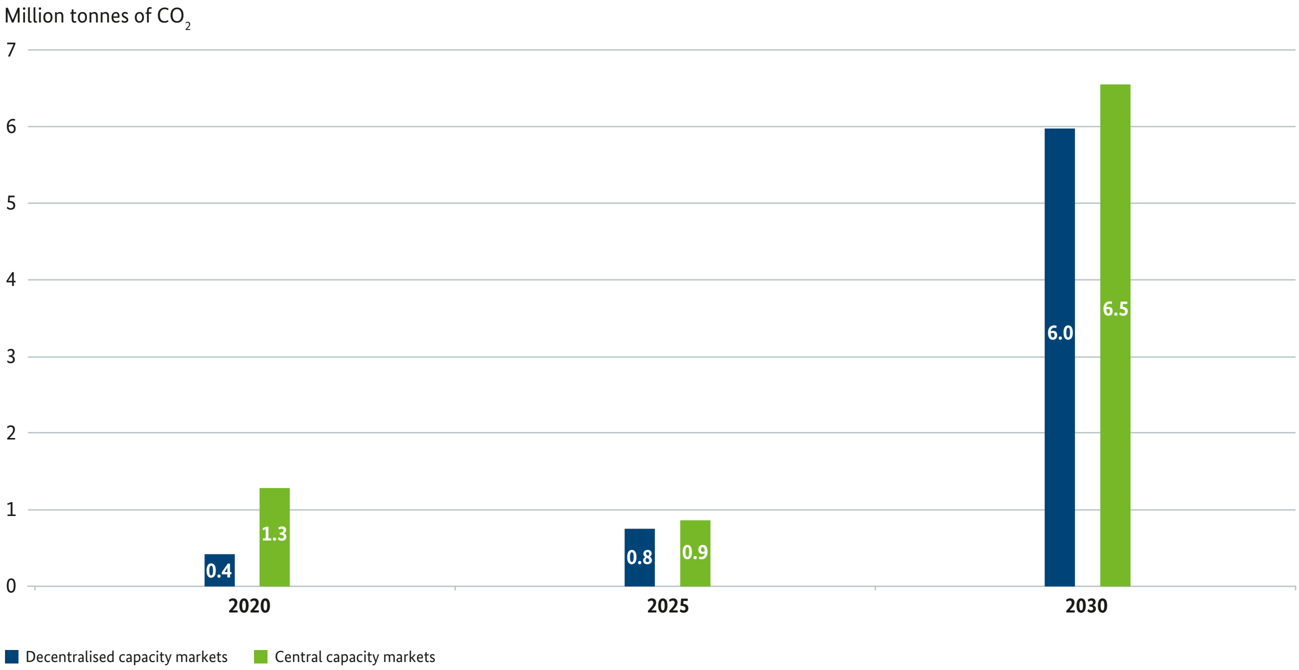


Source: Fraunhofer ISI

Innovative solutions can provide stimuli for various fields of business. Battery storage is one example. Additional storage will only be needed when there is a very high share of renewables so that electricity will still be available when there is no wind or sun (Fraunhofer IWES et al. 2014; FENES et al 2014). As a flexibility option, storage units will therefore only be able to play a competitive role amongst the flexibility options in the medium to long term. However, progress on developing battery storage is already fostering innovations in many areas: battery storage units are an important element of electric mobility and, in view of the directly available capacity, will in future be able to play a greater role in the provision of balancing capacity. In a few cases, battery storage will even be able to replace grid expansion at the low-voltage level (FENES et al. 2014). This means that they supplement other flexibility options and technical measures to optimise the distribution grids. Far-reaching developments in battery technology have resulted in much lower prices in recent years: in the case of lithium-ion cells, prices dropped by 30 percent between 2009 and 2012 (FENES OTH 2015). Further examples of new business fields can be found in the box on innovations (pp. 46f.).

The electricity market 2.0 allows the electricity system to be developed sustainably. The competitive electricity market 2.0 relies on price signals. In this way, it only incentivises the capacity that is actually needed and it ensures that renewables can be integrated at low cost. In comparison to this, capacity markets would make it more difficult to transform the electricity system because they reduce price volatility and – at least to a certain extent – prescribe in advance which generation technologies are funded. In capacity markets, the regulator must define the products and the conditions for their trading and pricing. It therefore tends to base its approach on existing flexibility options and their characteristics. This distorts the competition between the flexibility options. Also, capacity markets can tend to increase carbon emissions. The expert report by r2b energy consulting for the Federal Ministry for Economic Affairs and Energy finds that, given an optimal cost design, all the capacity market models studied – both decentralised and comprehensive central and focused – result in a slight rise in carbon emissions compared with an optimised electricity market (r2b 2014). This finding derives from the higher generation capacity and the higher exports. Inappropriate parameter-setting such as the funding of overcapacities could result in a further substantial increase in the level of carbon emissions (cf. Figure 13).

Figure 13: Increase in national CO_2 emissions in electricity production compared to electricity market 2.0 (reference scenario)



Source: r2b (2014)

The right policy framework needs to be put in place so that the electricity market 2.0 can lead to sustainable and innovative solutions. The policy framework includes, for example, the grids, and additional instruments to attain the climate change mitigation targets. The cost-efficient expansion of the power grid is generally the cheapest flexibility option (AG Interaktion 2012). If the price signals are to continue to have the same impact nation-wide, the grids must be expanded. Furthermore, counterproductive incentives for inefficient energy use need to be quickly reduced. Also, the carbon prices must reflect the actual external costs of emissions. Appropriate carbon prices are a precondition for a sustainable and cost-efficient transformation of the electricity system. Investors and electricity customers need to have a reliable basis for their planning, and to be able to trust in climate change mitigation policy. Only then investment in low-emission technology will follow. Alongside the electricity market in the narrower sense, the measures of component 3 also optimise the policy environment for the whole electricity sector (cf. Chapter 3).

Innovations for the energy transition – two examples

Example 1: Cuxhaven is testing smart networking of electricity producers and consumers in order to improve the integration of renewable energy sources

In the Cuxhaven region, the eTelligence project tried out new solutions for the energy transition. It tested a complex IT-based system which smartly integrates electricity from renewable sources and CHP into the grids and a regional market, and actively involves residential customers. The core of this was the actual testing of an electricity marketplace with regional products which brought together generators, commercial customers with movable loads and energy service providers. Two refrigeration plants, a wind farm and a PV installation acted together on the market; they were marketed together as a virtual power station; the ahoi!-Bad Cuxhaven swimming pool, a sewage treatment plant and a CHP unit also participated. In simulations, the grid system operator also participated on the marketplace.

One outcome: thermal-electric energy systems such as cold-storage depots and swimming pools can be used very effectively as energy storage facilities. When a lot of wind was available, the Cuxhaven cold-storage depot lowered its temperature and created a cold buffer for itself. When electricity prices were high, the refrigeration systems were switched off. Using the previously built up cold buffer, the cold-storage depot was then able to run for several days with much lower power demand. Across the year, the electricity costs were cut by up to 6 percent. This did not utilise the full energy conservation potential.

Another outcome: 650 households tested smart meters in everyday use. Various feedback systems enabled the participants to keep track of their own electricity consumption and analyse the cost of electricity, CO_2 emissions and their consumption pattern. Two different innovative tariffs, the quantitative tariff and the event tariff, led to promising findings. The quantitative tariff, which offers an incentive to reduce consumption, resulted in a monthly reduction in consumption of 13 percent in the participating households. The event tariff, which can reflect high or low availability of renewables in the energy mix via bonus/malus events, resulted in sharp time shifts in consumption. For example, malus events resulted in 20 percent less electricity being consumed when they were in effect. During the bonus events, energy consumption rose by up to 30 percent.

Cuxhaven was one of six model regions in the E-Energy technology funding programme. The funding programme pointed to new ways to cut electricity consumption, make more efficient use of energy, and implement a renewable energy supply. The main focus was on integrating renewable energies in the future grids with the help of newly developed information and communication technology (ICT) systems. The comprehensive report on the project and all model regions can be found in the “Smart Energy Made in Germany” brochure (BMWi 2014a).

Example 2: Dykes in Dithmarschen profit from cheap wind power

Traditionally, the low-lying areas behind dykes in Dithmarschen by the North Sea suffer from difficult weather situations. If there is a lot of rain, or a spring flood hits the coast, the drainage pumps operated by the Dithmarschen Dyke and Sluice Association need to dry out the hinterland again.

In future, these areas can profit from weather-dependent electricity production. As part of the Next Pool Virtual Power Plant, the Dithmarschen Dyke and Sluice Association will be able to profit from weather-related price differentials on the electricity exchange. The Next Kraftwerke virtual power plant operator not only supplies the company with electricity, but passes these price signals automatically on to the water pump control systems. In this way, the company can shift its electricity consumption into the most favourable quarter hours, e.g. when there is a lot of wind power in the grid and the prices on the electricity exchange are correspondingly low. By shifting its demand, it reduces its electricity bill. Next Kraftwerke is currently passing on variable electricity tariffs to medium-sized and large electricity consumers for a total of more than 1.5 GW of installed capacity (status April 2015, Next Kraftwerke & DHSV 2015).

Chapter 4:
Components of the electricity market 2.0

The Federal Ministry for Economic Affairs and Energy proposes three components for the further development of the existing electricity market into the electricity market 2.0: **component 1** strengthens the existing market mechanisms so that the market players maintain sufficient capacity and deploy it to the necessary extent (4.1); **component 2** optimises the electricity supply at a European and national level so that the market players use the capacities more efficiently and in a more environmentally friendly way (4.2). **Component 3** uses a capacity reserve and monitoring of security of supply to additionally back up the power supply (4.3). The three components build on the tried and tested structures of the liberalised electricity market and are designed to be compatible with European law.

The electricity market – one task, two functions

The electricity market basically is responsible for synchronisation. Electrical energy cannot be stored in the grid. The electricity market must ensure that at all times just as much power is fed into the electricity grid as is taken from it. In order to fulfil this synchronisation task, the electricity market has two central functions: a reserve and a dispatch function.

Firstly, the electricity market has a reserve function for sufficient capacity: To ensure that supply and demand can always be balanced, there must be sufficient capacity – i.e. generators, flexible consumers or storage – on the market. Price signals must ensure that the market players provide an efficient technology mix and invest in new capacities in good time. The market players use price quotes on the futures market and forward-looking market price forecasts for their investment decisions. If this information suggests that investment will pay off, then a key precondition for a positive investment decision is in place.

The electricity market also has a dispatch function. Electricity generation and consumption must always be in balance. It is therefore not sufficient for there to be sufficient technical capacity available. If there is to be a secure supply, the electricity market must always ensure via price signals that the existing capacity is contracted and actually used to the extent necessary (i.e. at the level of the expected consumption).

4.1 Component 1: Stronger market mechanisms

Component 1 strengthens the market mechanisms so that the market players maintain sufficient capacity and deploy them to the necessary extent. In the electricity market 2.0, the market mechanisms ensure that generation and consumption are synchronised. Component 1 strengthens the existing market mechanisms so that the electricity market is able to fulfil its synchronisation function and ensure security of supply. It ensures that the market players contract sufficient capacity (i.e. at the level of the expected consumption) and deploy this to the extent necessary. This means that the market mechanisms set the incentives so that the market players will fulfil their supply obligations. This enables the necessary capacities to be refinanced, e.g. on the short-term spot markets and the long-term futures markets, so that sufficient capacity is maintained (cf. box on the refinancing of capacities via market mechanisms, p. 37).

The confidence of the market players in competition-based price formation is to be strengthened. Stock exchange prices send important information to the market players. They show when the electricity is scarcer and are thus a key signal for investment. By taking this fundamental decision, the Federal Ministry for Economic Affairs and Energy is putting a stable framework in place on which investors can rely. Also, it will be enshrined in law that pricing will take place on the basis of competition. This means that high price peaks are allowed to occur, and the investment incentives of the market mechanisms can take full effect (**measure 1**). Also, the Bundeskartellamt will create greater transparency via its supervision of abuse of dominant positions in electricity generation. Companies will be aware of when they may offer electricity on the wholesale market at prices higher than their marginal costs (“mark-up”) (**measure 2**).

The incentives to uphold balancing group commitments will be strengthened. The balancing energy system provides the incentives for balance responsible parties to ensure they have contracted enough electricity to balance generation and consumption. The Federal Network Agency will revise the balancing energy system and thus strengthen the incentives to uphold balancing group commitments (**measure 3**). Also, it will be enshrined in law that even in rare situations of extreme capacity scarcity, entailing intervention by the transmission system operators, the high costs of balancing energy actually reach the balance responsible parties (**measure 4**).

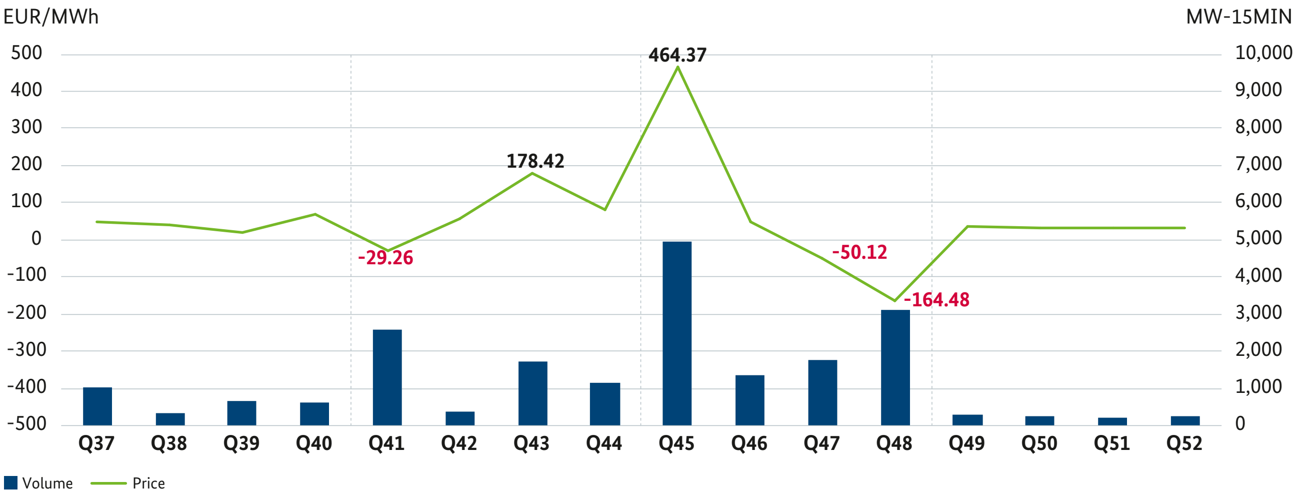
Partial solar eclipse in 2015: The electricity market has demonstrated its potential

The European electricity market responded flexibly to the partial solar eclipse on 20 March 2015. The partial solar eclipse represented a great challenge for Europe's electricity system. It was sunny in Germany, and the feed-in from 1.5 million PV installations changed within minutes. The transmission system operators kept 8 GW of positive balancing capacity and 7.3 GW of negative balancing capacity ready for the partial eclipse in Germany. Despite this, since the electricity markets responded flexibly, the transmission system operators only needed to activate a small portion of this balancing capacity. In fact, the balancing zone accounts amounted to approx. 1.2 GW in the positive direction and 1.4 GW in the negative direction.

The market players actively traded the volumes of electricity needed in the short term on the intraday market. EPEX SPOT reported that the market participants had estimated the timing and volume of the energy demand very accurately on the day before the partial solar eclipse. They were able to offset the remaining deviations via trade in flexible capacity on the intraday market. During individual quarter hours, there were very brief positive and negative peak prices: as the sunlight diminished, the market players paid a peak price of initially just under +465 euros/MWh. Shortly after that, when the moon moved out of the way of the sun again, the peak price was approx. -165 euros/MWh (cf. Figure 14). This shows that good day-ahead forecasts and well-organised wholesale electricity trading are capable of mastering major flexibility challenges without major problems.

The partial solar eclipse was a test for the future (cf. also Agora 2015). This is because flexibility will become much more valuable in future than it is today. Due to much higher shares of wind and solar power in the system, feed-in situations in which there is a high, short-term need for flexibility will become part of routine business. The short-term trade in flexibility will therefore become more and more important for the market participants.

Figure 14: Partial solar eclipse – prices and volumes on the intraday market for the German market area



Source: EPEX SPOT (2015)

4.2 Component 2: Flexible and efficient electricity supply

Component 2 optimises the electricity supply so that the market players use the capacities more efficiently and in a more environmentally friendly way. Here, not only the electricity market design, but also the regulatory framework and supporting instruments for the electricity sector play a role. The Green Paper describes these measures as "no-regret" measures. They should be implemented irrespective of the fundamental decision on capacity markets (BMWi 2014b).

