Expert Commission on the “Energy of the Future” Monitoring Process

Statement on the Fourth Monitoring Report of the Federal Government for 2014

Berlin · Münster · Stuttgart, November 2015

- Prof. Dr. Andreas Löschel (Chair)
- Prof. Dr. Georg Erdmann
- Prof. Dr. Frithjof Staiß
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Summary

ENERGY OF THE FUTURE

Commission on the Monitoring Process

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Statement

0 Foreword

1. This document contains our statement on the Federal Government's Fourth Monitoring Report. The "Energy of the Future" monitoring process is part of a long-term strategy anchored in the Federal Government's Energy Concept of September 2010, the ambitious goals of which were heightened further following the nuclear disaster in Fukushima, Japan, when the phase-out of nuclear power was stipulated by law in June 2011. The monitoring process aims to review the implementation of the programme of measures and of the Energy Concept, with a view to taking corrective measures if required. To this end, the Federal Government appointed an independent expert commission consisting of four energy scientists; they are tasked with evaluating and commenting on the monitoring reports to be produced by the ministries each year. Following last year's broader-based Progress Report, which is published every three years and which looks towards the coming years and includes a major analytical element, the statement in the current year, 2015, again refers to a monitoring report. These regular reports basically provide a fact-based overview of the current status of progress with regard to the implementation of the energy transition.

2. This year's statement refers to the draft of the Fourth Monitoring Report, which was provided to us by the Federal Ministry for Economic Affairs and Energy on 5 November 2015. At that time, the report was still being coordinated among the ministries; the chapter on transport was missing entirely. Against this background, it was unfortunately impossible to provide useful comments on this important aspect of the energy transition in which - going by current developments - the attainment of the 2020 target has moved a long way off. Apart from that, the necessary drafts and information were made available to us in sufficient time this year. We are grateful to the Federal Ministry for Economic Affairs and Energy for its efforts in this regard.

3. As part of the monitoring process and in the context of the sharing of information for the Fourth Monitoring Report, numerous meetings took place with representatives of the Federal Ministry for Economic Affairs and Energy, the Federal Network Agency and the Federal Environment Agency. In September 2015 there was a separate meeting between the expert commission and representatives of the Federal Ministry of Transport and Digital Infrastructure. These meetings provided scope to discuss the specifics of planned Federal Government policy instruments and to answer critical questions from the expert commission.

4. Some of the points raised in the meetings have been built into this statement (e.g. the question of the "integrated development" of the energy system). Furthermore, the chair of the expert commission was a member of the "Energy Transition Research Forum" at the Federal Ministry of Education and Research and of the board of trustees of the academy project "Energy Systems of the Future" of the Leopoldina National Academy of Sciences, the Union of German Academies of Sciences and acatech. Our thanks go to all our interlocutors, and particularly those in the ministries and federal authorities, for the constructive cooperation.

5. The National Action Plan on Energy Efficiency, which was adopted in December 2014, is the central pillar of the Federal Government's work in the 18th legislative term to boost energy efficiency in consumption and to conserve energy. The Fourth Monitoring Report devotes a separate sub-chapter to the National Action Plan on Energy Efficiency. In future, there is to be a separate monitoring process on the National Action Plan on Energy Efficiency, and it will be supported by the expert commission. In this context, a meeting between the expert commission and Prof. Dr. Ortwin Renn of Stuttgart University in September 2015 should be highlighted. The discussions focused on issues relating to energy efficiency monitoring, e.g. the shaping of policy instruments by considering insights from behavioural economics. We devote a broadly designed, fundamental chapter of this

statement to the question of energy efficiency and the National Action Plan on Energy Efficiency. The dialogue with the “Energy Systems of the Future” academy project is to be continued next year.

6. The statement of the expert commission on the first Progress Report by the Federal Government made a contribution amongst policymakers and the public towards the debate on the attainment of the goals of the energy transition. A large number of our suggestions and concepts were received very positively by the Federal Government and third parties. These include the issue of real unit energy costs, which has been taken up by other research institutes and institutions. With regard to central recommendations which have not been taken up by the Federal Government in particular, we will comment in greater detail below or explain our proposals in greater depth. On 25 February 2015, the members of the expert commission had the opportunity to discuss their view of the status of the energy transition and current successes and deficiencies with the Bundestag Committee for Economic Affairs and Energy.

7. The expert commission could not have produced this statement without the outstanding dedication of their academic assistants. For this reason, our sincere thanks go to Martin Baikowski, Oliver Kaltenegger, Roland Kube and Dr. Jörg Lingens of the University of Münster, Lars Dittmar and Fernando Oster of the Energy Systems Department of TU Berlin, Maike Schmidt of the ZSW, Stuttgart, and Andreas Prahl of the Ecologic Institute, Berlin.

8. Any errors or omissions in this statement are the sole responsibility of the undersigned.

Berlin, Münster, Stuttgart, 18 November 2015

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Summary of the statement

Statement on the Fourth Monitoring Report of the Federal Government

1. This document contains our statement on the Federal Government's Fourth Monitoring Report. The **"Energy of the Future" monitoring process** is part of a long-term strategy anchored in the Federal Government's Energy Concept of September 2010, the ambitious goals of which were heightened further following the nuclear disaster in Fukushima, Japan, when the phase-out of nuclear power was stipulated by law in 2011. The "Energy of the Future" monitoring process is to i) provide a fact-based overview of the status of the implementation of the energy transition, ii) evaluate the attainment of the goals, assess measures and if appropriate propose measures to attain the goals, and iii) present likely developments in Progress Reports and derive recommendations for action (BMWi, 2015a). To this end, the Federal Government appointed an independent expert commission consisting of four energy scientists; they are tasked with evaluating and commenting on the monitoring reports to be produced by the ministries each year.

2. The Federal Government's Fourth Monitoring Report continues the development of the structure for the long-term monitoring of the energy transition. The monitoring reports have become an established and significant component of the transformation of the energy system. Following the more problem-oriented Progress Report of 2014, the **2015 Monitoring Report** again describes very fact-based indicators and their changes. In the light of this, the expert commission repeats its recommendation that the Federal Government's monitoring reports should go beyond the mere presentation of indicators and their changes, and should aim to analyse and evaluate the observed developments. The naming of problems, the analysis of causes and the drawing of conclusions for policy initiatives are urgently needed, particularly where targets in specific fields of action are very unlikely to be met. Evaluation is also a central task for the monitoring reports.