Together with its neighbours, Germany is promoting the integration of the European internal market. The electricity markets are already European. Stronger integration offers great advantages, since the goals of the energy transition can be attained more cheaply in an integrated single European market. European electricity trading can take advantage of the smoothing effects over a wide area and efficiency gains on the demand side, the feed-in of renewables and the use of conventional power stations (cf. Chapter 3.2). This means that less national capacity needs to be maintained. Security of supply can be ensured more cheaply. Together with Germany's neighbours, the Federal Ministry for Economic Affairs and Energy therefore wishes to identify and promotepotential fields of cooperation for the further development of Europe's electricity markets (**measure 5**).

The price signals will be strengthened. Barriers to flexibility which distort the price signal will be reduced. The Federal Network Agency will examine and alter the design of the balancing markets. Not least, it is to become easier for new providers, such as renewable energies, flexible consumers and storage units, to participate in the balancing markets. This boosts competition, reduces costs and makes it possible to reduce the minimum generation by conventional power plans in an efficient manner (**measure 6**). Also, a target model is to ensure that there is a consistent development of grid charges, surcharges and other price components. The target model is to provide an orientation for the various reform steps, and ensure long-term consistency with the goals of the energy transition. The Federal Ministry for Economic Affairs and Energy will develop and discuss the target model with all the relevant players (**measure 7**). The creation of the possibility for special grid charges for large-scale consumers so that they can make greater use of demand side management is a first step in this direction (**measure 8**). Further to this, additional adjustments are to be made to the grid charges in order to take account of the changing environment in the energy industry (**measure 9**).

It will be easier to use flexibility options like demand side management and back-up power systems. If flexibility options are deployed efficiently via market price signals, renewable energy can be better integrated and the electricity supply can be ensured more cheaply. For secondary balancing capacity, entry barriers for specific providers of demand side management – often called aggregators – are to be reduced (**measure 10**). Also, the Federal Ministry for Economic Affairs and Energy will put statutory conditions in place for the expansion of charging facilities for electric vehicles. This means that more electric vehicles will be able to use electricity at times when, due to high electricity production from wind and solar power, it is particularly cheap (**measure 11**). Back-up power systems and their characteristics will be systematically registered. The improved information base will make it easier for market players to market additional installations on the electricity markets in future. On this basis, potential additional barriers in the way of marketing the installations on the spot and balancing energy markets can be identified. Furthermore, the Federal Ministry for Economic Affairs and Energy will ensure that new installations will meet the preconditions for participation on the electricity market (**measure 12**).

Grid operation and grid planning will be adapted to the challenges of the energy transition. The gradual introduction of smart meters can improve the information available to the grid operators and reduce barriers to the flexibilisation of electricity consumption (**measure 13**). Furthermore, it will be stipulated that the grids no longer need to be expanded to cope with the highest possible peaks in generation. This can minimise the costs of the expansion of the power grid (**measure 14**).

Minimum conventional generation can hamper the integration of renewable energy. Increasing shares of renewables and delays in the expansion of the power grid can greatly increase the amount of renewable electricity which needs to be curtailed due to minimum conventional generation. A process of monitoring the minimum generation from conventional power plants will analyse the key factors for minimum generation (**measure 15**).

The funding of CHP installations and the transfer of lignite-fired power plants to the capacity reserve with subsequent decommissioning will support the attainment of the national climate targets. Further instruments in addition to the electricity market are required if the climate targets are to be attained. Alongside the Renewable Energy Sources Act and the electricity efficiency instruments, this mainly refers to European emissions trading. This system is currently being reformed via a market stability reserve. The effects of the reform will probably not be felt until after 2020. For this reason, we will need an additional, national instrument. Also, the Federal Ministry for Economic Affairs and Energy is revising the CHP Act (**measure 16**). This is because CHP installations – particularly gas-fired ones – can help to cut greenhouse gas emissions. Both of these measures strengthen the existing package of instruments so that Germany can attain its targets for climate-friendly electricity generation in 2020.

An online platform increases transparency on the electricity market. The platform provides comprehensive and up-to-date energy and electricity market data for Germany. The transmission system operators will collect existing energy data and process them in a user-friendly way (**measure 17**).

The activities of the electricity exchanges support the electricity market 2.0.

The electricity exchanges are central trading platforms for the electricity market. For the German market area, the European Energy Exchange (EEX) and its subsidiary the European Power Exchange EPEX SPOT, as well as NASDAQ Commodities, Nord Pool Spot and Energy Exchange Austria (EXAA), are of relevance. Market participants can engage in medium-term and long-term trading on the EEX and on NASDAQ Commodities, e.g. in electricity, gas and CO_2 certificates (futures market). EPEX SPOT, EXAA and Nord Pool Spot offer short-term trading in electricity in Germany, France, Austria, the UK, Denmark, Sweden, Norway, Finland, the Baltic states and Switzerland (spot markets).

The electricity exchanges support the electricity market 2.0. Short-term trading supports the integration of renewables and active balancing group management. The introduction of harmonised rules for several European countries fosters progress on the European internal market. In longer-term trading, market players can hedge against or minimise risks and establish long-term payment movements (cf. Chapter 3.1).

The electricity exchanges have already adapted their products to the challenges of the energy transition. For example, since 2011 quarter-hour products on EPEX SPOT facilitate the management of balancing groups and the marketing and integration of renewable energy sources. Quarter-hour products can reflect short-term changes in electricity generation and consumption better than hourly products. Also, balance responsible parties can stick to their schedules more accurately if they manage their balancing groups in quarter-hour intervals rather than on an hourly basis. This also reduces the need for balancing capacity.

The electricity exchanges will continue to improve their products. The exchanges are competing to attract traders. The exchanges therefore aim to adapt their products and processes to the needs of the market participants in the energy transition. These new products facilitate electricity trading. At the same time, they offer new fields of business and thus promote innovation.

The EEX and EPEX SPOT electricity exchanges have announced the following steps (among others) (EEX 2015, EPEX SPOT 2015):

1. **Trading is to become possible on an even shorter-term basis.** At present, it is possible to trade in electricity up to 45 minutes before the time of delivery on EPEX SPOT. After that, market players can only offset new developments in generation and consumption over the counter or with their own flexibilities. However, the forecasts of electricity production from renewables and of electricity consumption do change very rapidly. It therefore makes sense to shift the gate closure on the exchange; this is planned for the summer of 2015.

2. **Balance responsible parties and consumers should be able to hedge better against price peaks via "cap futures"; at the same time, capacities should be able to use futures to earn revenue.** So far, market players can buy electricity on the EEX for hourly blocks, days or even longer periods and thus hedge against future price developments. But price peaks will occur more frequently in the electricity market 2.0 than has been the case so far. To enable market players to hedge better against price peaks, the EEX intends to introduce new products in 2015. These products will take account of the price development for (quarter) hours in a specific period and will set a price limit. If price peaks higher than the price limit occur, the seller pays the difference between the price limit and the price peak to the buyer of the product. The buyer of the product – e.g. an industrial company – therefore pays only the price limit plus the purchasing price of the option. This insures him against the risk of price peaks. The seller – e.g. a flexible power station – obtains a new revenue opportunity, i.e. it is rewarded for maintaining its capacity.

3. **New option products and weather derivatives are also to improve hedging against price peaks.** In the medium term, the EEX wishes to offer further products which permit the market players to buy/sell electricity at a specific price if the market prices move unfavourably. It also wishes to develop products which take account of weather factors. NASDAQ Commodities plans similar products.

4.3 Component 3: Additional security

Component 3 provides additional security of supply. Security of supply is paramount. Security of supply is of very great worth both for the ordinary citizen and for Germany as a base for industry. Component 3 guarantees that sufficient capacity will always be available for a secure electricity supply.

A monitoring process will continuously survey security of supply. If there is to be a secure power supply, sufficient capacity must always be available to cover electricity demand. It therefore makes sense to monitor the security of supply on the electricity market. The monitoring also provides the market players with transparency about the development of security of supply (**measure 18**).

A capacity reserve safeguards the electricity supply. Unlike the "capacity market", the capacity reserve consists solely of power stations which do not participate on the electricity market and do not distort competition and pricing. These power stations will be used only if, despite free price formation on the wholesale market and contrary to expectations, supply does not cover demand at a particular time. The capacity reserve ensures that all consumers can still obtain electricity in such a situation (**measure 19**). In addition to the capacity reserve, the grid reserve maintains power stations in southern Germany to bridge congestions in the grid, thereby ensuring a secure grid operation. The grid reserve will (possibly in modified form) be extended beyond 31 December 2017 and dovetailed with the capacity reserve (**measure 20**).

Part III:
Electricity market 2.0: The implementation

Part III explains how the current electricity market will be developed into the electricity market 2.0. Chapter 5 describes the measures to be taken in the short term. These measures ensure that security of supply will be permanently ensured in Germany, even under altered conditions. They also help to give the consumers an economically efficient electricity supply. In the medium term, it will make sense to take a number of further measures so that the energy supply can continue to be cost-efficient and environmentally friendly in the future. Chapter 6 provides a look ahead to the relevant fields of action for the future.

Chapter 5: Specific measures

Three components contribute to the success of the electricity market 2.0: component 1 “Stronger market mechanisms”, component 2 “Flexible and efficient power supply” and component 3 “Additional security”. The measures packaged in component 1 strengthen the existing market mechanisms. They ensure that the electricity market endogenously maintains the necessary capacities and thus continues to ensure security of supply (Chapter 5.1). The measures grouped in component 2 optimise the electricity supply at both European and national levels. They thus ensure a flexible, cost-efficient and environmentally compatible use of capacity (Chapter 5.2). The measures of component 3 provide additional security of supply (Chapter 5.3). All of the measures will be designed to conform with European law.

Overview of the measures

Component 1 “Stronger market mechanisms”: The measures packaged in component 1 strengthen the existing market mechanisms. The required capacities can thus refinance themselves and the electricity market can continue to ensure security of supply.

Measure 1	Guaranteeing free price formation on the electricity market
Measure 2	Making supervision of abuse of dominant market positions more transparent
Measure 3	Strengthening obligations to uphold balancing group commitments
Measure 4	Billing balancing groups for each quarter hour

Component 2 “Flexible and efficient electricity supply”: The measures of component 2 optimise the electricity supply at both European and national levels. They thus ensure a cost-efficient and environmentally compatible use of capacity.

Measure 5	Anchoring the further development of the electricity market in the European context
Measure 6	Opening up balancing markets for new providers
Measure 7	Developing a target model for state-induced price components and grid charges
Measure 8	Revising special grid charges to allow for greater demand side flexibility
Measure 9	Continuing to develop the grid charge system
Measure 10	Clarifying rules for the aggregation of flexible electricity consumers
Measure 11	Supporting the wider use of electric mobility
Measure 12	Making it possible to market back-up power systems
Measure 13	Gradually introducing smart meters
Measure 14	Reducing the costs of expanding the power grid via peak shaving of renewable energy facilities
Measure 15	Evaluating minimum generation
Measure 16	Integrating combined heat and power generation into the electricity market
Measure 17	Creating more transparency concerning electricity market data

Component 3 “Additional security”: The measures of component 3 provide additional security of supply.

Measure 18	Monitoring security of supply
Measure 19	Introducing a capacity reserve
Measure 20	Continuing to develop the grid reserve

5.1 Component 1: Stronger market mechanisms

The electricity market already balances supply and demand. It should continue to ensure a reliable electricity supply as the shares of intermittent renewable energy increase. The measures packaged in component 1 strengthen the existing market mechanisms. They ensure that the electricity market endogenously maintains the necessary capacities and thus continues to ensure security of supply. Measures 1 and 2 ensure that price formation remains free. Measures 3 and 4 strengthen the obligation to uphold balancing group commitments.

Overview of the measures of component 1

Measure 1	Guaranteeing free price formation on the electricity market
Measure 2	Making supervision of abuse of dominant market positions more transparent
Measure 3	Strengthening obligations to uphold balancing group commitments
Measure 4	Billing balancing groups for each quarter hour

Measure 1: Guaranteeing free price formation on the electricity market

In the electricity market 2.0, electricity prices send out important signals for investment. The market players must be able to rely on price formation remaining free, with no regulatory price limits being introduced. The Federal Ministry for Economic Affairs and Energy is thus strengthening the confidence of the market players: free pricing is to be included in the Electricity Market Act as a defined goal. This makes it clear that there are no plans to introduce state intervention in electricity pricing.

Justification

In the electricity market 2.0, electricity prices send out important signals for investment. The prices on the electricity market send relevant information to the market players (electricity suppliers, electricity traders, large-scale industry). For example, high prices show that the electricity supply is scarce at a certain time compared with electricity demand. This means that electricity prices are key signals for investment and provide incentives to flexibilise the electricity system (cf. Chapter 3).

The market players must be able to rely on price formation remaining free. Today, pricing on the electricity market is already free from state intervention. The electricity exchanges only have technical upper price limits, and can adapt these. However, some market players express a concern that the regulator could intervene in the market in future in order to prevent excessive prices on the exchange.

Key points

The Electricity Market Act is to create confidence amongst the market players:

- **The Electricity Market Act is to anchor the goals of the future electricity market design in the Energy Industry Act.** Free pricing will be a core objective of the Energy Industry Act. Prices for electricity will continue to be formed via competitive market mechanisms in future. The Electricity Market Act will insert this "target definition" into the Energy Industry Act as a fundamental policy decision by the legislature. This means that the market players can rely on there not being state intervention in price formation in future. The Energy Industry Act already cites the objectives of a grid-based supply of electricity and gas which is as secure, cheap, consumer-friendly and efficient as possible and which is increasingly based on renewable energy sources. The inclusion of a "target definition" of free pricing will serve to attain these objectives.

- **The Electricity Market Act sets out in law the basic principles of the future electricity market design.** The basic principles of the electricity market 2.0 will be regulated in the form of a "Basic Law for the Electricity Market". These basic principles make it clear that the electricity market must continue to ensure a balance between supply and demand at all times. There will be no state intervention in price formation.

- **Germany and its neighbouring countries have made a commitment to free price formation in their Joint Declaration.** The declaration of June 2015 on regional cooperation on security of supply stresses that no statutory price caps will be introduced. Also, national measures which could function as indirect price caps are to be avoided. It is also important for Member States to be able to rely on existing rules of the internal market in electricity being upheld. The declaration therefore confirms that the signatory states will not intervene (as long as grid stability is ensured) in cross-border electricity trading even where supply is scarce. This means that capacities can continue to ensure security of supply even across national borders (cf. measure 5).

Measure 2: Making supervision of abuse of dominant market positions more transparent

Free price formation is essential for the electricity market 2.0. Companies need clarity about the extent to which they may offer capacities on the market beyond their marginal costs (known as "mark-ups"). The Bundeskartellamt is therefore providing clarity: it will publish guidelines for the supervision of misuse of dominant positions for the field of electricity generation and will regularly present a report on market power.

Justification

Free price formation is an essential feature of the electricity market 2.0. If the electricity market 2.0 is to be able to ensure security of supply, it is necessary for price formation on the spot market to remain free (cf. Chapter 3). This includes situations in which companies offer capacities on the market at higher prices than their marginal costs (known as "mark-ups"). However, some companies are concerned that the ban on abuse of dominant positions under cartel law (the ban on mark-ups) restricts free pricing.

Market participants should therefore gain more clarity about when they are affected by the mark-up ban and when not. The ban on the abuse of dominant positions in cartel law does not aim to prevent price peaks in situations of scarcity. It stops companies from using market power to drive up prices without justification, artificially, and to a substantial degree. It is important to clarify which situations are covered by the ban under cartel law, and which companies can be affected by this.

Key points

The Bundeskartellamt will ensure greater transparency:

- **The Bundeskartellamt will publish guidelines regarding the supervision of abuse of dominant positions in electricity generation.** These guidelines will clarify the direction, the rules for application, and the scope of supervision of abuse of dominant positions under cartel law. Before it produces the guidelines, the Bundeskartellamt will enter into a dialogue with the companies affected.

- **At least every two years, the Bundeskartellamt will present a report on the market situation in electricity generation; this will be stipulated in the Electricity Market Act.** The report on the market power situation will give companies a clear understanding of whether they are dominant. Non-dominant companies will not be subject to any restrictions from supervision of abuse of dominant positions under cartel law in terms of their pricing – even in scarcity situations – irrespective of the general rules governing electricity trading. The report will form part of the existing, more comprehensive, monitoring undertaken by the Bundeskartellamt in the energy sector. It will include an analysis and an assessment of data collected by the Market Transparency Unit for Wholesale Electricity and Gas Markets and the energy monitoring process.

Measure 3: Strengthening the obligation to uphold balancing group commitments

In the electricity market 2.0, strong incentives to uphold balancing group commitments ensure security of supply. Together with the balancing markets, the balancing group and balancing energy system ensures that at all times just as much power is fed into the electricity grid as is taken from it. The prices of balancing energy, which can be high, deliver the key incentive to uphold balancing group commitments. The Federal Network Agency is therefore continuing to develop the balancing energy system: it is launching a discussion process in 2015 in order to open a procedure to stipulate auction rules during 2016.

Justification

In the electricity market 2.0, strong incentives to uphold balancing group commitments ensure security of supply. Balance responsible parties must already balance their balancing groups. All producers and consumers are assigned to a balancing group. For each balancing group, there is a player who must provide and comply with balanced schedules on the basis of demand and generation forecasts (obligation to uphold balancing group commitments). Together with the balancing capacity, the balancing group and balancing energy system ensures that at all times just as much power is fed into the electricity grid as is taken off it (cf. box on balancing group and balancing energy system, p. 39).

The price of balancing energy is the key incentive to uphold balancing group commitments. Transmission system operators use balancing energy to offset unpredictable deviations. To this end, they contract balancing capacity in advance (cf. Green Paper, Chapter 1.3). If balance responsible parties deviate from their schedules, balancing capacity needs to be used. The costs of this are borne by those balance responsible parties which have deviated from their schedule, via the price of balancing energy.

Key points

A further developed balancing group and balancing energy system strengthens the obligation to uphold balancing group commitments:

- **In 2015, the Federal Network Agency is leading a discussion process on the further development of the balancing energy system.** In 2016, a subsequent stipulation procedure will, once the relevant legal basis has been added to, address the following aspects:
  - **Costs of maintaining balancing capacity:** So far, the balance responsible parties – if they deviate from the schedules – only bear the costs of deploying the balancing capacity. The costs of maintaining the capacity are passed on by the grid operators to the consumers via the grid charges. However, by using the balancing energy, the balance responsible parties influence the quantity of balancing capacity maintained in the medium term – i.e. how much capacity is available to the grid operators for them to use balancing energy. If the costs of maintaining the capacity were at least partly billed via the balancing energy, this could increase the incentives to uphold balancing group commitments and distribute the costs more in line with the user-pays principle.
  - **Handling zero crossings:** The costs of the balancing energy are passed on by the transmission system operators via the balancing energy system to the balance responsible parties. In the first stage of calculating the balancing energy price, they proceed as follows: They divide the net costs – i.e. the costs minus the revenues – for the entire use of balancing energy by the total amount of balancing energy used in grid control cooperation. This total quantity derives in turn from the balance of the balancing energy used in a quarter hour (cf. Figure 15). This results in undesired incentives: if the system is relatively stable, i.e. if the grid operators use relatively little – and frequently both positive and negative – balancing capacity, positive and negative balancing capacity can offset each other (zero crossings). As a consequence, the denominator is relatively small and – due to the arithmetic – the numerator relatively large: relatively high balancing energy prices can result. Instead, high balancing energy prices should only occur when the system is relatively unstable, i.e. the grid operators use a relatively large amount of positive or negative balancing capacity.

Figure 15: Formation of balancing energy price at the first stage of calculation

$$\text{Balancing energy price 1} = \frac{\text{Costs – revenues from called balancing energy}}{\text{Quantitative balance of called balancing energy in grid control cooperation}}$$

Source: Own chart

  - **Replacing the intraday price as the reference price.** Balance responsible parties should always participate in intraday trading rather than using balancing energy. If the generation and demand forecasts in their balancing groups change, they should renegotiate electricity on the intraday market. The calculation of the balancing energy price already provides incentives for this by taking account of the intraday price. However, the intraday price which is currently used, and which is weighted by quantity and is averaged by the hour, causes problems, since balancing groups need to be managed on a quarter-hour basis. The Federal Network Agency will examine alternative purchase prices in preparation for its stipulation of the auction rules. Alternative purchase prices could be derived from the new day-ahead quarter-hour auction on EPEX SPOT, the continuous quarter-hour intraday trading, or a maximum price consisting of various purchasing prices.

- **The powers of the Federal Network Agency are to be widened.** Under current law, the Federal Network Agency has limited powers to develop the balancing energy system further. Section 8 of the Electricity Grid Access Ordinance states that the costs of maintaining balancing capacity are passed on via the grid charges. The Federal Ministry for Economic Affairs and Energy is altering this provision so that grid operators can also bill these costs via the balancing energy system (see above).

- **The Federal Ministry for Economic Affairs and Energy and the Federal Network Agency are constantly monitoring the balancing group and balancing energy system.** There are various sorts of balancing groups. It is relatively easy for balance responsible parties to account for capacity-profiled industrial and commercial customers. It is more difficult to account for the non-capacity-profiled residential customers. The deviations of these customers from the consumption predicted for them are managed by the distribution system operators in “differential balancing groups”. The Federal Ministry for Economic Affairs and Energy and the Federal Network Agency will review how efficiently these balancing groups are managed and will adapt the rules where needed (cf. field of action 6).

Measure 4: Billing balancing groups for each quarter hour

The balancing group and balancing energy system is the key instrument for synchronising generation and consumption. Balance responsible parties must secure their supply obligation for each quarter hour. However, there is no clear provision stating that transmission system operators must invoice the balancing groups if they have to intervene in the electricity system at short notice or in future if they have to use the capacity reserve. It will therefore be clarified in law that balancing groups should always be charged for this.

Justification

The balancing group and balancing energy system is the key instrument for synchronising generation and consumption. Together with the balancing capacity, the balancing group and balancing energy system ensures that at all times just as much power is fed into the electricity grid as is taken off it (cf. box on balancing group and balancing energy system, p. 39).

Balance responsible parties must adequately secure their supply obligation for each quarter hour. If they fail to do this, they should be liable for their error. But at the moment it is not always clear in law that the transmission system operators must invoice their balancing groups. This refers to situations in which they have to intervene in the electricity system at short notice (Section 13 subsection 2 of the Energy Industry Act) or in future if they have to use the capacity reserve.

Key points

It should be clarified in law that balance responsible parties must invoice their balancing groups in every case:

- **The Electricity Market Act is to add a corresponding provision to Section 8 subsection 2 of the Electricity Grid Access Ordinance.** This provision will ensure that the transmission system operators will invoice the balancing groups even if they have to intervene in the electricity system at short notice (Section 13 subsection 2 of the Energy Industry Act) or to use the capacity reserve.

5.2 Component 2: Flexible and efficient electricity supply

The measures cited in component 2 optimise the electricity supply and anchor the further development of the electricity market at European level. They thus ensure a flexible, cost-efficient and environmentally compatible use of capacity and competitive electricity prices.

Overview of the measures of component 2

Measure 5	Anchoring the further development of the electricity market in the European context
Measure 6	Opening up balancing markets for new providers
Measure 7	Developing a target model for state-induced price components and grid charges
Measure 8	Revising special grid charges to allow for greater demand side flexibility
Measure 9	Continuing to develop the grid charge system
Measure 10	Clarifying rules for the aggregation of flexible electricity consumers
Measure 11	Supporting the wider use of electric mobility
Measure 12	Making it possible to market back-up power systems
Measure 13	Gradually introducing smart meters
Measure 14	Reducing the costs of expanding the power grid via peak shaving of renewable energy facilities
Measure 15	Evaluating minimum generation
Measure 16	Integrating combined heat and power generation into the electricity market
Measure 17	Creating more transparency concerning electricity market data

Measure 5: Anchoring the further development of the electricity market in the European context

In taking the decision in favour of the electricity market 2.0, the Federal Ministry for Economic Affairs and Energy is making an explicit commitment to the liberalised, European internal market in electricity. In an integrated European internal market, a high level of security of supply can be ensured at a low cost. For this reason, Germany is working closely with its neighbours on the further development of the electricity market. The joint declaration by Germany and its “electrical” neighbours of June 2015 is a first important milestone towards anchoring the electricity market 2.0 in the European context. The signatory neighbouring states have thus sent out a clear signal: security of supply is to be viewed more from a European perspective in future, and full use is to be made of the advantages of the internal market in electricity.

Justification

In the electricity market 2.0, the Federal Ministry for Economic Affairs and Energy is making an explicit commitment to the liberalised, European internal market in electricity. Since the electricity markets were liberalised in the late 1990s, increased competition has resulted in more efficient electricity generation and lower wholesale prices. In parallel, the coupling of national markets has meant that electricity is now generated and traded across borders (cf. Part II). The electricity market 2.0 builds on the liberalised, European market and fosters its development.

In an integrated European internal market for energy, security of supply can be ensured at a low cost. The more the national electricity markets are interlinked, the greater is the available flexibility potential. At the same time, the capacity needed to cover demand falls, since the highest capacity requirement in each region occurs at different times. The supra-regional balancing of supply and demand means that less national capacity needs to be maintained. The likelihood of unplanned blackouts also falls further because supply and demand are able to match better in a larger market and the failure of single transmission lines can be offset (cf. also measure 18).

Key points

- **In June 2015, the Federal Minister for Economic Affairs and Energy signed a joint declaration on the electricity market with Germany's "electrical" neighbours** (cf. box on joint declaration). The signatories of this declaration are the Netherlands, Switzerland, Belgium, Luxembourg, France, the Czech Republic, Austria, Poland, Denmark, Sweden and Norway. The declaration stresses the importance of no-regret measures which all the countries deem sensible, no matter what their energy mix and electricity market model. In this declaration, which was negotiated with the involvement of the European Commission, the Federal Ministry for Economic Affairs and Energy highlights its offer to the European partners to cooperate closely in the context of the no-regret measures and beyond (cooperation readiness).

- **The signatories have agreed on the following measures:**
  - **They will cooperate on the further development of the national electricity markets.** In future, they want to engage in a closer dialogue when national decisions are likely to have a clear impact on the electricity markets of the neighbouring states. Measures to improve security of supply should take account of cross-border effects.
  - **They will develop a common understanding of security of supply and a common methodology on its calculation.** The Generation Adequacy Assessment of the European transmission system operators can serve as a basis for this. The transmission system operators carried out this analysis for central-western Europe on behalf of the Pentalateral Energy Forum. The modelling is to be improved. It could feed into a joint report by the transmission system operators on security of supply (cf. also Chapter 6, field of action 1).
  - **They will let the electricity markets grow closer together.** They wish to continue to upgrade the cross-border power grids. Also, the network codes are to be adopted and implemented. The network codes are uniform European rules for the market participants, e.g. to control cross-border trade in electricity and the handling of power failures (cf. also Chapter 6, field of action 1).
  - **They will not impede cross-border trade in electricity, even when prices are high.** The European rules only permit restrictions in the event of a danger to grid stability.
  - **They believe that flexible European electricity markets are in the common interest.** This is particularly true for the flexibilisation of the demand side. To this end, the signatories aim to remove barriers particularly to market access for flexibility options, prevent statutory price caps, accept price peaks and strengthen the obligation to uphold balancing group commitments (cf. also measures 1, 2, 3, 7, 8, 10, 11, 12).

Joint Declaration for Regional Cooperation on Security of Electricity Supply in the Framework of the Internal Energy Market

We are convinced that making the most of the internal energy market will be crucial for ensuring security of supply in a cost-effective way. **We emphasise** the rules regarding the internal energy market and will work towards their full implementation. **We stress** that we will not restrict cross-border trade of electricity including in times of high prices reflecting market scarcity and we will follow EU-regulations on cross-border trade also with respect to ensuring secure system operation. **We recognise** the right of each European state to determine its own energy mix. **We acknowledge** that neighbouring states face different situations which can lead to preferences for different concepts in our energy policy, and the need, within the EU-framework, for well-targeted national regulations, taking into account national specificities, also with regard to security of supply. **We are guided** by the intention to maximise the benefits of the internal market for security of supply. **We are convinced** that an intensified regional cooperation is an important step towards further EU market integration, that it will increase energy security, reduce energy prices and costs and promote further integration of renewable energy.

We aim at identifying common approaches ("no regrets") even though we might not agree on all details or policy options. **We are guided** by the intention to contribute to the further European market integration. We will implement this declaration in close cooperation with the European Commission and within regional initiatives such as the Pentalateral Energy Forum and based on their valuable work and input. **We therefore agree, as a starting point, on the following "no-regrets" for regional cooperation:**

- We will improve cooperation among neighbouring countries as regards the main decisions on national energy policies with potential transnational effects.

- Policy interventions for security of supply should take into account cross-border effects and minimise possible market distortion.

- While acknowledging all European states' own responsibility as regards ensuring security of supply, we will develop a common methodology to assess generation adequacy; we will work towards further harmonisation of security of supply indicators and a common understanding of security of supply as well as towards a joint regional generation adequacy assessment, to complement the work carried out at national level.

- We will foster further market-coupling and increased cross-border trade based on flow-based capacity calculations and, as the case may be, based on Net Transfer Capacity. We will foster reinforcement of internal grid and interconnection capacity to overcome bottlenecks.

- We will not restrict cross-border trade of electricity including in times of high prices reflecting market scarcity and we will follow EU-regulations on cross-border trade also with respect to ensuring secure system operation.

- We will foster improved cross-border capacity allocation and will work towards a coordinated implementation of the Regulation on Capacity Allocation and Congestion Management.

- We will foster further market integration of renewables in a coordinated way thereby also making use of different flexibility options.

- We agree that the flexibilisation of our energy system is a no-regret to cost-effectively improve energy security.

- We will analyse our new and existing national regulations, with the aim to minimise any negative impact on, and if possible increase, system flexibility ("flexibility check").

- As a first step we agree on the following flexibility "no-regrets":
  - we will identify barriers for flexibility of supply and demand and seek to remove them in a coordinated manner;
  - we will develop demand side response and consider the potential of demand options from other sectors, such as heating and transport into the electricity system;
  - we will work towards ensuring an adequate level of short-term products;
  - we will allow flexible prices; we will particularly not introduce legal price caps and we will avoid that national measures have the effect of indirect price caps;
  - we will make sure that there is an adequate regulatory framework in order to ensure that balancing responsible parties will comply with their balancing obligations;
  - market parties, including producers of variable renewable energy, should react to market price signals;
  - we will support the cost-effective cross-border integration of markets for ancillary services (in particular balancing energy).

We invite other European states to join this declaration.

Measure 6: Opening up balancing markets for new providers

The balancing markets, which are important for the short-term balancing of supply and demand, offer ways to remunerate capacities. In order to facilitate more competition and thus to cut costs, they should be open to as many providers as possible. The Federal Network Agency is therefore opening up the balancing markets to more providers: it is starting a procedure to stipulate the auction rules before the end of 2015.

Justification

The balancing markets offer ways to remunerate the capacities. In order to keep the system stable at all times, the transmission system operators use balancing capacity. In this way, they physically offset unforeseen power plant failures or deviations from forecasts of demand and renewable-based generation. Capacities can generate income if they participate in the balancing markets (cf. Chapter 3.1 including the box on refinancing).

Balancing markets should be open to all providers. Every provider which can reliably make balancing capacity available should be permitted to compete. A large diversity of providers minimises the costs of maintaining and using balancing capacity. Also, more competition on the balancing markets can reduce the minimum generation from thermal power plants: in certain situations, thermal power plants will no longer be needed to cover the demand on the electricity market. Nevertheless, some of them will remain in operation if they provide balancing capacity.

Key points

The balancing markets will be opened up to new providers:

- **The Federal Network Agency will launch a procedure to stipulate the auction rules for balancing capacity in order to permit new, flexible providers to participate.** If there are shorter ramp-up times and smaller products, providers like storage units, flexible consumers and renewable energy can play a greater role on the balancing markets. System stability will continue to be the priority when the balancing markets are opened up to new providers. In the long term, the "Leitstudie Strom" expert report proposes calendar-day procurement with one-hour blocks (Connect et al. 2015).

Table 2: Current auctioning rules on balancing markets

	Frequency of auction	Product duration	Minimum bid size	Pooling
MR	Each working day	4 hours	5 MW	Yes
SRR	Weekly	High (Mon. – Fri. 8 a.m. – 8 p.m.), Low (Mon. – Fri. 8 p.m. – 8 a.m.; Sat. – Sun., public holidays: all day)	5 MW	Yes
PRR	Weekly	1 Woche	1 MW	Yes

Source: Connect (2015b)

- **The Federal Network Agency will give particular attention to the following aspects**:
  - **Shortening the blocks for the secondary balancing capacity.** So far, providers can bid either for a peak load period, i.e. each working day from 8 a.m. to 8 p.m. Or they can bid for periods of low demand, from midnight to 8 a.m. and from 8 p.m. to midnight. Weekends and public holidays are also currently defined as all-day periods of low demand (cf. Table 2). This can result in very long blocks, particularly when the weekend is adjacent to a public holiday. So thought is being given to shortening these periods, e.g. to four-hour or hourly products. Table 2 shows the current auction rules.
  - **Auctioning secondary balancing capacity and minute reserves for each calendar day.** Transmission system operators distinguish between three types of balancing capacity: primary balancing capacity must be fully available within 30 seconds of demand, secondary balancing capacity within five minutes, and minute reserves (tertiary balancing capacity) within a quarter of an hour. At present, providers can only bid to provide secondary balancing capacity on a weekly basis. The transmission system operators procure the minute reserves each working day (cf. Table 2). So the auction does not take place each day on weekends and public holidays at present. Shorter times between gate closure and delivery could strengthen the competition on the balancing markets.
  - **Enabling providers of secondary balancing capacity to sell on their capacity rights.** An alternative to shorter times between gate closure and delivery is a secondary market for secondary balancing capacity. This could be designed decentrally or centrally. Market players could then sell on their capacity rights decentrally and bilaterally or the transmission system operators could carry out a central day-ahead auction for the voluntary selling on of the capacity rights.
  - **Enabling for more providers to supply balancing energy.** So far, grid operators can only call on the balancing energy they need at short notice from those capacities which they have previously contracted in an auction (capacity right). This rule could be relaxed by a balancing energy market. This is also proposed by the European network code regarding balancing capacity.
  - **Shifting gate closure to offer secondary balancing capacity.** Independently from the decision for shorter auctioning periods or secondary markets, the secondary balancing capacity could in future be auctioned before the minute reserve and before the day-ahead auction of the spot markets.
  - **Shortening the product length of the minute reserve.** The minute reserve is currently auctioned in four-hour blocks. Shorter e.g. hourly, blocks would be feasible. These could be supplemented by the possibility to offer block bids.
  - **Setting prices for balancing energy in the minute reserve and secondary balancing capacity via a uniform pricing procedure.** The balancing energy used must currently be paid for at the price offered pursuant to Section 8 subsection 1 sentence 2 of the Electricity Grid Access Ordinance (pay-as-bid auctions). In their bids, market players take account of the potential remuneration and the expected price-related likelihood that it will be required. In a uniform pricing procedure, on the other hand, the market participants offer bids at the level of their marginal costs and obtain a price at the level of the marginal cost of the last unit deployed. A uniform pricing procedure could result in simpler bids and thus more efficient market outcomes.