3. This year's **statement refers to the draft of the Monitoring Report**, which was provided to the expert commission by the Federal Ministry for Economic Affairs and Energy on 5 November 2015. At that time, the report was still being coordinated among the ministries; the chapter on transport was missing entirely. For that reason, it was unfortunately impossible to provide useful comments on this important aspect of the energy transition. This statement again analyses in detail relevant developments, targets and measures. Our main focus is on the following issues:

- the monitoring process as an element of the energy transition,
- integrated development of the energy system,
- greenhouse gas emissions,
- renewable energy,
- energy efficiency and the National Action Plan on Energy Efficiency,
- transport,
- electricity industry,
- energy prices and energy costs,
- macroeconomic and societal impact of the energy transition and
- outlook up to 2030.

Nuclear energy is not covered by this report, since there are no signs that the phase-out schedule will change. The expert commission will consider the related challenges (e.g. search for final storage site, securing the funding, lawsuits by the energy companies) at a later stage.

4. These comments assess statements made in the Federal Government's Monitoring Report and add to them where the expert commission believes that aspects of considerable significance require further treatment (e.g. sector coupling, monitoring of the National Action Plan on Energy Efficiency, energy costs, outlook up to 2030). In line with our mandate, our report refrains from making forecasts where this would involve the use of models, and from making substantiated evaluations of measures. However, we do look at the likely effects of the energy policy and environmental policy decisions taken in terms of likely target attainment in order to identify **relevant fields of action**. Like the Monitoring Report, this statement refers to 2014; in view of the timing of the publication, the information already available for 2015 is also taken into account.

The monitoring process as an element of the energy transition

5. As the Federal Government states in its Monitoring Report, the development of the target indicators varies widely. In some cases, we move along the target path (e.g. renewables-based electricity generation); in others, we are clearly below (e.g. greenhouse gas emissions and efficiency in transport). The expert commission basically shares the Federal Government's view, but sees more or less pronounced **risks to target attainment** in the case of certain indicators. The following section briefly sketches out the changes to important variables, because comprehensive needs for action derive from the empirical developments in central variables of the Energy Concept.

6. It can be said that there is a significant risk of the Federal Government's central aim, to cut **greenhouse gas emissions** by 40% by 2020 (from the level in 1990), not being met. In comparison with the figures for 2014, this target can only be attained if the emissions are cut by approx. 28 million tonnes of CO_2 equivalent on average each year up to 2020 (a total of 170 million tonnes). If these figures are compared with the longer-term changes in the years from 2000 to 2014, in which the temperature-adjusted greenhouse gas emissions dropped by scarcely more than 9 million tonnes of CO_2 equivalent on average each year, it can be seen that the rate of emission reduction must be at least tripled in the few years until 2020.

7. The **expansion of renewable energy in the electricity sector**, with a view to attaining a minimum share of 35% of electricity consumption by 2020, is on track. According to initial estimates, a 33% share might be attained in the course of 2015.[1] The guarantor of this success is the Renewable Energy Sources Act. After the new amendment, the version of 1 August 2014 is now in force (EEG, 2014). It defines the first development corridors for specific forms of renewable energy and thus specifies the politically desired quantitative expansion, whilst the overall target is still expressed in terms of relative variables. A 40-45% of gross electricity generation is to be attained by 2025.

8. Germany has to meet a national contribution to **gross final energy consumption** of 18% by renewable energy in 2020. In the National Renewable Energy Action Plan pursuant to Directive 2009/28/EC, which launched the implementation of the directive in Germany, the Federal Government assumes that it is even possible to attain a 19.6% share by 2020 (BReg, 2009). At present, however, renewable energy only accounts

[1] In this context, the question arises as to whether electricity consumption really is a useful target reference point for the share of renewable energy. After all, it is based on the rather implausible assumption that the electricity export surplus (which rose again in 2015) does not contain any electricity generated from renewables. Power generation would surely be a better point of reference; it is likely that renewables will cover just under 30% of this in 2015.

for 13.5% of gross final energy consumption according to the Federal Government's Monitoring Report; in 2013, the figure was 13.2%. The Federal Government should show ways to overcome the stagnation in the proportion of renewable energy outside the electricity sector.

9. **Primary energy consumption** is to be reduced by 20% by 2020 compared to 2008 levels. Over the last six years, from 2008 to 2014, it dropped by 6.5% after adjustment for temperature; if the target is to be attained, this rate must be more than doubled during the remaining six years up to 2020. This necessitates considerable additional effort, especially as the target path was clearly missed over the last four years.

10. The **gross electricity consumption** situation is clearly different; here, the target is a 10% reduction between 2008 and 2020. In the 2008-2014 period, the fall was 4.6%, or already almost half of the target. The main factors here were increased efficiency in the use of electricity and the economic situation in the industrial sector, particularly in electricity-intensive sectors. However, it is also the case that 2015 is recording a slight rise in electricity consumption, so that it is not possible to be sure that the declining trend will continue. It will be necessary to ascertain whether the instruments intended to cut electricity consumption under the National Action Plan on Energy Efficiency are likely to enable the target to be met.

11. The increase in **final energy consumption in transport** in 2014 marks a further setback in terms of the Energy Concept target. This development is due both to passenger and to freight transport on the roads. Both sectors registered an increase in the overall distance travelled to the highest ever figures in the history of the Federal Republic, and this was not offset by progress on efficiency. Here, a crucial role is played by rebound effects between improved vehicle efficiency and distance travelled, as well as between improved vehicle efficiency and an increase in vehicle weight and engine power. For the transport sector, the situation in terms of the attainment of the target of cutting energy consumption by 10% between 2005 and 2020 is particularly problematic. If this target is to be attained, consumption needs to be reduced by 2% each year from the 2014 level - but in the years between 2005 and 2014, there was on average a slight rise of 0.2%.

12. The situation for the **space heating requirement** is more favourable (interpreted here as final energy consumption used to cover the space heating requirement); it is to be reduced by 20% between 2008 and 2020 and by 80% by 2050. This segment of final energy consumption has indeed been declining since the beginning of this century. Whilst it rose by approx. 14% between 1990 and 2000, it dropped by nearly 24% between 2000 and 2014. In terms of 2008, the base year, it dropped by nearly 10% by 2014, even though the total floor space has risen by more than 7%. The trend of declining energy consumption needs to be strengthened, particularly with a view to the long-term requirements.