- **The powers of the Federal Network Agency are to be widened.** The Federal Ministry for Economic Affairs and Energy will adapt Section 8 subsection 1 sentence 2 of the Electricity Grid Access Ordinance in order to put the conditions in place for the conclusion of the procedure to stipulate the auction rules. This gives the Federal Network Agency the possibility of determining balancing energy and balancing capacity prices in a uniform pricing procedure rather via the pay-as-bid procedure.

Measure 7: Developing a target model for state-induced price components and grid charges

Price components and grid charges imposed by the state override the effects of the wholesale price. In the electricity market 2.0, market players should be able to respond flexibly to price signals. The state-induced price components and grid charges will therefore be gradually aligned with the requirements of the energy transition: the Federal Ministry for Economic Affairs and Energy is developing a target model which offers orientation for future adjustments and ensures consistency.

Justification

Price components and grid charges imposed by the state override the effects of the wholesale price. The electricity price for final consumers consists both of the wholesale price and of various state-induced price components and grid charges. The price components particularly include the EEG surcharge, the CHP surcharge, the electricity tax and the concession levy. In the case of residential customers, for example, less than a quarter of the whole electricity price is accounted for by the costs of electricity generation. These price components currently override the effects of the wholesale price. They thus weaken the price signals from the electricity markets. For many players, it is not worthwhile, or scarcely worthwhile, to adapt consumption patterns to the market prices. This can unnecessarily increase the total system costs (cf. Green Paper, Chapter 4.3).

In the electricity market 2.0, market players should be able to respond flexibly to price signals. The wholesale prices signal whether electricity in the whole system is scarce or is amply available at any given time. They are the central steering signal for the whole system (cf. Chapter 3).

Key points

The state-induced price components and grid charges will be gradually aligned with the requirements of the energy transition:

- **The Federal Ministry for Economic Affairs and Energy is developing a target model.** The target model will provide consistent answers to the challenges described below and offers orientation to the market players for future reforms. It will make the development predictable. The Federal Ministry for Economic Affairs and Energy will work together with the relevant stakeholders to draft the target model. The aim is to ensure the cost efficiency of the whole system and competitive electricity prices. This must include flexibility options on both the supply and demand side.

- **The target model will provide consistent answers to two challenges:**

1. **Restricting the costs of the energy supply and strengthening security of supply** – whilst attaining the goals of the energy transition: the structure and level of state-induced price components and grid charges should be adapted so that players orient their operation to central steering signals from the wholesale price which are as undistorted as possible. This particularly includes the following aspects:
   - **Competition between the flexibility options:** The future electricity market needs flexibility. The most cost-efficient flexibility options will only win through in a fair competition between all flexibility options which is distorted as little as possible by price components and grid charges (cf. Chapter 1.1 and 3.2).
   - **Operation of autogeneration installations which meets the needs of the system:** State-induced price components and grid charges provide for privileges for self-supply. These exceptions boost the competitiveness of distributed installations which serve the needs of the system, but they can also distort electricity price signals. A stronger orientation of autogeneration installations to electricity price signals can help to further reduce fuel costs, to cut emissions, and to open up additional flexibilities. This ensures that the competitiveness of electricity-intensive self-suppliers is not impaired. The existing privileges will remain in place. The autogeneration installations will then be used even more efficiently in the competition between the flexibility options.

   - **Efficient coupling of the electricity sector with the heat and transport sector:** The increasing use of electricity in the heat and transport sector and in industry is an important element of the energy transition (cf. Chapter 6, field of action 4). Charges and levies should make it possible to couple the sectors efficiently. The market players decide individually whether to use electricity or fuel. If these decisions are to lead to an efficient overall system, the prices for energy sources must reflect the economic costs caused by them.
   - **Efficient grid use and expansion:** Grid expansion is the most cost-efficient flexibility option (AG Interaktion 2012). The expansion of the power grid is funded not by the electricity market, but by grid charges. For this reason, adapted grid regulation must strike the optimal balance between the use of local flexibility and grid expansion (cf. e.g. measure 14 "Limiting the costs of grid expansion via peak shaving of renewable energy installations").
   - **Energy efficiency:** The tried-and-tested incentives for efficient use of energy should be retained and strengthened. Impediments should be removed. Incentives for efficiency and flexibility must be coordinated (cf. field of action 5).
2. **Fair and transparent burden-sharing.** The various consumer groups should make an appropriate contribution to the necessary financing without losing their existing privilegestreatment. Here, there is a tension between the privileges needed to maintain international competitiveness and the broadest possible payment base in order to limit the costs for consumers not enjoying privileges. The macroeconomic view must determine the policy-making. A transparent allocation of costs is also of relevance, e.g. in the grid sector (cf. measure 9).

- **The Federal Ministry for Economic Affairs and Energy will develop the target model with the relevant stakeholders.** Discussions on this are taking place e.g. in the Electricity Market Platform. In the development of this, the Federal Ministry for Economic Affairs and Energy will take account both of grid and of market needs (cf. field of action 6).

Measure 8: Revising special grid charges to allow for greater demand side flexibility

Flexible large-scale consumers can relieve the burden on the grid and offer their flexibility on the electricity market. At present, the rules on special grid charges restrict this potential for flexibility. To permit scope for more flexibility in the interest of the grid and the market, the rules on the special grid charges are therefore being revised. For example, large-scale consumers will in future be able to provide balancing capacity.

Justification

Flexible large-scale consumers can relieve the burden on the grid and offer their flexibility on the electricity market. The higher the share of wind and solar power, the more important it will be for consumers to respond flexibly to market price signals (cf. Chapter 3 and field of action 4). If suitable large-scale consumers are to utilise their potential for flexibility, they should be able to take account of the price signals of the electricity market in their decisions with as little distortion as possible.

At present, the rules on special grid charges restrict this potential for flexibility. Large-scale consumers receive reduced grid charges in return for acting in the interest of the system. However, the special grid charges for "electricity-intensive final consumers" can provide excessive incentives for constant electricity take-off: under current law, flexible large-scale consumers can lose their grid charge reduction if they increase or reduce their consumption. Further to this, grid operators stipulate the peak load times for special grid charges with "atypical grid use" a calendar year in advance. Peak load times are periods in which many consumers in a grid area have a high level of electricity consumption at the same time. In peak load periods, increasing demand can result in a (pro-rata) loss of the grid charge reduction. The increasing expansion of wind and solar power necessitates an adjustment at shorter intervals of time so that producers and consumers can behave flexibly.

Key points

The revision of the Electricity Grid Fee Ordinance (Section 19 subsection 2) will reform the special grid charges to permit greater demand side flexibility:

Grid operators will be able to stipulate peak load times on a shorter-term basis. For example, it would be feasible to go down to weekly and in future even to day-ahead times. Consumers can then adapt their behaviour more precisely to the current grid situation. In this way, they can foster stable grid operation and a less tense market situation. Also, storage facilities can benefit from this change.

Large-scale consumers will be able to participate in balancing markets. In future, flexible consumer behaviour in the form of providing balancing capacity should not lead to a loss of the special grid charge. This will enable large-scale consumers to participate in the balancing markets. This can have a positive impact on competition.

Reduction in consumption by large-scale consumers at high-price times will be increasingly made possible. Reduction in consumption at high-price times should no longer lead to a loss of the special grid charge: large-scale consumers which reduce their demand above an appropriate threshold and thus cut demand in the interest of the market should be able to continue to fulfil the preconditions for the special grid charges.

Increased consumption by large-scale consumers will be allowed more at times of negative prices. Increased consumption at low-price times should – if possible – no longer lead to a loss of the special grid charge: large-scale consumers can then increase demand at times of negative electricity prices in the interest of the market. The technical grid effect and implementation in law are being examined.

Measure 9: Continuing to develop the grid charge system

In the electricity market 2.0, the costs should not only be reduced, but also distributed transparently and fairly. The level of grid charges varies considerably from region to region in Germany. Greater alignment would be appropriate. However, the economic incentives for cost-efficient grid operation in the regions are to be maintained. In a first step, therefore, a uniform charge for the use of the transmission systems is to align the level of the grid charges. In a subsequent step, so-called "avoided grid charges" – i.e. charges which have so far been disbursed to distributed installations feeding into the grid or credited to the EEG account – are to be abolished for new installations.

Justification

The level of grid charges varies considerably from region to region in Germany. The grid costs which accrue in a grid area are currently basically paid for by the final consumers in that grid area. The grid charges of the various levels of the grid cumulate.

In the financing of grid infrastructure, there is to be fair burden-sharing. At transmission system level, a nationwide sharing of the costs is appropriate. Even today, some costs of the transmission system are shared between the four transmission system operators, e.g. the costs of offshore grid connection. This cost sharing is to apply to the entire transmission system in future. Another cause of differing regional grid charges is what is known as "avoided grid charges". In the case of CHP installations and conventional installations, these are paid to the distributed installations feeding into the grid. In the case of installations covered by the Renewable Energy Sources Act, they are paid into the EEG account. The background to this provision, when it was enacted, was the assumption that distributed feed-in at downstream levels reduces the use of upstream grid levels and thus avoids infrastructure costs. This assumption is no longer valid. The main driver behind the need to expand the grid is the increased connection of distributed generating installations.

Key points

Regional disparities in grid charges are reduced:

- **The charges for the transmission system will be shared nation-wide.** Regional disparities in grid charges will not be removed, but will be reduced.

- **The so-called "avoided grid charges" are to be abolished for installations which enter into operation after 2021.** Existing installations and installations which enter into operation by the end of 2020 will be covered by the existing rules. This applies equally to renewable, conventional and CHP installations. The incentives for cost-efficient grid expansion in the regions will remain in place.

Measure 10: Clarifying rules for the aggregation of flexible electricity consumers

So far, large consumers have dominated the market for demand side management. The aggregation of medium-sized and small flexible electricity consumers can efficiently leverage unutilised potential. There are currently no specific rules on rights and obligations of aggregators in the electricity market 2.0. For this reason, the rules on the aggregation of flexible electricity consumers will be clarified. In a first step, access for the aggregators to the balancing energy markets will be simplified.

Justification

The aggregation of flexible electricity consumers can efficiently leverage unutilised potential. The development of potential for flexibility is of particular significance for the electricity market 2.0 (cf. Chapter 3). Alongside traditional suppliers of electricity, specialised suppliers – known as aggregators – perform a threefold function in the flexibilisation of demand: they identify and evaluate flexible consumers, provide the necessary technical connection for these consumers, and deliver the flexibility to the market. Here, they can increasingly include new, flexible consumers from the heat and transport sector (cf. also field of action 4).

There are currently no specific rules on rights and obligations of aggregators in the electricity market 2.0. So far, large consumers have dominated the market for demand side management. Aggregators can open up the potential for flexibilisation in medium-sized and small electricity consumers to the extent that they have direct access to the electricity markets. Here, it is important to have clear rules for the interaction between aggregators, balance responsible parties and electricity suppliers.

Key points

The rules for the aggregation of flexible electricity consumers will be clarified:

- **The rights and obligations of aggregators in the electricity markets will be evaluated.** To this end, the Federal Ministry for Economic Affairs and Energy and the Federal Network Agency will enter into a dialogue with the relevant stakeholders. On this basis, they will clarify the rules for the aggregation of flexible electricity consumers.

- **In a first step, access for the aggregators to the balancing energy markets is to be simplified.** For the minute reserve, aggregators already have the right to access the balancing groups (the duty of the balance responsible parties to "open up" their balancing groups). In future, this duty will also apply to secondary balancing energy. To achieve this, Section 26 subsection 3 of the Electricity Grid Access Ordinance is to be revised to permit the opening up of the balancing groups for secondary balancing energy. The Federal Ministry for Economic Affairs and Energy and the Federal Network Agency will examine whether and to what extent an efficient implementation of the opening up of the balancing groups requires further legislation.

Measure 11: Supporting the wider use of electric mobility

Electric mobility is a key for sustainable mobility and can provide greater flexibility for the electricity market in future. The increased use of electric mobility depends on a needs-based charging infrastructure. For this reason, the rules governing investment in the provision of recharging points for electric vehicles are to be improved. To this end, the categorisation of recharging points in terms of energy law is to be clarified. It will also be ensured that every user can “fill up” and pay at every publicly accessible recharging point (non-discriminatory access).

Justification

Electric mobility is a key for sustainable mobility and can provide greater flexibility for the electricity market in future. Electric mobility can make an important contribution to the energy transition. It can also deliver flexibility in the electricity supply: particularly when there is a lot of wind and solar power and the prices are therefore relatively low or even negative, electric vehicles can, depending on the price signals from the market, control their recharging process (cf. field of action 4).

The increased use of electric mobility depends on a needs-based charging infrastructure. Investors need clear rules if they are to invest in the provision of recharging points for electric vehicles. At the same time, the legal framework for the users of electric vehicles must ensure system-neutral, non-discriminatory access to the charging infrastructure. Diverse business models should be able to develop and flexibility passed on in the form of market price signals.

Key points

The rules governing investment in the provision of recharging points for electric vehicles are to be improved:

- **The categorisation of the charging infrastructure in terms of energy law is to be clarified.** The Electricity Market Act will categorise the recharging points in the Energy Industry Act in terms of energy law, and will thus stipulate the rights and obligations of operators of recharging points. This will provide the necessary legal certainty. The Electricity Market Act should thereby also ensure that the operators can connect their recharging points to the grid, have access to the grid, and can freely choose their electricity provider.

- **Rules are to be put in place governing non-discriminatory access for the users of electric vehicles to the charging infrastructure.** European Directive 2014/94/EU requires clear rules on non-discriminatory access to recharging points for users of electric mobility. This requirement will be implemented by an ordinance based on Section 49 of the Energy Industry Act. The ordinance will ensure that it is possible to respond flexibly and quickly to the special needs of the various market players.

- **In particular, the ordinance is to give consideration to the following aspects:**
  - **Ensuring non-discriminatory access:** The ordinance implements the requirements of European Directive 2014/94/EU regarding interoperable, system-neutral and thus non-discriminatory access for the users of electric vehicles to the charging infrastructure.
  - **Enabling payment and billing at the recharging points:** The ordinance will put the conditions in place for harmonised authentication and billing procedures, direct payment systems and transparent pricing at recharging points.
  - **Utilising potential for flexibility:** It is to be possible to utilise the flexibility of electric vehicles on the electricity market. For this, it must be possible to pass on market price signals.

Measure 12: Making it possible to market back-up power systems

Back-up power systems secure the supply of electricity for infrastructure when there are local failures in the public grid. In the electricity market 2.0, back-up power systems can contribute towards a secure and cost-efficient electricity supply. To this end, it is necessary to ascertain systematically what potential already exists and to remove regulatory impediments. The Federal Network Agency's new core market data register will therefore list the back-up power systems of relevance to the electricity market. Further to this, it is being ensured that new installations can participate on the electricity market.

Justification

In the electricity market 2.0, back-up power systems **can help to cover peak demand on the spot market.** Back-up power systems secure the supply of electricity for infrastructure – e.g. airports or computer centres – when there are local failures in the public grid. These back-ups are, for example, emergency generators with a diesel engine which do not normally feed into the public grid. Operators of back-up power systems can not only benefit from the security these installations provide, they can also profit from marketing them. The investment costs and the fixed operating costs of existing back-up power systems accrue in any case, whether they are marketed or not. For this reason, some operators of back-up power systems are already active on the balancing energy markets via virtual power stations. In future, back-up power systems will be able to make a cost-efficient contribution to security of supply at peak times, alongside other flexibility options like demand side management. To this end, back-up power systems need to meet the technical and regulatory preconditions for temporary participation on the electricity market.