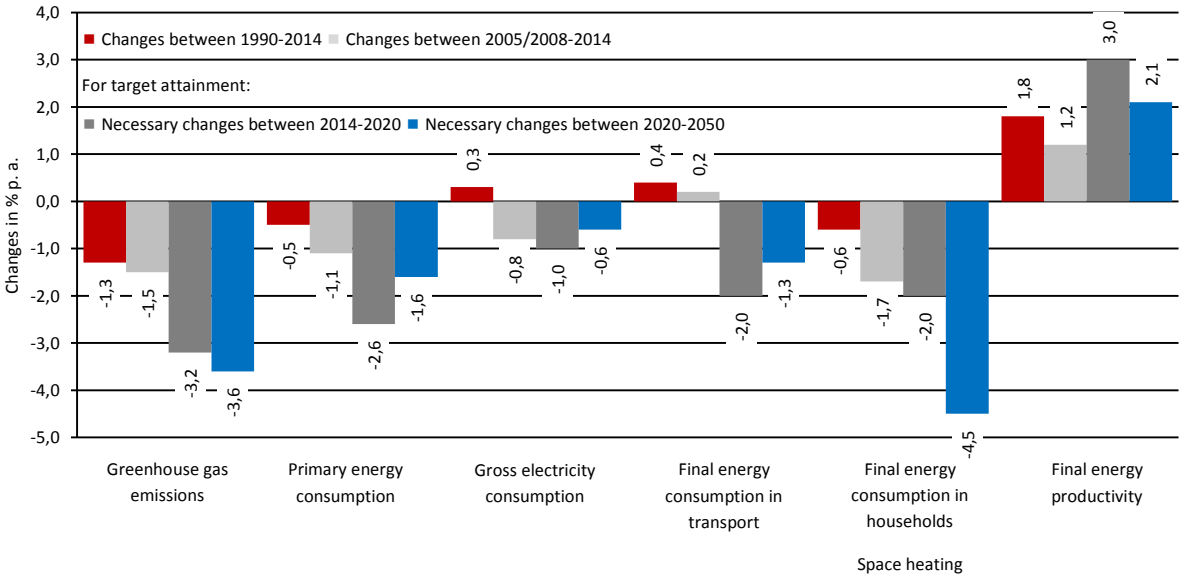
13. The Federal Government aims to boost **final energy productivity** in Germany by 2.1% a year, starting from 2008. However, the empirical finding shows that there was an average annual increase of only 1.8% during the 1990-2014 period. In fact, the rate (temperature-adjusted) was only 1.2% from the base year of 2008 until 2014. So Germany has remained consistently below the target path over the last six years. If the 2020 target is to be attained, final energy productivity will have to increase by approx. 3% each year from 2015 on.

14. Figure 1 provides a brief **summary of the development so far** and of the changes in selected variables required if the 2020 targets are to be attained. This shows that, with certain exceptions in electricity consumption and final energy consumption for space heating, there are more or less sizable deviations between the other emissions and efficiency target paths and the changes achieved so far. This mainly refers to the greenhouse gas emissions, primary energy consumption, final energy productivity and final energy consumption in the transport sector. Taking the long-term view, this also applies to energy consumption in households for space heating. It is also likely that the target will be missed in cogeneration with a view to its

share of net electricity generation. This is true at least when the target of a 25% share of total electricity generation - as contained in the current version of the CHP Act - is taken rather than the redefined target based on controllable electricity generation. In this case, the target would actually have been practically attained already.

15. In the draft 2015 Monitoring Report, which the expert commission received on 5 November 2015, the level of target attainment for all indicators is evaluated in terms of a **points system** for the first time. The expert commission welcomes the idea of presenting the trend in the form of a points system for the quantitative energy transition indicators. Where less than full points is awarded, there is the danger that the target will be missed in the relevant field, particularly if the target year is not far off. However, it is suggested that the points system should be revised. For example, the developments of the last year should be given greater weight than the developments of earlier years, so that it can be seen whether the most recent development is likely to lessen or heighten the risk of missing the target. This would also provide a better illustration of the urgency of further measures.

Figure 1: Contrast of the past changes and the changes needed to meet selected targets up to 2020



Source: Own presentation

16. The expert commission has made various proposals on the development of a consistent system of indicators in recent years which can be used to reflect and assess the complex package of political targets for the energy transition and guide future action. Some of these proposals have been taken up by the Federal Government, for example the establishment of a hierarchy of targets for the energy transition and the use of innovation indicators. In contrast, some proposals have not been addressed in the Report. Reference should again be made to the main **recommendations by the expert commission** in the previous four sets of statements, so that the recommendations developed for future monitoring are not forgotten. In particular, it is necessary to ensure that the following aspects are taken into consideration:

- development of lead indicators (cf. Chapter 1 in EWK, 2014a),
- evidence-based evaluation of measures, and particularly the distinction between endogenous and exogenous developments (cf. Chapter 3 in EWK, 2014b),
- cancellation of emissions rights (cf. Chapter 4 in EWK, 2014b),
- further development of indicators on security of supply (cf. Chapter 6 in EWK, 2014a),

- enhanced methodological approach to assess power balance (cf. Chapter 6 in EWK, 2012 and Chapter 6 in EWK, 2014a),
- application of the energy account system (cf. Chapter 7 in EWK, 2012, Chapter 7 in EWK, 2014a and Chapter 11 in EWK, 2014b; Chapter 8),
- international comparisons of real unit energy costs (cf. Chapter 11 in EWK, 2014b; Chapter 8),
- consideration of macroeconomic effects (cf. Chapter 12 in EWK, 2014b; Chapter 9),
- use of a comprehensive system of innovation indicators (cf. Chapter 10 in EWK, 2014b),
- use of model-based analyses (cf. Chapter 2 in EWK, 2014b),
- consideration of distributional conflicts (cf. Chapter 7 in EWK, 2014a; Chapter 9),
- taking account of public acceptance (cf. Chapter 13 in EWK, 2014b),
- environmental impact indicators (cf. Chapter 5 in EWK, 2012 and Chapter 5 in EWK, 2014a),
- possibilities for sector coupling (Chapter 2),
- 2030 Outlook (Chapter 2).

Here, we are engaged in a constructive dialogue with the Federal Government, and we recognise that there is still a need for research into certain points.