There will be a systematic assessment of the existing potential and a removal of regulatory impediments. A systematic analysis of the potential can provide operators of virtual power stations with an overview of existing back-up power systems and potential business partners. The listing will also provide information about the characteristics of existing back-up power systems. This will enable the regulator to assess whether technical and/or regulatory impediments affect the marketing of the installations. Also, it will be possible to quantify more precisely the contribution of back-up power systems to security of supply.

Key points

The marketing of back-up power plants is to be simplified:

- **The Federal Network Agency's new core market data register will systematically list the existing back-up power** systems**.** This listing will provide information about the quantity and main characteristics of the existing installations – e.g. the installed capacity, the site, the grid connection point and the grid level connection to the public grid. There will be a de minimis limit below which smaller installations will not be included in the core market data register.

- **It is to be ensured by law that new installations will be able to play a greater role on the electricity market in future.** The Electricity Market Act defines the basic technical preconditions for new installations to be able to participate on the electricity market, e.g. the preconditions for parallel generation. There will be a de minimis limit below which smaller installations will not be included.

Measure 13: Gradually introducing smart meters

Producers and consumers can use the market price signals to become more flexible in the electricity market 2.0. This flexibilisation requires a reliable metering and control infrastructure. The "smart grids" package of ordinances will therefore provide the main rules for a reliable and economic deployment of smart meters. The Federal Ministry for Economic Affairs and Energy will present this package in the summer of 2015.

Justification

Producers and consumers can use the market price signals to become more flexible in the electricity market 2.0. The cheapest solutions win through in a technology-neutral competition between flexibility options (cf. Chapter 3.2). We are transitioning from a power system in which dispatchable power plants follow electricity demand to a power system where flexible producers, flexible consumers and storage systems respond to the intermittent supply of wind and solar power.

This flexibilisation requires a reliable metering and control infrastructure. All capacities must be able to engage in a secure and standardised data exchange. That will make it possible to control the system and bill the services provided. For this reason, smart meters are important: they provide market players with information about the development of consumption and generation and pass on price signals to consumers quickly. In this way, they replace pure forecasts based on estimates, pre-year figures and imprecise standard load profiles, and put a basic prerequisite in place for the flexibilisation of demand. Smart meters generate new business models and market opportunities for companies in the energy sector, small-scale producers, commercial operations and large private consumers (BMWi 2014a). Smart meters gradually move the electricity sector into the age of the modern industrial society ("Industrie 4.0").

Key points

Smart meters will be gradually rolled out with high data protection standards:

- **In February 2015, the Federal Ministry for Economic Affairs and Energy presented key elements for a "smart grids" package of ordinances.** The cost-benefit analyses undertaken by the Federal Ministry for Economic Affairs and Energy have shown that smart metering systems can make a major contribution to the energy transition. For this to happen, the roll-out must be oriented to costs and benefits and use standardised technology which can be used in many different settings. The key points can be found on the website of the Federal Ministry for Economic Affairs and Energy (BMWi 2015a).

- **The "smart grids" package of ordinances will be presented in the summer of 2015:**
  - A metering system ordinance will be the basic technical ordinance containing the rules (protection profiles and technical guidelines) to ensure data protection, data security and interoperability.
  - A data communications ordinance will stipulate who can/should receive what data, how often, from whom, for what purpose.
  - A roll-out regulation will cover all the roll-out issues (who is required to install the meter and when) and the financing.

- **The Federal Office for Information Security (BSI) is continuing the modular development of the protection profiles and technical guidelines.** The rules on protection profiles and technical guidelines will stipulate a high standard for the smart meter gateway – i.e. the metering system's communications unit. This will create the necessary data security and the necessary confidence in the smart technology. The Federal Ministry for Economic Affairs and Energy is compiling the work plans for the necessary technical advances in a roadmap entitled "protection profiles for the smart energy grid".

- **A pilot programme will support the development of energy saving meters.** The "energy saving meters pilot programme" was adopted as part of the National Action Plan for Energy Efficiency and will be launched before the end of 2015. In the case of energy saving meters, a combination of hardware and software measures the energy consumption of a certain appliance, e.g. a household appliance or commercial equipment. If an old appliance is replaced by a new appliance, or if maintenance work optimises its energy performance, the meter can register the energy consumption. It can also compare the new consumption with the previous level and display the amount of electricity saved – both in kWh and in euros. Energy saving meters also show users where they consume the most energy and what energy efficiency and flexibility measures make sense for them.

Measure 14: Reducing the costs of expanding the power grid via peak shaving of renewable energy facilities

It makes economic sense for the transmission system operators not to expand the grids to cover the "last kilowatt-hour generated". Rarely occurring output peaks do not need to be transported. The curtailing of wind and solar power installations – often called "peak shaving" – can considerably reduce the need to expand the grid. Transmission system operators will therefore be required to undertake peak shaving: the figures they use when planning the grids must reduce the annual power generation of each connected onshore wind energy and PV installation by 3 percent.

Justification

It makes economic sense for the transmission system operators not to expand the grids to cope with the "last kilowatt-hour generated". If the transmission system operators build a curtailment of 3 percent of annual feed-in of wind and PV energy into their grid planning, the need to expand the grid is reduced substantially. The aim is a needs-based grid expansion, the dimensions of which make economic sense. This requirement is already built into the scenario framework for the 2025 grid development plan approved by the Federal Network Agency.

Key points

The peak shaving of renewable energy installations is to be introduced as a statutory requirement for transmission system operators:

- **To achieve this, the Federal Ministry for Economic Affairs and Energy will adapt the Energy Industry Act and the Renewable Energy Sources Act.** The curtailing will refer to the onshore wind energy and PV installations connected directly to the respective grid. Existing and new installations will be treated equally. The planners are to simulate a level of power generation reduced by a maximum of 3 percent per installation. This rule will only apply to transmission system level. At distribution system level, the grid operator is given the possibility to take account of peak shaving in its grid planning.

- **The grid operators are to continue to be able to flexibly curtail the individual installations.** In actual operations, the grid operators will carry out the feed-in management measures in accordance with the usual ranking. The statutory rules and guidelines will not change. The priority feed-in of renewables-based and CHP electricity will not be altered. Grid operators will continue first to curtail those installations which have the greatest impact on the grid congestions. This will enable them to keep the curtailed quantities of energy as small as possible.

- **Redispatch and compensation rules will remain in place.** The distribution system study by the Federal Ministry for Economic Affairs and Energy has shown that peak shaving which retains the current rules on redispatch and compensation is the most economically efficient way to reduce the need to expand the grid (BMWi 2014a). At present, redispatch and compensation rules treat the conventional and renewable installations virtually as though no curtailment had taken place. If such compensation is removed, there is a great danger that, due to rising risks, the grid operators will not use peak shaving. Rather, it is to be expected that the relevant installation operators would question each (non-compensated) curtailment demand. The grid operators would then have to show the order in which curtailment takes place and demonstrate that the installations which they have curtailed without compensation have not been discriminated against. Otherwise, they would have to pay damages to the installations which have been discriminated against. This would make it more difficult to respond quickly and flexibly to grid congestions. Also, without compensation, the risk of curtailment would have to be priced into all installations even though only certain installations would be actually curtailed. This would increase the total costs of financing and funding wind and PV installations.

Measure 15: Evaluating minimum generation

At present, a certain level of minimum generation from thermal power stations is needed for system stability; however, this can make it more difficult to integrate renewable energy and can thus generate economic inefficiencies. It is therefore important to regularly evaluate the factors influencing minimum generation and its development, and to make them transparent. The Federal Network Agency will therefore evaluate this in a report published every two years.

Justification

At present, a certain level of minimum generation is needed for system stability; however, this can displace renewable energy and thus generate economic inefficiencies. Ancillary services like frequency control, voltage stability and redispatch capability are required for the maintenance of system stability. These ancillary services are currently provided chiefly by conventional power station and pumped storage power stations. This results in what is termed “minimum generation”. The provision of heat can also result in minimum generation. This is the case when CHP installations are needed to provide heat, but they simultaneously feed in electricity irrespective of the market price or their feed-in quantity cannot be reduced for redispatch (cf. Green Paper, Chapter 2.3).

It is therefore important to regularly evaluate the factors influencing minimum generation and its development, and to make them transparent. On this basis, it is possible to examine how system stability can be ensured even if there is lower minimum generation.

Key points

The minimum generation will be continuously evaluated:

- **The Federal Network Agency will evaluate minimum generation from thermal power stations in a report.** The report will be published every two years, the first report appearing on 31 March 2017.

- **The report will identify the factors which chiefly influence the minimum generation in the last few years and present them in a comprehensible manner.** These include, for example, balancing capacity, reactive power, short-circuit power, redispatch capability and heat generation. It will also, by way of example, evaluate relevant grid situations – and particularly those which are critical in terms of the integration of renewable energy – on the basis of the available information.

- **An important basis for the analyses is provided by the information on minimum generation received from power plant operators by the transmission system operators in the context of the energy information network.** On this basis, the analyses are to identify the most critical hours for the integration of renewables – e.g. hours with the lowest residual load. For these hours, the reason for the cited minimum generation and the fuel used by the installations will be ascertained.

- **The report will also consider the future development of minimum generation.** It will derive recommendations as to how the provision of ancillary services can be developed further and made transparent in a sensible and efficient manner in the context of the ongoing processes.

Measure 16: Integrating combined heat and power generation into the electricity market

The highly efficient and climate-friendly cogeneration of heat and power will continue to play an important role in the energy transition in future. However, the future funding of CHP must be designed to be compatible with the other goals of the energy transition. For example, since the proportion of electricity generated from renewables keeps rising, there is no point in basing the expansion target of 25 percent by 2020 on total power generation.

Justification

Flexible and efficient CHP reduces the use of primary energy as a fuel, thereby cuts carbon emissions, and can respond to the feed-in of electricity from wind and solar power. The CHP Act is one of the instruments which enable sustainability in the electricity market 2.0 (cf. Chapter 3.3).

At present, some of the existing CHP installations are at risk of closure due to the fall in electricity prices. The loss of highly efficient cogeneration of heat and power would result in higher carbon emissions and primary energy consumption. Temporary funding for CHP installations at risk of closure should therefore serve as a “bridge” until the planned measures to improve the market have an impact. At the same time, by converting existing coal-fired installations to gas-fired installations, we can further reduce the carbon emissions.

Key points

The CHP Act will be revised in line with the following principles:

- **The future expansion target for CHP will be set at a share of 25 percent of thermal electricity generation and not, as in the past, expressed as a share of total electricity generation.**

- **The electricity generation from CHP is to become more responsive to the price signal, and thus more flexible.** To make this possible, larger heat storage units are needed so that the unchanged level of demand for heat can be met despite the flexibilisation of electricity generation. In order to do this, the funding rates are to be kept constant, whilst the eligible volume of investment in heating networks and storage is to be increased.

- **Where the viability of highly efficient gas-fired CHP installations supplying the public is at risk, funding will be provided for a limited period in order to safeguard them.** Otherwise, the generation of heat and power would be separated again, resulting in lower energy efficiency and higher carbon emissions. This is a transitional measure until the reduction in overcapacities on the electricity market normalises the situation and reformed emissions trading again provides economically effective incentives for lower carbon emissions.

- **In the case of existing CHP installations, a move from coal-fired to gas-fired installations can bring about a substantial reduction in carbon emissions.** We will provide euros 500 million for this in the context of funding for CHP. In order not to undermine the reduction effect, the funding for existing installations will not include coal-fired installations.

Measure 17: Creating more transparency concerning electricity market data

The electricity market 2.0 is based on the individual decisions taken by the market players. The public is also to have access to transparent and up-to-date electricity data. In future, an online platform will provide electricity market data for Germany in a user-friendly and up-to-date manner. This will be regulated by the Electricity Market Act.

Justification

The electricity market 2.0 is based on the individual decisions taken by the market players. The market players respond to the price signals from the electricity market on a decentralised basis. In this way, the electricity market 2.0 can ensure security of supply, is cheaper, and can make innovation and sustainability possible (cf. Chapter 3).

The public is also to have access to transparent and up-to-date data. In principle, the generation and consumption data are already publicly accessible. However, some of them are not presented in a very user-friendly manner, are incomplete, or are available late or not in German. In contrast, an online platform will create broad access to relevant information. In this way, it can contribute to an informed and objective discussion about the energy transition. This will facilitate reliable monitoring of the energy transition and enhance public acceptance of the energy transition.

Key points

An online platform will create more transparency concerning electricity market data:

- **The Electricity Market Act is to establish the basis for an online platform for electricity market data.** The platform will collate electricity market data and present them in a user-friendly manner, where possible in real time. It will follow the models provided by other member states like Denmark and France. The Electricity Market Act will adapt the existing publication requirements as necessary in the Energy Industry Act. Additional reporting channels for data providers are to be avoided.

- **The online information platform will provide market data for Germany.** The platform builds on the central European transparency platform required by the European Transparency Regulation (Regulation (EU) No 543/2013), which ENTSO-E has been operating in English since January 2015. This website publishes data on generation, transport and consumption of electricity. By taking the following steps, the Federal Ministry for Economic Affairs and Energy can also provide these data in a national format:
  - **Recourse to the data which are available under the EU Transparency Regulation and are transmitted to ENTSO-E:** These include total load, generation, electricity exports and imports, cross-border physical flows of electricity, unavailability of production units and transmission infrastructure.
  - **Presentation of the information on a website:** The platform will contain interactive and user-friendly diagrams with the possibility to request data.
  - **Consideration of inclusion of further relevant information.** In this way, new user groups can be attracted to the platform. Examples include electricity prices on the wholesale market, price sheets for the grid use fees of the distribution system operators, or the joint publication of insider information in the context of the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT).

- **The Federal Network Agency will ensure greater transparency through the core market data register.** The register is to be available by 2017 and comprise all the relevant basic data for all renewable and conventional generating installations. It will only include data which are admissible under data protection rules, and will protect operating and business secrets. In this context, consideration will be given to what existing reporting requirements could be abolished.

5.3 Component 3: Additional security

The measures of components 1 and 2 strengthen the existing market mechanisms and ensure that there is a flexible, efficient electricity supply. The measures of component 3 provide additional security of supply. The monitoring process will continuously survey the security of supply. The capacity reserve will guarantee the security of supply on the electricity market, including in unexpected situations. The grid reserve protects the grid against regional congestions until major grid expansion projects have been completed. It will be dovetailed with the capacity reserve.

Overview of the measures of component 3

Measure 18 Monitoring security of supply
Measure 19 Introducing a capacity reserve
Measure 20 Continuing to develop the grid reserve

Measure 18: Monitoring security of supply

Security of supply is of central importance. It is to be continuously monitored on the basis of appropriate methods. For this reason, the Federal Ministry for Economic Affairs and Energy will regularly publish a report on security of supply on the electricity market. It will appear at least every two years and will consider Germany in the context of the European electricity market.

Justification

If there is to be a secure power supply, sufficient capacity must always be available to cover electricity demand. Capacity includes conventional power stations, renewable energy installations, and also storage facilities and flexible consumers (cf. Chapter 3.1).

The present monitoring pursuant to the Energy Industry Act requires the transmission system operators to produce an annual national system adequacy forecast. This purely national perspective is no longer appropriate. It does not provide any meaningful information about security of supply in an internal European market. In particular, it does not give appropriate consideration to (cross-border) smoothing effects in the case of renewable energy, demand and power plant failures. A new methodical approach is therefore required.

Key points

The development in security of supply in Germany within the European electricity market will be continuously monitored:

- **The Federal Ministry for Economic Affairs and Energy will publish a regular monitoring report on security of supply, the first one appearing in 2017.** The report will provide a quantitative analysis of the development in security of supply. It will also analyse possible impediments affecting the use of flexibility options.
- **The Electricity Market Act will anchor the monitoring process in law and revise the existing Section 12 subsection 4 and 5 and Section 51 of the Energy Industry Act.** The transmission system operators will continue to provide the data on the supply and demand situation in Germany and – where possible – in the neighbouring countries.
- **The monitoring will deliver quantitative analyses of the development of security of supply (indicator-based calculation).** The quantitative analyses will be based on a cross-border perspective. This perspective will consider smoothing effects in the case of renewable energy, loads and power plant failures, and also dynamic adjustment processes on the electricity market.
- **The monitoring will take account of the probabilistic nature of security of supply.** It will study the likelihood that the available supply can meet the demand for electricity. The monitoring will also take account of the available interconnectors. It will use a new calculation method based on suitable indicators. In particular, the indicator of supply probability will likely be used: it describes the expected proportion of electricity consumption (in GWh) which the available generation can cover without further measures, and takes account of flexibility options like demand side management. The data basis of generation and consumption data will be improved for the report.

Measure 19: Introducing a capacity reserve

By creating a capacity reserve, we are providing a further back-up for the electricity market 2.0. These power stations will be used only if, despite free price formation on the wholesale market and contrary to expectations, supply does not cover demand at a particular time. The capacity reserve ensures that all consumers can still obtain electricity in such a situation.

Justification

It is possible that, in unforeseeable situations, supply and demand will not match. Unlike the “capacity market”, the capacity reserve consists solely of power stations which do not participate on the electricity market and therefore do not distort competition and pricing.

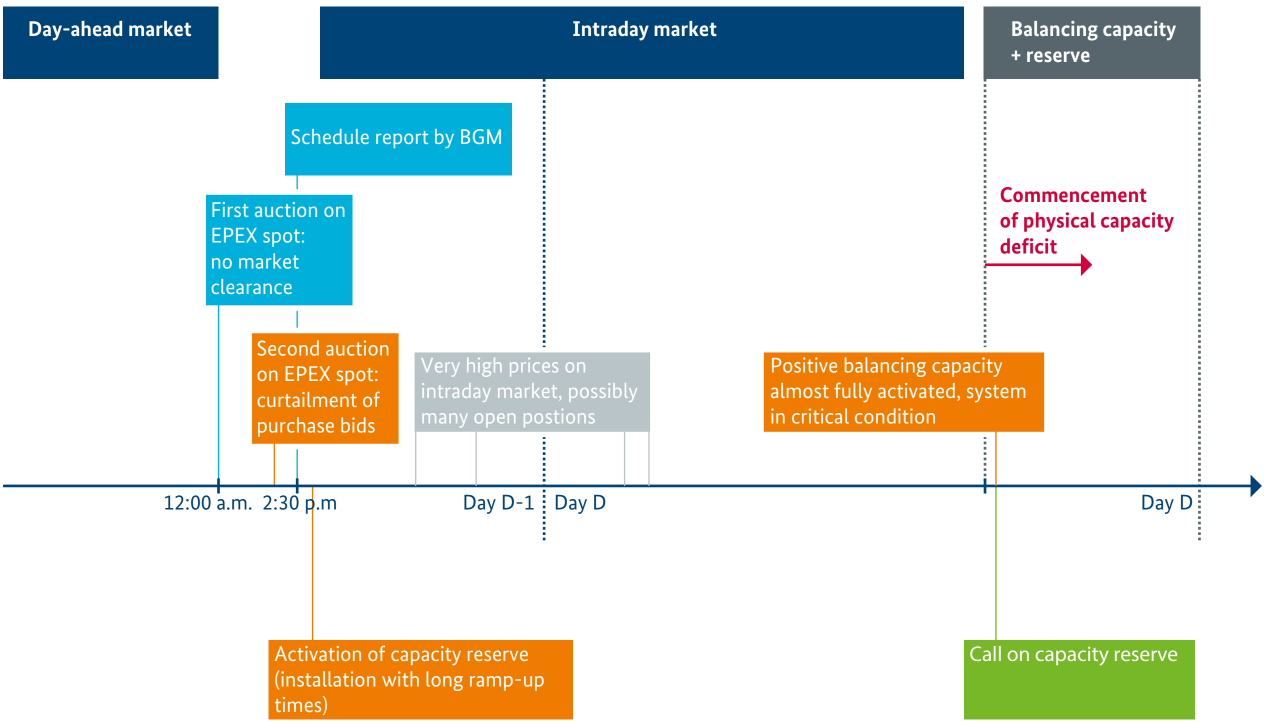
Key points

The Electricity Market Act will introduce a capacity reserve:

- **The capacity reserve will maintain technically suitable reserve power stations.** Following an auction, the transmission system operators will enter into contracts with power stations whose technical characteristics make them suitable to provide the reserve capacity in time and in a targeted manner. It looks likely that power stations will only participate in the auction if they can no longer be commercially operated on the electricity market. They will remain the property of their operators. The transmission system operators will only control their dispatch.
- **Temporarily, old lignite-fired power plants will be moved into the capacity reserve on the basis of contracts, and will subsequently be decommissioned.** This measure will serve the attainment of the national climate targets for 2020.

- **The capacity reserve will only be deployed if there is a capacity deficit.** In the unlikely event that, on the day-ahead market, despite free pricing, insufficient electricity is offered on the electricity exchange in order to cover demand, the transmission system operators will call on the power plant operators to place their installations " on stand-by". The power stations will ramp up to their minimum partial load and await further instructions from the transmission system operator. On the following day, the short-term, intraday trading takes place. The transmission system operators will only intervene if this intraday trading is also unable to fully cover the demand, despite free pricing. First of all, they will use the available balancing capacity. If this proves insufficient, the transmission system operators will call on the reserve power plants to cover the remaining demand (cf. Figure 16).

Figure 16: Deployment schedule



Source: Own chart

- **The capacity reserve and the grid reserve are two different instruments.** The capacity reserve safeguards the electricity supply in the unlikely event that the market is unable to balance supply and demand. In contrast, the grid reserve secures the functioning of the grid where there are regional congestions. Until the congestions in the grid have been removed, it will retain power stations in southern Germany so that they can be used for redispatch in the case of grid congestions. Whilst the capacity reserve will be introduced nation-wide and without a time-limit, the grid reserve has a regional, temporary task which largely depends on the progress made on expanding the grid. The grid reserve can be closed down as and when key grid expansion projects are completed and reserve power plants are no longer needed for secure grid operation.

- **The procurement of the capacity reserve will be dovetailed with the procurement of the grid reserve.** The first step will be the call for bids to provide the capacity reserve. Bids can be made by all technically suited power stations, including those which are already in the grid reserve. The contracts will be awarded to the cheapest power stations with the lowest costs for maintaining their availability. In a second step, the transmission system operators will review which of these power stations are located in southern Germany and can serve in parallel as a grid reserve. Where, after this step, there is still an additional need for a grid reserve, contracts will continue to be concluded with power stations to serve solely as a grid reserve in order to cover this additional quantity. However, since the group of potential bidders in southern Germany is too small, there is no point in inviting bids for this. The transmission system operators will continue to purchase the grid reserve in direct negotiations with the power stations (cf. Figure 17). The current Reserve Power Plant Ordinance, which regulates the grid reserve, will be extended beyond 2017.

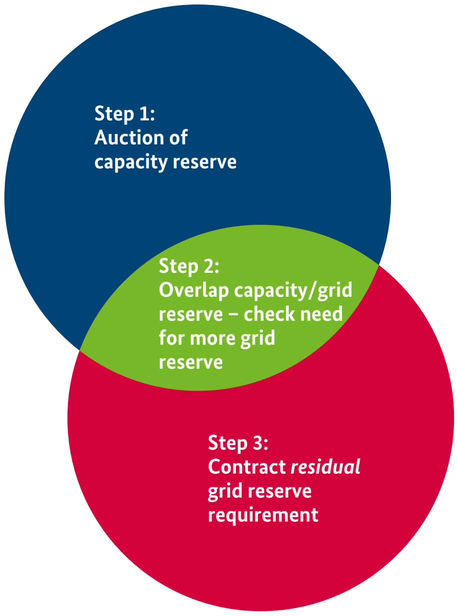
- **The cost of maintaining the capacity reserve will chiefly be determined by the outcome of the auction.** To the extent that the reserve is not deployed, the costs of maintaining it will be shared amongst all electricity consumers.

- **The costs of the use of the capacity reserve will be billed in line with the user-pays principle.** If the capacity reserve is deployed, it will be paid for by the electricity suppliers which were unable to meet their obligations to supply; these suppliers will pay an appropriate percentage of the total costs of the reserve in line with their contribution to the need to deploy the reserve. The billing will take place via the established balancing capacity system. If the reserve is deployed, the minimum price for the suppliers which failed to cover their needs will be euros 20,000/MWh. This equates to the maximum technical price in intraday electricity trading plus a 100 percent surcharge. This gives the suppliers clear incentives to cover their supply obligations at an early stage via futures contracts or agreements with their customers, so that the reserve does not need to be used at all.

- **The size of the capacity reserve is based on the anticipated average annual peak load.** 5 percent of this, i.e. approx. 4 GW of installed capacity, will be retained as a capacity reserve. The Federal Network Agency will review the required size of the capacity reserve at regular intervals.

- **The capacity reserve will not impair the electricity market.** It will therefore be set up entirely separately from the market. These reserve power stations will be available exclusively to the transmission system operators, and will only feed in electricity as instructed by them. The electricity will not be sold on the electricity market. Once the contract governing their role as a reserve has ended, the power stations can bid again to act as a reserve. Power plants which previously formed part of the reserve and are no longer in it must be permanently shut down.

Figure 17: Dovetailed procurement of capacity reserve and grid reserve



Source: Own chart

Measure 20: Continuing to develop the grid reserve

The grid operators will ensure that the traded electricity reaches the consumers. Until leading grid expansion projects are completed, the transmission system operators will need the regional grid reserve to safeguard against particular load situations in the grid. The grid reserve will therefore be extended until the end of 2023 and developed further in line with practical experience.

Justification

The market players in Germany act in a single price zone. It is assumed that the electricity can be transported from the generating installations to the customers. In practice, however, grid congestions are rendering this impossible in a growing number of hours each year. At these times, the transmission system operators use “redispatch” measures. That means that they ramp down power stations ahead of the congestion (power stations which won contracts to supply electricity on the electricity market) and ramp up power stations behind the congestion (power stations which did not win such contracts). The power stations ahead of and behind the congestion are paid compensation for this intervention. The costs are passed onto the customers via the grid charges (cf. field of action 6).

Until leading grid expansion projects are completed, the transmission system operators in southern Germany will need a grid reserve. Systemically relevant power stations in southern Germany cannot be closed down at present, since they are required for redispatch. The size of the grid reserve can be reduced in line with progress on expanding the power grid.

Key points

The Electricity Market Act will extend and develop the grid reserve:

- **The grid reserve will be extended until the end of 2023.** At present, it expires at the end of 2017. However, it will continue to be needed.

- **The grid reserve will continue to be procured via the procedure established in the Reserve Power Plant Ordinance.** The transmission system operators and the Federal Network Agency will determine the need for reserve power plants for the grid reserve function in annual system analyses. Following this, the need for generating installations will be covered by contracting them as members of the grid reserve.

- **If a power station is temporarily shut down, the conditions governing its standby operation will apply not from the shutdown, but as soon as the Federal Network Agency has established that the power station is systemically relevant.** Power stations which have not yet been amortised will also receive the pro-rata annual amortisation in future as compensation for the depreciation. Also, the statutory conditions will be put in place for power stations which are only temporarily closed down to be able to return to the commercial market after four (currently: five) years.

- **Power stations in the capacity reserve will in future also be able to provide the grid reserve.** To be able to do this, they must be located “at the right place” on the grid. The transmission system operators will examine the locations once the capacity reserve auction has been completed (cf. measure 19). Installations which are already active in the grid reserve will also be able to bid to form the capacity reserve. No double fees will be paid.

- **The dovetailing with the capacity reserve necessitates amendments to the Reserve Power Plant Ordinance.** The total volume required according to the system analysis will not be procured immediately. Instead, the transmission system operators will first establish whether and how many installations in the capacity reserve can also function as the grid reserve. These installations will reduce the need to procure additional grid reserve capacities. This dovetailing and the practical experience with the grid reserve – and the system analyses – will result in further adjustments. These include for example the deadlines for the transmission system operators and the Federal Network Agency. The criteria governing appropriate cost reimbursement for the installations in the grid reserve will also be reviewed and adjusted if necessary. Further to this, as part of a reserve solution for southern Germany, from 2021 a segment of up to 2 GW will be set aside for new power plants that are able to ramp up quickly and without assistance from the electricity grid (black start capability) and which can be controlled very flexibly..

Chapter 6: Fields of action for the future

Chapter 5 describes the measures to be taken in the short term to improve the electricity market's ability to function. However, the electricity market 2.0 will face new challenges (6.1) as the implementation of the energy transition proceeds. More extensive measures are therefore required. The following section outlines the relevant fields of action (6.2).

6.1 Outlook for the further development of the electricity market 2.0

The electricity market 2.0 will face new demands as the implementation of the energy transition proceeds. The Federal Government's targets are ambitious: by 2020, the goal is to reduce greenhouse gas emissions by 80 – 95 percent compared to 1990 levels, and cut primary energy consumption by 50 percent over rates for 2008. This will be helped by reduced electricity consumption. At the same time, the Federal Government seeks to increase the share of renewables in total electricity consumed to at least 80 percent. By way of comparison: in 2014, the share of renewables in the total of electricity consumed was approximately 28 percent.

The measures outlined in Chapter 5 implement the electricity market 2.0 for the current phase of the energy transition. In particular, the measures contained in the "Stronger market mechanisms" and "Additional security" components will ensure that the electricity market can continue to guarantee a very high degree of security of supply. Also, the measures from the "Flexible and efficient energy supply" component are geared towards a more affordable and environmentally friendly electricity supply.

The energy transition will place new challenges on the design of the electricity market:

- The European Member States have already taken important steps on the path towards a liberalised, integrated electricity market. This development is to be continued and intensified in the coming years (**field of action 1**).

- The electricity supply system must integrate the rising share of renewable energy sources in a secure and cost-efficient manner. Meanwhile, an appropriate policy framework can reduce the support requirement for renewable energies (**field of action 2**).

- Conventional power plants will remain an important means of ensuring security of supply. However, they will assume a new role in the supply of electricity: whereas in the past, these base load power plants were the backbone of the electricity generation system, providing a continuous supply of electricity, their role in future will be to supplement the fluctuating supplies from wind and solar energy (**field of action 3**).

- With the continued expansion of renewables, it is increasingly important to link the electricity, heating and transport sectors. If there is demand for electricity at market prices in all sectors and electricity is thus also converted to heat and mobility in response to market demand, the targets for reducing carbon emissions in the transport and heating sectors can be achieved at low cost (**field of action 4**). The electricity market design must therefore take into account the entire regulatory framework of the electricity sector.

- The focus of the electricity market design is shifting: besides addressing the goals for the electricity sector, the electricity market design must in future take greater account of the other goals targeted by the energy transition, such as boosting energy efficiency (**field of action 5**).

- Coordination between the power grids and the electricity market is vital. For example, greater interaction between the electricity, heating and transport sectors can have an impact on the power grids (**field of action 6**).

Other steps will therefore be implemented. Chapter 6.2 provides a look ahead at the fields of action described for the further development of the electricity market design.

Many of the comments on the Green Paper highlight the need for more action. Many of the proposals submitted by the consultation participants go beyond the measures set out in Chapter 5. For example, numerous stakeholders have commented on the support provided to renewable energy and its future role in the energy system (cf. field of action 2). There are also calls for a clear definition of the role of grid operators (cf. field of action 6). Many comments also focus on coupling of the electricity, heating and transport sectors (cf. Chapter 1.2 and field of action 4).

6.2 Fields of action for the future

Six fields of action outline the prospects for the further development of the electricity market 2.0.

Field of action 1: Strengthen the European internal market for electricity

The European Member States have already taken important steps on the path towards a liberalised, integrated electricity market. The monopolies controlling electricity supply and power grids were eliminated in the late 1990s. Today, numerous neighbouring countries are already tightly interconnected. The European electricity markets are largely coupled and continue to grow more closely together. This development should be continued and intensified in the coming years.

The European internal market reinforces security of supply. In an integrated European internal market for energy, a high level of security of supply can be created at low costs. The more the national electricity markets are interlinked, the greater the available flexibility potential. At the same time, advantage can be taken of the smoothing effects over a wide area and efficiency gains on the demand side, renewable energy and the use of conventional power stations (cf. Chapter 3.1 and measure 5).

The European target model for the electricity market is setting the direction of European electricity market policy. The European target model for electricity provides a basis for the further development of the European internal market in electricity. Its main components are: the coupling of national electricity markets in the day-ahead markets, cross-border trade in electricity (intraday market), a framework for long-term transmission rights and shared methods for the relevant underlying capacity calculations. The uniform rules for the market participants are implemented in the form of network codes (top-down approach). At the same time, regional initiatives such as the Pentalateral Forum are promoting the internal market in electricity, while taking account of local differences in integration (bottom-up approach).

The European target model requires further steps. The European Commission should complete the network codes without delay. The necessary implementation measures will then take place at national level. The Commission has also announced legislative proposals regarding the market design and security of supply. These legislative proposals should be informed by the European target model for the electricity market. If the target model is successfully implemented, the investment incentives across Europe will always be greatest where they are needed most urgently.

Security of supply must increasingly be considered from a European perspective. The latest report from the Pentalateral Energy Forum provides a starting point for a European outlook. This report was compiled by the transmission system operators from this region (Benelux countries, Germany, France, Austria, Switzerland) (Pentalateral Energy Forum 2015). It is a milestone in the monitoring of security of supply in electricity market. For the first time, the calculations take account of smoothing effects resulting from cross-border trade in electricity (cf. Chapter 3.1). In the coming years, the transmission system operators should continue this analysis and further develop the methodology. In doing so, they should also include a more detailed consideration of neighbouring countries. Looking ahead, the European transmission system operators should also apply a similarly advanced approach to their forecast for security of supply – the “Scenario Outlook and Adequacy Forecast” – (cf. also Chapter 5, measure 5).