Integrated development of the energy system

17. The Federal Government's Monitoring Report addresses the question of **"sector coupling"**, but does so at a comparatively abstract level. It is about flexibly deployable technologies to use surplus renewable electricity to provide heat (power-to-heat), fuel or chemical raw materials (power-to-X). Under the prevailing market conditions, including the current rules on charges and taxes, these technologies are not yet economic.

18. Following the wishes of the Federal Ministry for Economic Affairs and Energy, the expert commission has considered the question of **cost allocation** and is developing some ideas for this on a scientific basis. One option is "Ramsey prices", which can be used to attain an optimal price differentiation of a homogeneous product (electricity) on various market segments. This concept is similar to the "imputable prices", a price-formation method used in the field of heat-driven CHP. A tax-funded solution is discussed as an alternative concept. In both cases, these are initial ideas, not a finalised cost-allocation proposal.

19. The comments centre on **power-to-heat technologies**. Most of them are used on the balancing energy markets "to serve the system", but it would be desirable in terms of the energy transition for the potential of power-to-heat (including power-to-X technologies) to impact on the regular energy markets. Our thinking aims to make a contribution to this.

Greenhouse gas emissions

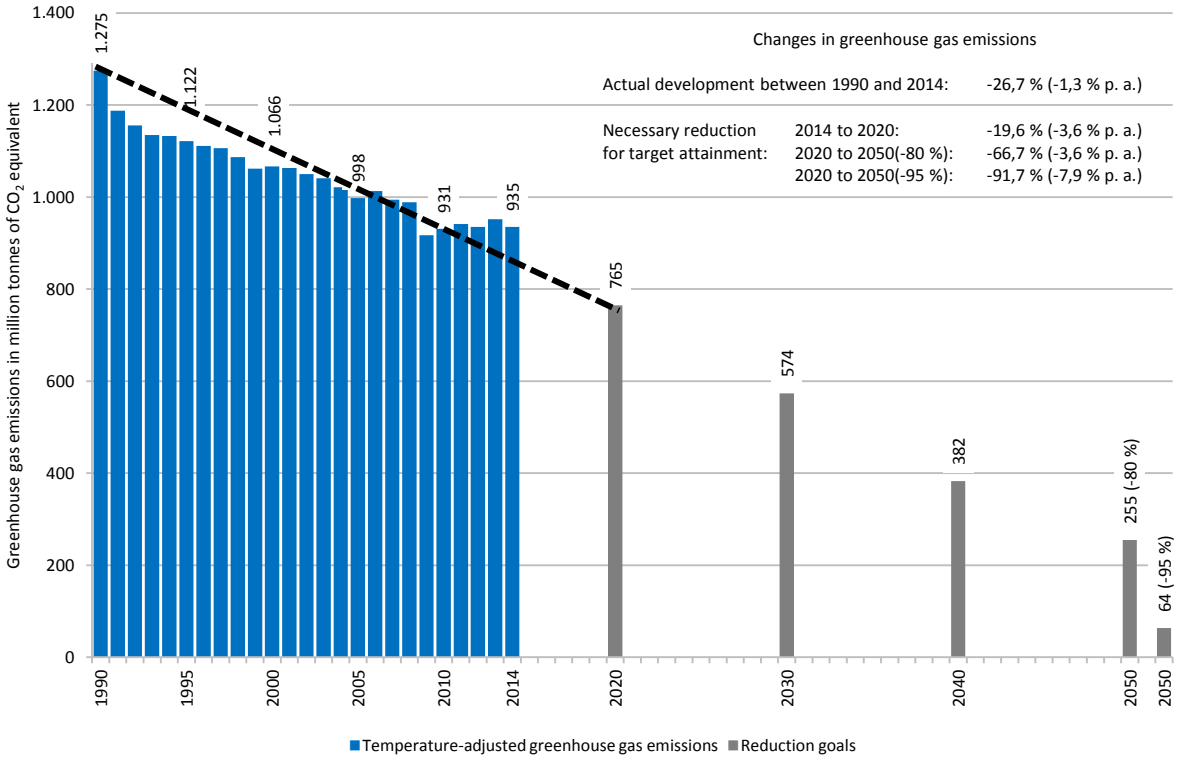
20. The expert commission agrees with the Federal Government that continuing with the measures implemented so far is likely to mean that the 2020 reduction target for greenhouse gas emissions will be missed. As in the chapter on primary energy consumption, it would have been desirable for the remarks on greenhouse gas emissions to refer to the influence of temperature. For example, going by one estimate, **greenhouse gas emissions** were probably only 1.7% lower in 2014 than in 2013, not 4.3%, if temperature is taken into account.

21. However, the Federal Government’s Monitoring Report assumes that the **measures adopted since 2014** can still enable the target to be reached. These measures particularly include the Climate Action Programme 2020, the National Action Plan on Energy Efficiency and the initiative to decommission older lignite-fired power plants. In this context, the expert commission regrets that the Federal Government did not provide it with the Climate Action Report in time.

22. The expert commission recognises the **initiatives** the Federal Government has since taken. However, in view of the dimension of the reduction still required for the target to be attained (170 million tonnes of CO_2 equivalent) and the remaining time until 2020, it takes the view that these activities will not suffice for the attainment of the target, especially as the world market prices for energy make it more difficult to reduce emissions in the electricity sector and the other sectors. Also, the Federal Government has not yet been able to obtain the necessary political majorities for potentially effective instruments like tax breaks for energy refurbishments. In the view of the expert commission, this could have been one of the most effective measures. Furthermore, it is by no means certain that the various measures launched by the Federal Government will bring about sufficient greenhouse gas reductions by 2020. For example, of the desired reduction of 22 million tonnes of CO_2 equivalent in the electricity sector, now only 12.5 million tonnes are to be attained via the de-facto closure of old lignite-fired power plants and 4 million tonnes via the revision of the CHP Act. Even if those figures are achieved, the expert commission does not believe that 22 million tonnes of CO_2 equivalent are sufficient - as mentioned in the last statement.