Field of action 2: Reduce the support requirement for renewable energy by optimising the whole system

Further development of the electricity system crucially hinges on the expansion of renewables. First, the use of wind and solar power will continue to modify the electricity system: producers, consumers and storage systems are becoming ever more flexible in their response to the feed-in of these energy sources, which is weather-dependent. Second, wind and solar power are assuming a greater responsibility for the system due to direct marketing.

In the area of direct marketing, renewable energy installations currently already bear the same responsibility as conventional power stations. The Renewable Energy Sources Act, amended in 2014, requires new installations to sell electricity from renewables directly to the market.

In contrast to the arrangement under fixed feed-in tariffs, green energy producers are now incentivised by the floating market premium to respond to fluctuating market prices. For example, the operators of renewable energy installations in the market premium system curtail production when prices are moderately negative. The producers must also comply with the balancing group obligations and are thus subject to the same balancing group responsibility as conventional power stations (cf. box on direct marketing). In addition, new installations will no longer receive funding as of 2016 if prices are negative. This restriction stems from the European Commission's guidelines on state aid for environmental protection and energy. Renewable energy installations commissioned as of 2016 will no longer receive funding if prices are negative for a block of six hours. However, this will increase the cost of financing, which could in turn hinder the expansion of renewables. The provision will therefore be examined in the context of the Electricity Market Act.

The level of compensation required for renewables is determined by the difference between the electricity production costs and revenue opportunities on the electricity markets. Electricity production costs are made up of capital and operating costs such as the cost of fuel and the rate of return. Some important drivers are determined by (international) market conditions and are largely independent of the policy framework. For example, the price of gas and hard coal fuels influence the revenue level for electricity, including electricity from renewables. Steel prices, the availability of land and ongoing technological developments determine the costs of wind energy installations. However, some drivers can be influenced by the policy framework. The mission here must be to minimise the level of compensation required for renewable energy.

Efficient integration of renewables in the market through direct marketing

Operators of renewable energy installations in the market premium system are responsible for short-term production forecasts and for balancing any differences. They must forecast their feed-in requirements on a quarter-hour basis. To reduce differences or balance these efficiently, there is an incentive for these producers to improve their methodology and databases used for forecasting.

Renewable energy installations in the market premium system shut down production when prices are moderately negative. In this way, they help balancing between supply and demand and ease the burden on the EEG surcharge system compared to installations that receive fixed feed-in-tariffs.

Provided they fulfil the technical conditions, operators in the market premium system can offer their renewable energy installations on the balancing markets. Biomass plants, in particular, increasingly provide balancing capacity. The transmission system operators have also examined technical strategies for including wind energy installations in the market for (negative) balancing capacity. These are to be put into practice shortly and could reduce the minimum generation of fossil-fuel power plants.

The market and flexibility premium gives operators of renewable energy installations an incentive to generate electricity according to demand, as far as possible. The premium already incentivises biogas plants to focus on flexible operation. In future, it will be particularly in the interest of these plants to feed in electricity, especially when electricity prices are high, that is, when the demand for further electricity generation is high. Wind and photovoltaic installations can also feed in electricity according to demand, for example, by using wind energy installations with lower installed capacity and the same rotor diameter (turbines that work in low wind) or via an east/west alignment of the photovoltaic module. In this way, these installations help to meet demand, even when electricity prices are high.

As a result of mandatory direct marketing, electricity from renewable sources is already well integrated in the electricity market. At present, approximately 70 percent of electricity generated from renewables is sold directly to the market. By 2020, this share will rise to approximately 80 percent, according to current estimates.

An appropriate policy framework limits the level of compensation required for renewable energy:

- **Switching the support system to an auction-based model represents a paradigm shift.** The Renewable Energy Sources Act 2014 made provision for switching the support provided for ground-mounted PV installations to an auction-based system. In this new system, payment is made to the providers offering the most competitive electricity production costs. The Federal Government will present a report on the experience with auctions for ground-mounted PV installations. The amount of funding provided for other renewables should also be determined using auctions by 2017 at the latest. By identifying competitive electricity production costs, auctions should help to limit the cost of funding to the required level. The auction design plays a key role in this regard. In the design of auctions for onshore wind power, for example, it is important to foster competition through high availability and development of space while also maintaining a high degree of investment security to keep capital costs low.

- **An efficient emissions trading system reduces the level of compensation required for renewables.** The electricity production costs for renewable energy are continuously decreasing. There has already been a sharp drop in the cost differential between electricity from photovoltaic and onshore wind energy installations and electricity from lignite and hard coal. Today, new wind energy and photovoltaic installations in good locations can produce electricity at lower cost than new gas and hard coal power plants (Prognos 2013, Fraunhofer ISE 2013). The cost differentials between electricity from renewable and fossil energy sources will continue to decline. Aside from the technical advances in renewable energy technologies, key drivers of this development are the fuel and carbon allowance prices for fossil-fuel power plants. The rising costs of emissions is making fossil-based electricity production more expensive and raising the price on the exchanges. This in turn reduces the EEG differential costs and eases the burden on the EEG surcharge system.

- **A flexible European electricity system offers more revenue opportunities for wind and solar energy.** The power input from wind and solar energy sources is weather-dependent. Wind energy and photovoltaic installations only produce electricity when the wind blows or the sun shines. Based on the way electricity exchanges work, a high supply of electricity from wind and solar power plants that have close-to-zero marginal costs results in lower wholesale prices. This means lower revenues for the operators. A flexible electricity system can cushion the effects of this mechanism: for example, if the supply of electricity from renewable sources is relatively large and the demand for electricity is relatively low, flexible additional consumers (cf. field of action 4) and flexible conventional producers (cf. Chapter 5, measure 15) can prevent further reductions in the electricity price during these hours (Energy Brainpool 2014). In this case, lowering the must-run base in particular helps renewables achieve higher revenues on the electricity market. Furthermore, fluctuating demand and renewable electricity production are levelled out at European level through grid expansion and European electricity trading. Having a highly developed grid throughout Germany and Europe is a key factor in creating revenue opportunities for renewables. The more money the renewables can earn on the electricity markets, the lower the applicable market premium according to the Renewable Energy Sources Act. This reduces the costs that electricity consumers have to bear via the EEG surcharge. In this context, it is clear that the measures from Chapter 5 are essential to lower costs and enhance the market and system integration of renewables (cf. component 2, Chapter 5).

Field of action 3: Conventional power plants and renewables will complement each other in the future electricity supply system

Conventional power plants will remain an important means of ensuring security of supply. At present, over 50 percent of electricity generated in Germany is from fossil-fuel power plants. In 2014, lignite and hard coal accounted for around 43 percent of gross electricity production, while gas made up approximately 10 percent. Nuclear energy currently supplies another approximately 16 percent of total production. Fossil energy sources thus continue to make an essential contribution towards electricity production and ensuring security of supply. As the share of electricity production from renewable sources grows, the share of electricity produced from fossil energy sources will decline. However, these fossil energy sources play a crucial role in the integration of renewables in the electricity market by supplementing and levelling out the fluctuating electricity supplies from renewable sources.

Define the new role to be played by conventional power plants. The new role of conventional power plants in electricity production and the resulting new business model is more important than their quantitative share in electricity production. In the past, electricity production followed demand. Power plants continuously producing electricity and with low marginal costs covered the base load, while other power plants with higher marginal costs catered for the mid-merit and peak loads. As the share of renewables in the energy mix grows, the role of and the business model followed by conventional plants are changing. On the electricity market, the power plants are deployed in the order of their marginal costs. Wind energy and solar power plants with close-to-zero marginal costs take precedence over "base load power plants" in the base load. The role of conventional power plants is changing to offer a flexible partnership with sources of renewable energy and supply the necessary residual load. Responding flexibly to production and demand, as the new business model requires, presents power plants with additional challenges. However, the new business model will also allow power plants to tap into additional revenue when existing overcapacities are reduced in the case of high price differences on the electricity market.

Efficient and flexible conventional power plants will continue to be needed in the future. Modern power plants provide backup capacity for extended periods when insufficient electricity is generated by wind energy and photovoltaic installations.

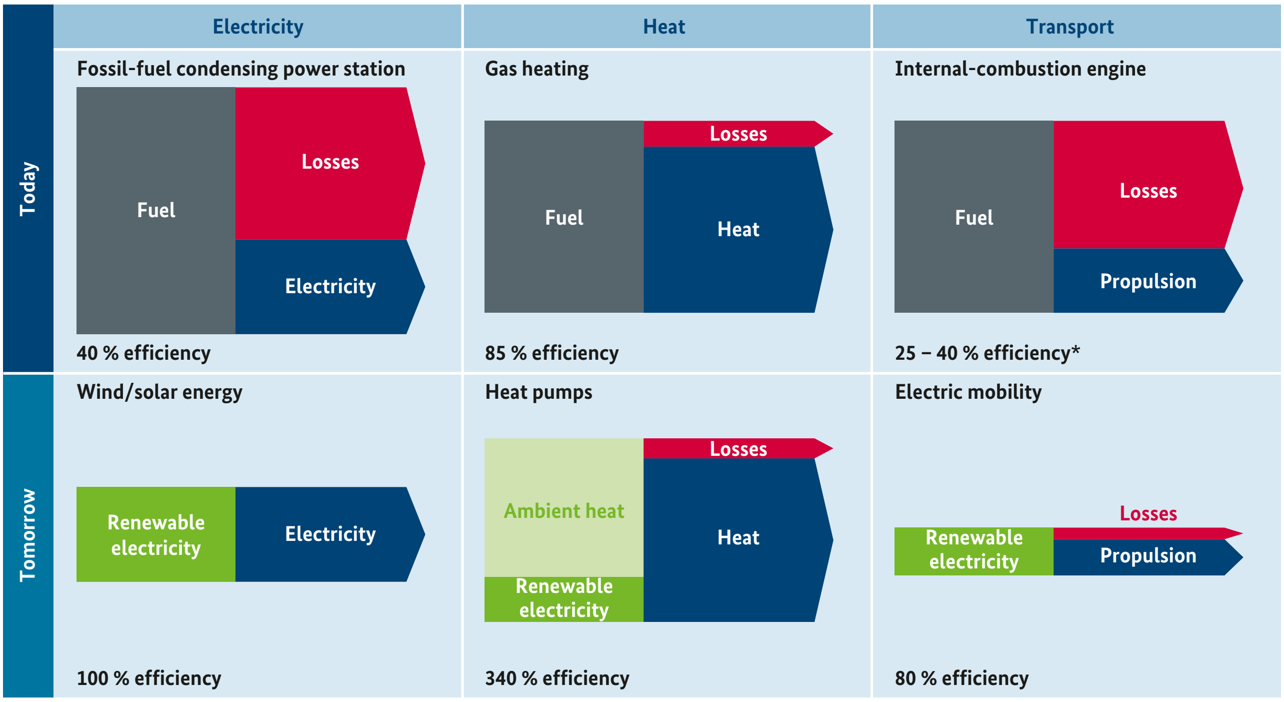
Structural changes are well underway. The conditions in which power plants based on fossil energy sources are deployed have already changed considerably. Nowadays these plants are increasingly operated according to a load profile, that is, depending on the wholesale prices resulting from fluctuations in the generation of renewable energy and the relevant demand. In future, power plants with rapidly dispatchable capacity will smooth fluctuations in power generation from renewables. Achieving high efficiency even at partial loads and at low minimum loads is one of the challenges these plants are now facing. The electricity market sends the relevant signals for dispatch of the power plants and investment in developing the flexibility of power plant fleet.

As part of the COORETEC research and development initiative, the Federal Government is funding research projects in the area of conventional power plants. One of the goals of the research initiative, in addition to further improving efficiency and minimising emissions, is to provide a low-cost, flexible means of covering the residual load.

Field of action 4: Apply sector coupling to use renewable electricity for heat, mobility and industry

Sector coupling will shape the future electricity supply system. Sector coupling (also referred to as "Power-to-X") is the use of electricity from renewable sources in the heating sector (Power-to-Heat), the transport sector (Power-to-Mobility) and in industrial processes (Power-to-Industry). Demand for renewable electricity outside the electricity sector gives rise to new and efficient applications that convert electricity into heat and mobility. This promotes market and demand-driven investment in renewable energy and also provides a cost-efficient means of achieving the targets for reducing carbon emissions in the heating and transport sectors in Germany.

Figure 18: Heat pumps and electric mobility boost energy efficiency and substitute fuels



* The efficiency of internal-combustion engines in other applications (e.g. maritime transport, engine-driven power plants) can exceed 50 %.

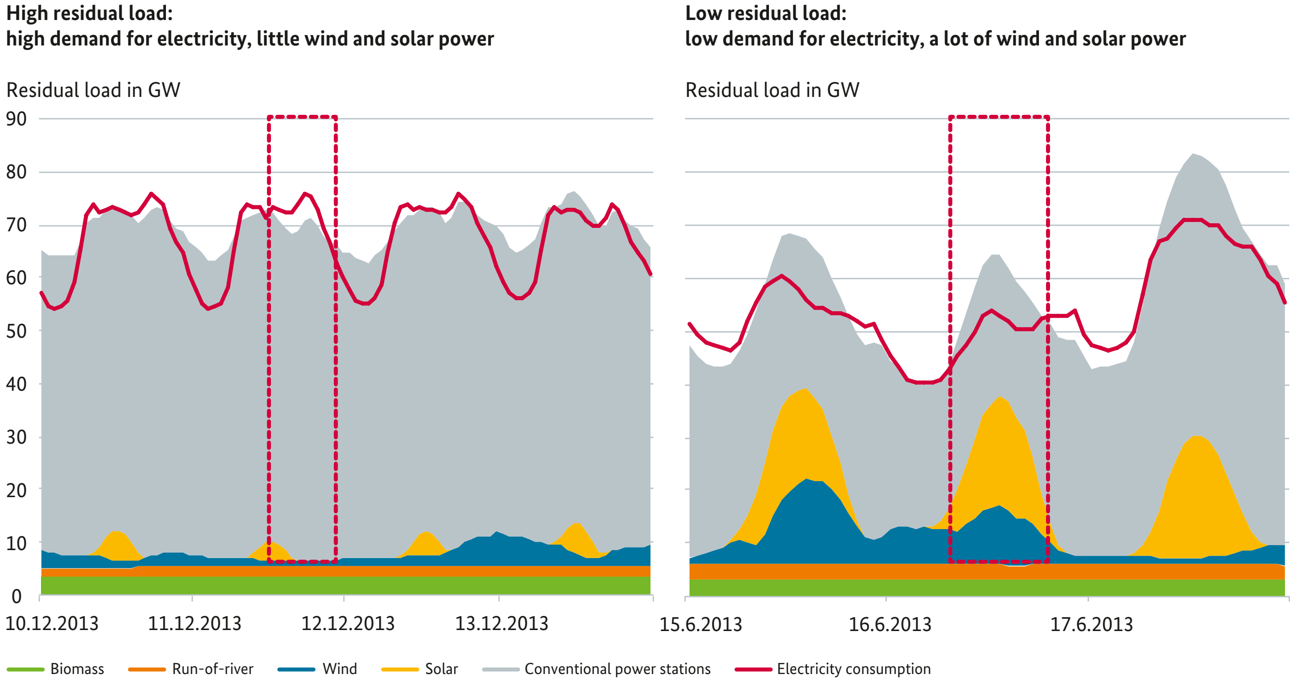
Source: Own chart based on Fraunhofer IWES (2015a)

Sector coupling is to favour high-efficiency technologies. Some of the most efficient applications using electricity include, for example, high-efficiency heat pumps in the heating sector and electric mobility in the transport sector. Heat pumps and electric mobility can replace fossil energy sources with renewables and reduce energy consumption in the heating and transport sectors (cf. Figure 18). Some industrial processes can also reduce their carbon emissions efficiently by using electricity. Electrical direct heaters are inefficient in terms of primary energy requirement, but relatively cheap. The supply of electricity from power-to-gas is less energy-efficient in general and until now, relatively expensive. It could therefore be a long-term option. For climate-related and efficiency reasons, electrical heaters and power-to-gas are only temporary options.

Sector coupling holds enormous flexibility potential for the electricity market. Final energy consumption in the heating, transport and industrial sectors is roughly three times higher than in the electricity sector (Fraunhofer IWES et al. 2015b). The new applications appearing on the electricity markets are flexible consumers. These applications offer enormous flexibility potential (cf. e.g. Fraunhofer IWES et al. 2015b, Öko-Institut, Fraunhofer ISI 2014). It is imperative that these new consumers follow the market prices in the electricity market 2.0. For example, battery and heat pump storage systems should be filled particularly when a large amount of electricity is generated by the sun and wind and demand is relatively low (cf. chart on low residual load, Figure 19). In this way, heat pumps with storage systems offer great potential for load management.

Sector coupling offers many more benefits. Sector coupling opens up new opportunities for industry and the energy sector. In the electricity market 2.0, market players can focus in particular on developing innovative solutions for times when a high feed-in of wind and solar power exists (cf. Chapter 3). Sector coupling also boosts the domestic economy when less money is spent on oil and gas and invested instead in “Power-to-X” technologies in Germany. New electricity applications also reduce Germany’s dependency on imports of oil and gas. Germany spends tens of billions of euros every year on fuel imports of oil and gas.