23. Figure 2 shows that last year did **not see a return to the desired target path** in temperature-adjusted greenhouse gas emissions. For this to be the case, the temperature-adjusted greenhouse gas emissions would have had to drop by over 3% as an annual average for 2013 to 2020, assuming a linear path. Our estimated reduction of 1.7% in 2014 implies that the development is well below that. The absolute figures for the annual reduction needed in future also provide a tangible illustration of the future necessities. The target figure for 2020 signifies maximum greenhouse gas emissions of approx. 765 million tonnes of CO_2 equivalent (temperature-adjusted). This means that, up to 2020, greenhouse gases need to be cut by an average of approx. 28 million tonnes of CO_2 equivalent every year (a total of 170 million tonnes). In comparison with the 2000-2014 period, with a temperature-adjusted reduction in greenhouse gas emissions of a total of nearly 115 million tonnes of CO_2 equivalent or an annual average reduction of slightly over 9 million tonnes of CO_2 equivalent, a tripling of reductions is required.

Figure 2: Development of temperature-adjusted greenhouse gas emissions in Germany from 1990 to 2014, and targets up to 2050



Source: Own presentation

24. Last year, the expert commission made a whole series of proposals about how to handle the likely failure to meet targets. In the view of the expert commission, the current situation is such that, whilst almost all the stakeholders in government, commerce and society would like to support the challenging greenhouse gas reduction targets, there is virtually no willingness to accept the measures needed to achieve this if they seemingly involve personal sacrifices. Everyone knows that **climate change mitigation does not come free of charge**; despite this, many people's behaviour is designed to derive a direct economic advantage from the process. Such a model cannot work.

Renewable energy

25. The attainment of the 35% minimum target by 2020 for the proportion of electricity consumption covered by **electricity generated from renewable energy** as set out in the Federal Government's Energy Concept seems likely. It may even be the case that there is significant over-achievement of the target. This is welcome in view of the contribution towards the overriding climate change mitigation goal, since it offers potential to offset other, unattainable goals. In the view of the expert commission, the forthcoming systemic change in the Renewable Energy Sources Act, away from price controls and towards quantitative steering, marks a further step along the road towards exposing renewables-based power generation to competition. In this context, an increasing role is also likely to be played by the rise in quantities of electricity not funded under the Renewable Energy Sources Act. Greater attention should be paid to this segment in the future design of the funding regime.

26. In the field of renewable heat, the Federal Government’s Monitoring Report indicates great uncertainties in the data and repeated tinkering with the calculation method, without any transparent explanation of this being provided. For example, the shares cited and the developmental trend diverge significantly from last year’s Progress Report. Greater data transparency is crucial, not least for the assessment of the progress made towards the attainment of the 14% target in 2020. The **use of renewable heat** declined in 2014. The Monitoring Report attributes this to the mild weather, but does not say why the percentage share decreased as well.

27. In terms of the development of **renewable energy in the transport sector**, there are substantial discrepancies in the data and definitions for the targets (share of renewable energy v. greenhouse gas reduction), so that the reliability of the indicator system used so far seems doubtful. It is possible to factor in certain fuels several times over, meaning that the EU-imposed 10% target up to 2020 could be achieved in arithmetical terms, whilst the actual contribution towards greenhouse gas reduction is likely to be much smaller.

28. The proportion of **gross final energy consumption covered by renewables** rose to 13.5% in 2014, but the development has slowed considerably. Progress is now basically only being achieved via the growth in renewable power generation. This raises concerns in view of the little time left in which to attain the 18% target in 2020.

Energy efficiency and the National Action Plan on Energy Efficiency

29. The **empirical findings on energy efficiency** show that the developments in electricity consumption and final energy consumption for space heating were roughly on track for the 2020 targets. In terms of the other efficiency-related targets for primary energy consumption, final energy productivity and final energy consumption in the transport sector, however, there are greater or smaller negative deviations. In view of these developments, which are confirmed by the Monitoring Report, the Federal Government has launched a package of roughly 40 new instruments in the National Action Plan on Energy Efficiency. However, in many cases their impact up to 2020 is still uncertain. The expert commission would therefore have liked to see strategies to cover a situation in which the intended savings are lower than expected.

30. The expert commission gladly accepts the Federal Government’s invitation to accompany the **monitoring of the National Action Plan on Energy Efficiency**. It understands this to mean the evaluation not only of macroeconomic indicators, but also of the individual instruments in terms of their effects, effectiveness and efficiency. However, it is still impossible to make a reliable evaluation of many of the effects. For this reason, the expert commission has for the time being only undertaken some general reflections. These include the question of the causes of an energy efficiency gap, and particularly the **role of market and behavioural failure**. The latter is particularly important for the National Action Plan on Energy Efficiency, since the plan relies very much on changes in behaviour in response to information and advice instead of relying on regulation.

31. Further to this, we have formulated a proposal for **10 principles for good energy efficiency monitoring**. These address the suitability of instruments for the relevant fields of action, the demands imposed on the indicator system and the data basis, as well as the evaluation of the effectiveness, particularly taking into account the influence of endogenous and exogenous factors and their interrelationships - not least in terms of the attainment of long-term energy and climate targets. Here, it should be possible to implement the instruments and measures efficiently, and also the relevant monitoring process itself. Recommendations must always meet the requirements for transparency and neutrality.

Good energy efficiency monitoring

(1) identifies the useful instruments in line with the criterion of the relevant fields of action,
(2) disposes of a suitable system of indicators,
(3) is based on a sufficiently reliable and up-to-date data basis,
(4) has a suitable methodology to assess the effectiveness of instruments and measures, particularly taking into account endogenous and exogenous factors,
(5) distinguishes between direct and indirect effects,
(6) takes account of distributional effects,
(7) examines whether the effect of instruments is sustainable,
(8) reviews the efficiency of instruments and measures,
(9) can itself be implemented efficiently,
(10) is transparent and neutral.

32. Because the instruments of the National Action Plan on Energy Efficiency are still at the testing or planning stage, or just starting to be implemented, results-oriented ex-post monitoring of the Plan is not possible at present. Table 1 and Table 2 take the example of selected instruments and show an **attempt at a schematic application of these principles**. The tables can be viewed as a basic model of an evaluation matrix; to back it up, it would be necessary to undertake more or less detailed model calculations, (data) surveys, etc. for the various instruments. A key question here is how the development would have taken place without the measure (determining the baseline or reference development) and what overlaps there are with other measures and external factors. At this point, this must be left for further studies.

Table 1: Evaluation scheme for a monitoring of the instruments used by the Federal Government to boost energy efficiency - Part 1

		National Top Runner Initiative	Legal requirement for energy audits for non-SMEs (Article 8 of the EED)	Auction model for energy, and specifically electricity efficiency	Further development of the KfW energy efficiency programmes
Characteristics and results of the measures/instruments expected by the government	**Brief description**	Consumer awareness campaign, training of retail sales staff; dialogue with manufacturers	Requirement to introduce regular energy audits; 1st audit by 5 December 2015; thereafter every 4 years	"STEP up!" auction model (electricity efficiency potential)	Interest-rate reduction; entry standard (10% reduction); premium standard (30% reduction)
	Character of the instrument	Advice, information, motivation	Obligation under regulatory law	Competition-based development of efficiency	Financial incentives for investments in manufacturing equipment/processes
	Target group	Manufacturers, retailers and consumers	Companies with more than 250 employees or annual turnover of more than €50m and total balance sheet of more than €43m; a total of around 50,000 firms	Companies, energy service providers, municipal utilities, energy cooperatives and other stakeholders	Companies in trade and industry, contractors and professional service providers
	Affected energy sources	Electricity	All energy sources	Electricity	All energy sources, focus on electricity
	Status of instrument	Auction by BAFA in August 2015; project to run till end of 2018, possibly end of 2020	Energy Services Act adopted by Bundestag on 5 February 2015	"STEP up!" pilot phase from 2015; support by "Competitive auction model" WG of Energy Efficiency Platform	Implementation by KfW in 2015; funding for investment ensuring at least 10% or 30% energy conservation
	Next steps	Continuation of stakeholder dialogue; externally moderated dialogue process with equipment manufacturers, retailers and consumers; funding volume: €6m p.a. for consortium winning contract	If audit not undertaken, fine of €50,000; exemption from audit requirement if energy/eco-management audit scheme in place (EMAS)	Planning: up to 2018 auctions totalling approx. €300m; if system works, continuation, development, perhaps expansion	Expansion of cooperation with Länder funding institutes
	Expected energy saving in PJ	85.0	50.5	26.0-51.5	29.5
	Expected GHG reduction in million t CO_2 equivalent	5.1	3.4	1.5-3.1	2.0
	Evaluation/ monitoring planned	Contract to cover monitoring of target attainment, effect and economic viability	No requirement that companies report; only random checks by BAFA in 20% of companies	Planned	Planned

Source: Own presentation

Table 2: Evaluation scheme for a monitoring of the instruments used by the Federal Government to boost energy efficiency - Part 2

		National Top Runner Initiative	Legal requirement for energy audits for non-SMEs (Article 8 of the EED)	Auction model for energy, and specifically electricity efficiency	Further development of the KfW energy efficiency programmes
Principles for efficiency monitoring	**Addressing relevant fields of action**	Yes, electricity consumption is directly addressed	Yes, energy efficiency in general	Yes, electricity consumption is directly addressed	Yes, energy and specifically electricity efficiency
	Availability of suitable indicators	Level of diffusion of the "promoted" top runner appliances	Yes, on the basis of reports on audit (but only random checks)	Number of participating companies together with price and conservation data of measures	Only via evaluation of KfW data on beneficiary companies and measures
	Reliable and up-to-date data basis	Sales figures for top runner appliances available	Yes, on the basis of reports on audit (but only random checks)	Data available with results of auction model	Yes, if all relevant funding data are available for assisted measures and their results
	Methods to evaluate effectiveness of measures/instruments taking account of endogenous/exogenous factors	Define reference development; broad-based impact of instrument: dissemination of information, target groups reached; interaction with other instruments (e.g. Eco-Design Directive)	Survey of implementation of potential, if reports to BAFA make no statement in this regard; potentially high interaction with EU ETS	Reference development regarding the measures which won the auction; scope of participation in the auction; before and after analyses on the basis of corporate data	Reference development for the assisted measures; before and after analyses on the basis of corporate data; interaction with EU ETS
	Distinction between direct and indirect effects	Direct: market penetration of top runner appliances; indirect effects rather weak	Direct: savings; no significant indirect effects apparent	Direct: savings; no significant indirect effects apparent	Direct: savings; no significant indirect effects apparent
	Taking account of distributional effects	Presumably low; may depend on costs of top runner appliances	Distributional effects within sectors (SMEs v. non-SMEs)	Regarding diversity of players depends on auction model	Only limited distributional effects
	Taking account of long-term effects	Durability of instrument; comparative studies	Long-term effects probable due to regular audit	Dependent on durability of auction programme	Implicitly given in the case of long-term investment projects
	Efficiency of measures and instruments	Costs of project are comparatively low; efficiency depends on effectiveness	Costs probably low; efficiency depends on energy conservation; potentially high efficiency	Basically high; depending on type and scope of auction and participants	Funding volume low if interest rate low; efficiency depends on free-rider effects
	Efficiency of monitoring	Only in the case of limited funding (possibly responsibility of project contractor)	High where reliable data available from reports	Comparatively favourable due to high data availability	Depending on data situation favourable, but: estimate of free-rider effects
	Transparency and neutrality of monitoring	Rather difficult with regard to transparency in case of soft instruments	Dependent on securing and implementing random checks	High in case of public auction processes	High where data available for assisted measures