Figure 19: Examples of situations with high and low residual load



Source: Connect

Sector coupling requires the development of infrastructure and adjustments to state-induced price components and grid charges. Electric vehicles need a charging infrastructure (cf. measure 11). Heat pumps require the installation of surface heating systems during the construction and refurbishment of buildings. Both fields of action need time. The Federal Government has therefore already been active in these two areas. In addition, state-induced price components and grid charges are to be further developed to enable efficient sector coupling. The Federal Ministry for Economic Affairs and Energy is supporting this endeavour by developing a target model (cf. measure 7). Barriers to the direct use of electricity from renewable energy – for example in high-efficiency heat pumps – should be removed to this end.

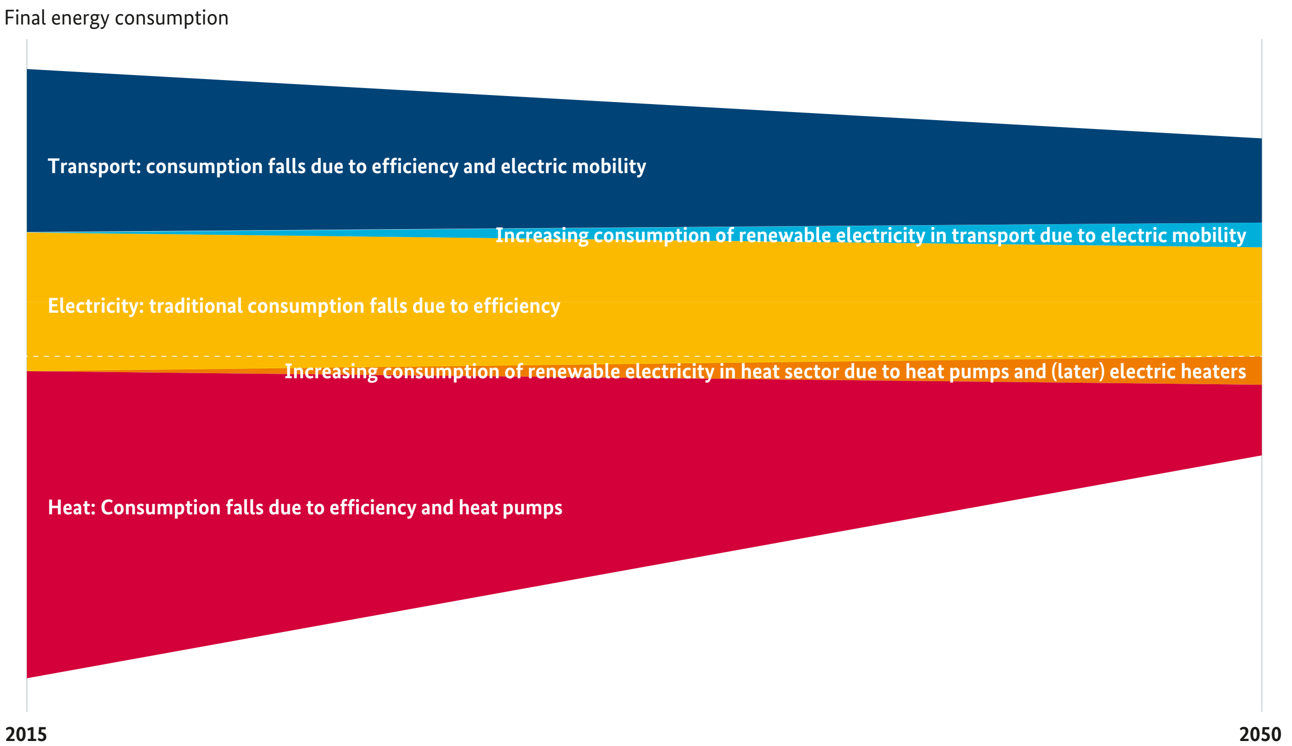
Field of action 5: More joined-up thinking behind energy efficiency and electricity market design

Energy efficiency is becoming ever more vital for the electricity market. Energy efficiency in traditional and new electricity applications cuts costs, drives down emissions and reduces fuel imports. This is because the efficient management of electricity in traditional electricity applications frequently reduces the need for power grids and capacities such as wind and solar energy installations, conventional power plants and storage systems. New applications such as efficiently used heat pumps and electric mobility boost energy efficiency in the heating and transport sectors. In the area of space heating, heat pumps, for example, replace roughly three to four kilowatt-hours from oil and gas through the use of two to three kilowatt-hours of ambient heat and roughly one kilowatt-hour of operating current. A prerequisite in this case is that the building envelopes must meet an appropriate energy performance level. Thanks to the higher efficiency of electric motors, electric mobility is also replacing internal combustion engines with one kilowatt-hour of electricity compared to roughly three electrical kilowatt-hours from oil or fuel (cf. also field of action 4).

Electricity consumption is falling due to the energy-efficient use of traditional electricity applications, but rising because of new electricity applications. Electricity consumption by traditional electricity applications is declining. In 2013, Germany consumed only 599 terawatt-hours of electricity, compared to approximately 618 terawatt-hours in 2008 (BMWi 2015c). This trend will be countered in the long term by new electrically driven applications such as electric mobility or heat pumps that use renewable electricity in the heating or transport sector. While these applications do lead to an increase in electricity consumption, they also substantially improve energy efficiency in the whole system: a technology transition towards high-efficiency heat pumps and electric motors is clearly reducing primary energy consumption. Heat pumps and electric motors can use electricity from renewable sources and thus replace imported oil and gas. In this way, these technologies cut carbon emissions and increase the share of renewable energy in the heating and transport sector. These trends can complement each other: when traditional electrically driven applications consume less electricity, leeway is freed up in the electricity supply system for new electrically driven applications. Figure 20 illustrates this correlation.

Energy efficiency and flexibility should be considered jointly. The relationship between energy efficiency and flexibility in the electricity system depends on whether a large or small amount of wind and solar power is produced in relation to demand (cf. Figure 19). If wind energy and photovoltaic installations produce low volumes of electricity and demand is particularly high (high residual load), flexibility and energy efficiency measures tend to lower system costs in the case of traditional electricity applications. If wind energy and photovoltaic systems produce large volumes of electricity relative to demand (low residual load), it could be increasingly useful in future to connect high-efficiency heat pumps and electric mobility applications and charge their battery and heat storage systems. At times when electricity is otherwise curtailed – that is, not used – the temporary connection of less efficient electricity applications such as electrical heaters could also make sense (cf. field of action 4).

Figure 20: Total energy demand decreases even though by sector coupling more renewable electricity is used



Source: Own chart based on Fraunhofer IWES et al. (2015b)

Field of action 6: Align the grid and the market

The energy transition is changing the demands on the market and grid. On the one hand, market players are responding ever more flexibly to the fluctuating supplies of wind and solar power. On the other, the expansion of wind and solar power means that power grids are facing new challenges: producers are increasingly feeding in electricity to the grid at lower voltage levels in particular. In the case of high feed-in of wind and solar power and low electricity prices, new flexible consumers such as heat pumps or electric vehicles may simultaneously increase their consumption of electricity and thus place a burden on the power grids (cf. field of action 4). Meanwhile the number of conventional power stations is ever diminishing and new providers are supplying ancillary services to maintain grid stability.

Grid expansion is still a core priority. To function efficiently, an electricity market needs strong grids. Market players must be able to conduct their business under the assumption that no grid congestions exist within the single price zone in Germany. Meanwhile only a well-developed grid can actually transport the electricity, as purchased and sold within the single price zone, from the producer to the consumer. The grid development plan and federal requirements planning outline the grid expansion necessary to achieve this goal.

The electricity market 2.0 should coordinate between the grid and market. The challenges faced by the market and power grid as a result of the energy transition can be jointly overcome through efficient coordination. System stability is a valuable asset that must be protected.

- **Grid operators must assume new tasks and coordinate these more closely with each other.** Increasingly, electricity from the distribution grids is fed into higher grid levels. This means that distribution grid operators must play a more active and thus more complex and responsible role in managing their grids. Checks should therefore be performed to verify if the current system of differential balancing groups (the system by which distribution grid operators manage the deviations associated with non-capacity-profiled customers such as residential customers in their grids) can cope with these challenges. Smart metering systems can help distribution grid operators to meet the growing demands on stable grid operation management. Furthermore, the increased systemic importance of producers and consumers at lower voltage levels requires more intensive cooperation between distributors, distribution grid operators and transmission system operators. It is therefore necessary to define these roles more clearly and optimise the required communication processes (dena 2014).

- **Grid and market instruments should be more tightly aligned.** The current market design comprises multiple products and instruments that have been developed to support market activity or secure the market and grid: in addition to the short-term spot markets and balancing markets, there are also, for example, redispatch and feed-in management measures and the grid reserve. At the lower voltage levels, grid operators are likely to use more storage systems and other flexibility options for ancillary services. As a rule: the fewer instruments and products there are pursuing the same goals, the lower the costs. For this reason, market products and instruments serving the needs of the grid should be more closely aligned in future. Flexibility services must also be clearly defined and harmonised as far as possible. Furthermore, barriers to efficient energy use must be removed so that synergies can be leveraged. The dovetailing between a capacity reserve and the grid reserve is a good example of this (cf. measure 19).

Part IV: Next steps

The Federal Ministry of Economic Affairs and Energy will discuss the White Paper with the relevant stakeholders. The Federal Ministry for Economic Affairs and Energy will be holding an event to discuss the White Paper in the context of the Electricity Market Platform during this summer. In particular, the deliberations will focus in greater depth on the measures for the electricity market 2.0. The Electricity Market Platform commenced work in preparation for the Green Paper in the summer of 2014. It comprises four working groups assigned to specific subject areas and a plenary group. For more information, see the website of the Federal Ministry for Economic Affairs and Energy.[11]

The Federal Ministry for Economic Affairs and Energy will be discussing the White Paper with the parliamentary groups in the Bundestag, the Länder, the neighbouring countries and the European Commission. Dialogue with the neighbouring countries commenced at the Federal Ministry for Economic Affairs and Energy in the summer of 2014 in a high-level working group led by the state secretary in charge. So far, the participants have mainly dealt with issues surrounding security of supply and improved cooperation at regional level.

The necessary legislation will be completed following the White Paper. As a follow-up to the White Paper measures, the proposals for the relevant legislative changes (laws and ordinances) will be made before the end of this year. The Electricity Market Act will form the core of this legislative package. As an omnibus bill, it will amend the Energy Industry Act in particular. The bill for the Electricity Market Act is due to be approved by cabinet in the fourth quarter of this year. The relevant legislative process is to be completed in spring 2016.

11 http://www.bmwi.de/DE/Themen/Energie/Strommarkt-der-Zukunft/plattform-strommarkt.html

Expert support

The communication and dialogue consultancy IFOK GmbH assisted the Federal Ministry for Economic Affairs and Energy in the evaluation of the consultation alongside International Energy Transition (IET), r2b energy consulting, Energy Brainpool, Ecofys and BET. Katharina Grave from Ecofys proofread the White Paper.

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- Thorsten Lenck, Energy Brainpool
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- Dr. Christian Nabe, Ecofys
- Dr. Marco Nicolosi, Connect Energy Economics
- Markus Peek, r2b energy consulting
- Dr. Jens Perner, Frontier Economics
- Lukas Schuffelen, BET Büro für Energiewirtschaft und technische Planung
- Dr. Frank Sensfuß, Fraunhofer ISI

List of abbreviations

50Hertz	50Hertz Transmission GmbH
8KU	8KU GmbH
AmCham Germany	American Chamber of Commerce in Germany e. V.
Amprion	Amprion GmbH
ARGE Netz	ARGE Netz GmbH & Co. KG
Baden-Württemberg	Ministry of the Environment, Climate Protection and the Energy Sector
BASF	BASF SE
Bavaria	Bavarian Ministry of Economic Affairs and Media, Energy and Technology
BDEW	German Association of Energy and Water Industries
BDI	Federation of German Industries
BEE	German Renewable Energy Federation
Berlin	Senate Department for Urban Development and the Environment of the State of Berlin
BfE Switzerland and others	Federal Office of Energy, Federal Department of the Environment, Transport, Energy and Communications and Swiss Federal Electricity Commission
BKartA	Bundeskartellamt (Federal Cartel Office)
BMWi	Federal Ministry for Economic Affairs and Energy
BNE	Association of Energy Market Innovators
BNetzA	Federal Network Agency
Brandenburg	Ministry for Economic Affairs and Energy of the State of Brandenburg
BUND	Friends of the Earth Germany
BVES	German Energy Storage Association
BVMW	German Association for Small and Medium-sized Businesses
BWE	German Wind Energy Association
BWP	German Heat Pumps Association
Caterva	Caterva GmbH
ChemCoast	ChemCoast e. V.
DGB	German Trade Union Federation
DIHK	Association of German Chambers of Commerce and Industry
DIW	German Institute for Economic Research
E.ON	E.ON Energie Deutschland GmbH
e2m	Energy2market GmbH
e-control	Energie-Control Austria für die Regulierung der Elektrizitäts- und Erdgaswirtschaft (E-Control)
EEG	Renewable Energy Sources Act
EEX	European Energy Exchange AG
EFET	European Federation of Energy Traders EFET Deutschland
EIKE	European Institute for Climate and Energy
EnBW	EnBW Energie Baden-Württemberg AG
Energetische Biomassenutzung	"Energetische Biomassenutzung" funding programme, DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH
EnerNoc	EnerNOC Inc.
EPEX SPOT	EPEX SPOT SE
EUROSOLAR	EUROSOLAR e. V.

Evonik	Evonik Industries AG
EWE	EWE Aktiengesellschaft
FÖS	Green Budget Germany
Fraunhofer IWES	Fraunhofer Institute for Wind Energy and Energy System Technology
GDF SUEZ	GDF SUEZ Energie Deutschland AG
GEODE	GEODE AISBL
Greenpeace	Greenpeace e.V.
GVSt	Hard Coal Association
Hamburg	State Ministry for Urban Development and the Environment of the State of Hamburg
Hesse	Ministry of Economics, Transport and Regional Development of the State of Hesse
IASS	Institute for Advanced Sustainability Studies Potsdam e.V.
IG BCE	Mining, Chemical and Energy Industrial Union
IG Metall	German Metalworkers' Union
Klima-Bündnis	Climate Alliance of European Cities with Indigenous Rainforest Peoples/Alianza del Clima e.V.
Mecklenburg-Western Pomerania	Ministry of Energy, Infrastructure and State Development of the State of Mecklenburg-Western Pomerania
MIBRAG	Mitteldeutsche Braunkohlengesellschaft mbH
NABU	Nature and Biodiversity Conservation Union
Next Kraftwerke	Next Kraftwerke GmbH
Lower Saxony	Ministry for Environment, Energy and Climate Protection of the State of Lower Saxony
North Rhine-Westphalia	State Government of North Rhine-Westphalia
Oesterreichs Energie	Österreichs E-Wirtschaft
Öko-Institut	Öko-Institut e.V.
Piratenpartei	Pirate Party Germany
RAP	The Regulatory Assistance Project
Repower	Repower AG, Poschiavo, und Repower GuD Leverkusen GmbH & Co. KG
Rhineland-Palatinate	State Ministry for Economic Affairs, Climate Protection, Energy and Regional Planning of the State of Rhineland-Palatinate
RWE	RWE AG
Saarland	Ministry of Economics, Labour, Energy and Transport of the State of Saarland
Saxony	State Ministry of Economic Affairs, Labour and Transport of the State of Saxony
Saxony-Anhalt	Ministry of Sciences and Economic Affairs of the State of Saxony-Anhalt
Schleswig-Holstein	Ministry of Energy, Agriculture, the Environment and Rural Areas of the State of Schleswig-Holstein
SRU	German Advisory Council on the Environment
Stadtwerke Duisburg	Stadtwerke Duisburg AG
Statkraft	Statkraft Germany GmbH

Statnett	Statnett SF
Statoil	Statoil ASA
TenneT	TenneT TSO GmbH
Thüga	Thüga Aktiengesellschaft
Thuringia	Ministry for the Environment, Energy and Nature Conservation
TransnetBW	TransnetBW GmbH
Trianel	Trianel GmbH
UBA	Federal Environment Agency
VCI	German Chemical Industry Association
VDMA	German Engineering Federation
ver.di	United Services Trade Union
VGB PowerTech	VGB PowerTech e. V.
VIK	Federation of Industrial Energy Consumers and Self-Producers
VKU	German Association of Municipal Enterprises
vzbv	Federation of German Consumer Organisations
Wacker	Wacker Chemie AG
Wärtsilä	Wärtsilä Power Plants
WV Stahl	Association of Steel Producers
WVM	Association of the Metal Industry
WWF	WWF Deutschland
ZVEI	German Electrical and Electronic Manufacturers' Association
ZVKKW	Refrigeration, Air Conditioning and Heat Pump Federation

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