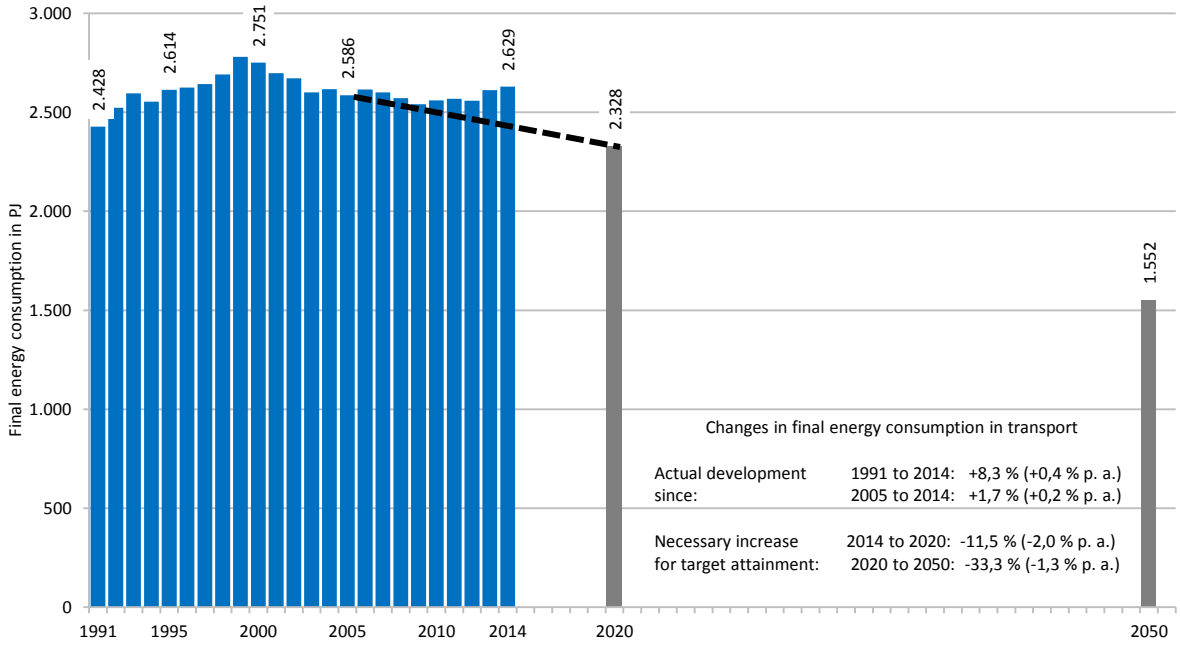
Source: Own presentation

Transport

33. The chapter on transport was not available to the expert commission in the draft of the Monitoring Report sent by the Federal Ministry for Economic Affairs and Energy on 5 November 2015. The expert commission is therefore unable to comment on it. Nevertheless, some general points can be made about transport on the basis of the known developments. Further **comments could be made** in a separate report or in the statement on the 2016 Monitoring Report.

34. The increase in **final energy consumption in transport** in 2014 marks a further setback in terms of the Energy Concept target, which provides for a 10% cut in final energy consumption by 2020 from 2005 (cf. Figure 3). This development is due both to passenger and to freight transport on the roads. Both sectors registered an increase in the overall distance travelled to the highest ever figures in the history of the Federal Republic, and this was not offset by progress on efficiency. Here, a significant role is played by rebound effects between improved vehicle efficiency and distance travelled, as well as between improved vehicle efficiency and an increase in vehicle weight and engine power.

Figure 3: Development of final energy consumption in transport in Germany from 1991 to 2014, and targets for 2020 and 2050



Source: Own presentation

35. In view of the current development, the attainment of the 2020 target is now but a far-distant prospect. Various scenarios suggest that, even with additional measures, it will still be missed. The Climate Action Programme is currently focused on freight transport and will not close the gap. The expert commission continues to take the view that the **target attainment in the transport sector** is not being taken seriously enough. This is also reflected in the fact that no measures which might remedy the problem are apparently being prepared. A further indication is the fact that the Federal Government only expects a 10% drop in energy consumption by 2030, according to its 2014 Progress Report. Particularly in the light of the recently discovered irregularities in the citing of specific CO_2 emission figures for vehicles, there is an urgent need for action here.

36. It is necessary to review the existing instruments to reduce emissions and energy consumption in the transport sector and to develop them further in order to incentivise further reductions. In addition to this, it is also necessary to consider the introduction of new instruments. Here, the expert commission believes that the **Mobility and Fuel Strategy,** focussing on fuels and technical options, does not go far enough. A multimodal, integrated strategy for the mobility system with quantitative targets is required; this must coordinate infrastructure planning, spatial planning, policy instruments, design of local passenger transport and intermodal transport concepts.

37. Further to this, account needs to be taken of **technology trends in the transport sector**. For example, developments in battery technology are crucial for the success or failure of battery-driven electric vehicles. If Germany is to be a lead market for electric mobility, changes to its infrastructure will be needed. For long-range use and, particularly, for freight haulage, however, fuel cell propulsion is currently the most promising technology. Here, the development of infrastructure is even more crucial, since these vehicles rely on a refuelling infrastructure for hydrogen.

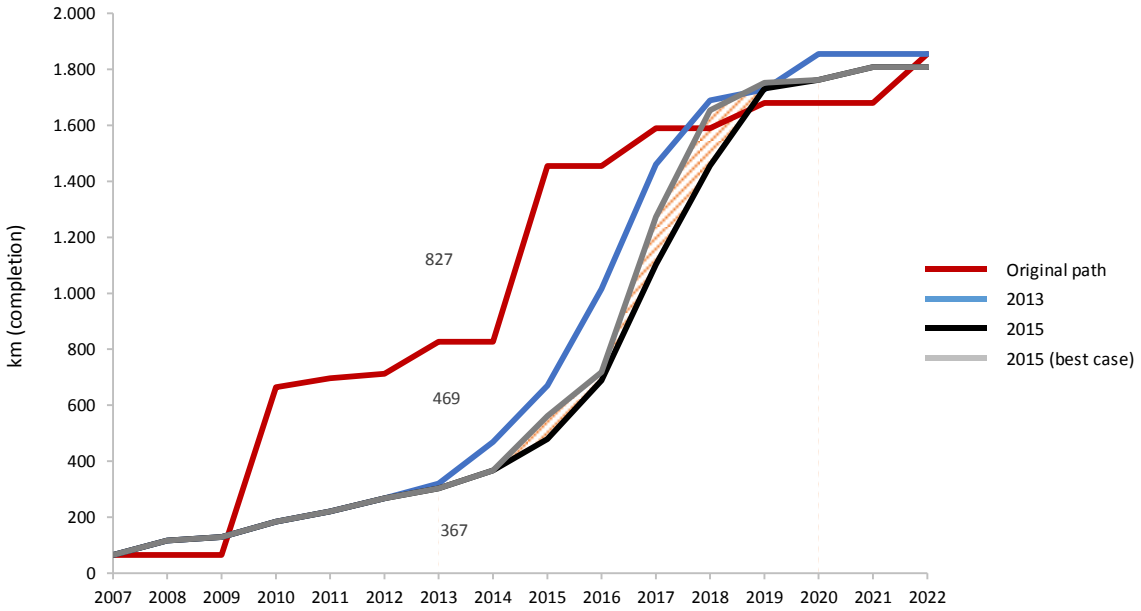
Electricity industry

38. In terms of security of supply, the expert commission welcomes the development of a statistical **indicator for power balance** in line with developments in other European countries. At the same time, it can understand that it is not possible to publish any figures yet, since the relevant studies and calculations are still ongoing.

39. In the draft CHP Act, the Federal Government proposes a **redefinition of the required share of CHP**. Whereas the relevant indicator currently refers to total net electricity generation, in future it is to refer to controllable electricity generation. The act is thus de facto not aiming at a further quantitative increase in CHP electricity, but is primarily aiming at a fuel switch from coal to gas. The increased share of renewable energy and its limited suitability for CHP will further weaken the CHP expansion target. In the view of the expert commission, this clarifies the priority-setting between the expansion target for renewable energy and the expansion target for CHP in favour of renewable energy. The consequence of this is that the heat-driven operation of CHP installations will in future drop significantly in favour of back-up electricity generation for renewables.

40. The expert commission shares the view expressed in the Monitoring Report that the **grid expansion is lagging behind the needs of the energy transition**. One first field is that of the original 24 grid expansion projects cited in the Power Grid Expansion Act of 2009 (so far, only expansion project no. 22 has been cancelled). The extent of the delays in these projects becomes clear in Figure 4. There are four curves. The “original path” illustrates the timetable envisaged in 2009. Further to this, updated time curves have been added in, and for 2015 a best-case scenario has been included. At the end of 2014, only 367 km had been finished, more than 100 km less than forecasted in 2013, and more than 450 km less than originally planned. Further to this, the expert commission would like to point out that the onshore expansion of the power grid needs to be coordinated better with the offshore expansion, as otherwise it will be possible to feed offshore wind power to the transformers on the coast, but only some of it will be able to make it through to the centres of consumption.

Figure 4: Originally planned and actual target path of grid expansion pursuant to the Power Grid Expansion Act



Source: In-house calculations based on BNetzA (2015a)

41. On 27 August 2015, the Federal Ministry for Economic Affairs and Energy presented its draft Act on the Further Development of the Electricity Market (Electricity Market Act). According to this proposal, the price for electricity is to be formed freely on the market in line with competitive principles. "The level of electricity prices on the electricity wholesale market shall not be restricted by regulation." There are only a few observers who assume that this self-imposed restriction in energy policy is sufficiently durable for private-sector investment decisions to be able to rely on it. In the case of the electricity **market design 2.0**, the expert commission therefore shares the frequently heard scepticism regarding the promises by policymakers to keep out of price formation on the wholesale electricity market in future. This promise does not provide a reliable basis for the market participants, not least because the strategic reserve is implicitly designed to create a new possibility for regulatory influence on price formation.

42. In view of the planned legislation to digitise the energy transition, the expert commission has looked at the issue of **smart energy**. However, it is not possible to derive any recommendations at the current point in time.

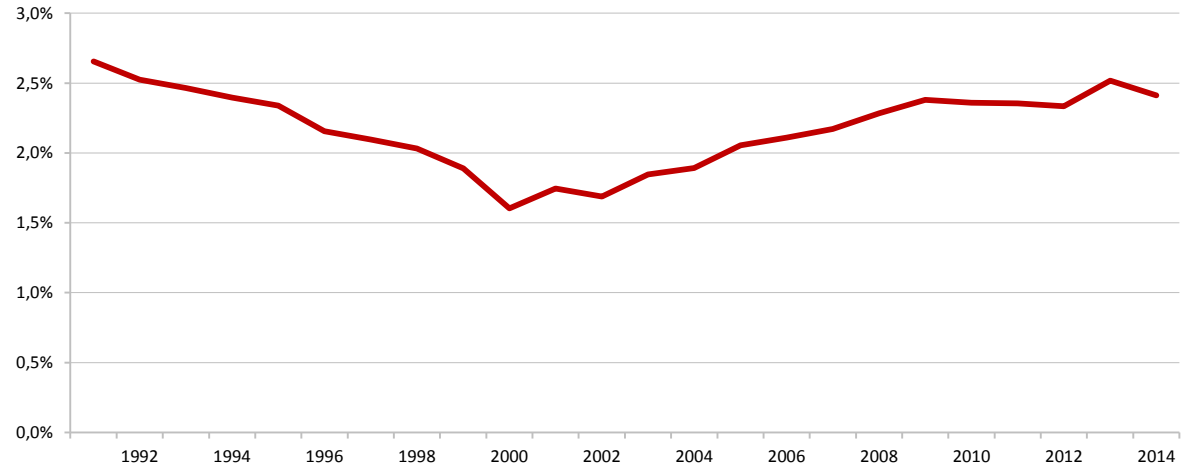
Energy prices and energy costs

43. In terms of the affordability of the electricity supply, the expert commission welcomes the Federal Government's efforts to slow the further **rise in expenditure by end-users**. Successes are apparent in the reference period, but on the other hand there are also signs that the rise in expenditure could accelerate again. One indication of this is the current draft of the CHP Act with implicit carbon avoidance costs of more than €300/t. A further indication is the decision on priority for underground cables as the ultra-high voltage grid is expanded. The expert commission recommends to the political decision-makers not to lose sight of the aspect of affordability, particularly in view of the innumerable wishes and demands which would entail further expenditure.

44. For this reason, the expert commission again argues in favour of taking **aggregated end-user expenditure on electricity** as an indicator for the affordability of electricity in macroeconomic terms, and again provides a detailed overview of this, although some of the figures are provisional. Absolute end-user expenditure dropped slightly in the reference period. This means that, at present, the energy transition is developing in a slightly positive way in the eyes of private, commercial and industrial consumers. However, a closer look shows that this is chiefly due to the drastic fall in spending on "generation and sales". This item has almost halved since 2010. The causes of this are to be found in the sales of non-renewable electricity, which have fallen by over a fifth, and the ongoing fall in wholesale prices. The collapse in wholesale prices is only partly due to the "merit order" effect, i.e. only partly driven by the energy transition. The wholesale prices are largely determined by the development of international prices for primary energy sources (coal and gas) and the carbon dioxide price.

45. The indicator proposed by the expert commission - the **share of end-user expenditure on electricity in nominal GDP** - fell slightly to 2.4% in the 2014 reference period (€70 billion) (cf. Figure 5). End-user spending on heat and transport has mainly fallen due to the international development in oil and gas prices. This amounted to 3.5% for heat in 2013 (€100 billion), and around 2.8% for transport in 2014 (€83 billion). For 2013, the total proportion of end-user spending on energy amounted to about 9.0% (€255 billion).

Figure 5: Proportion of GDP accounted for by end-user spending on electricity



Source: In-house calculations

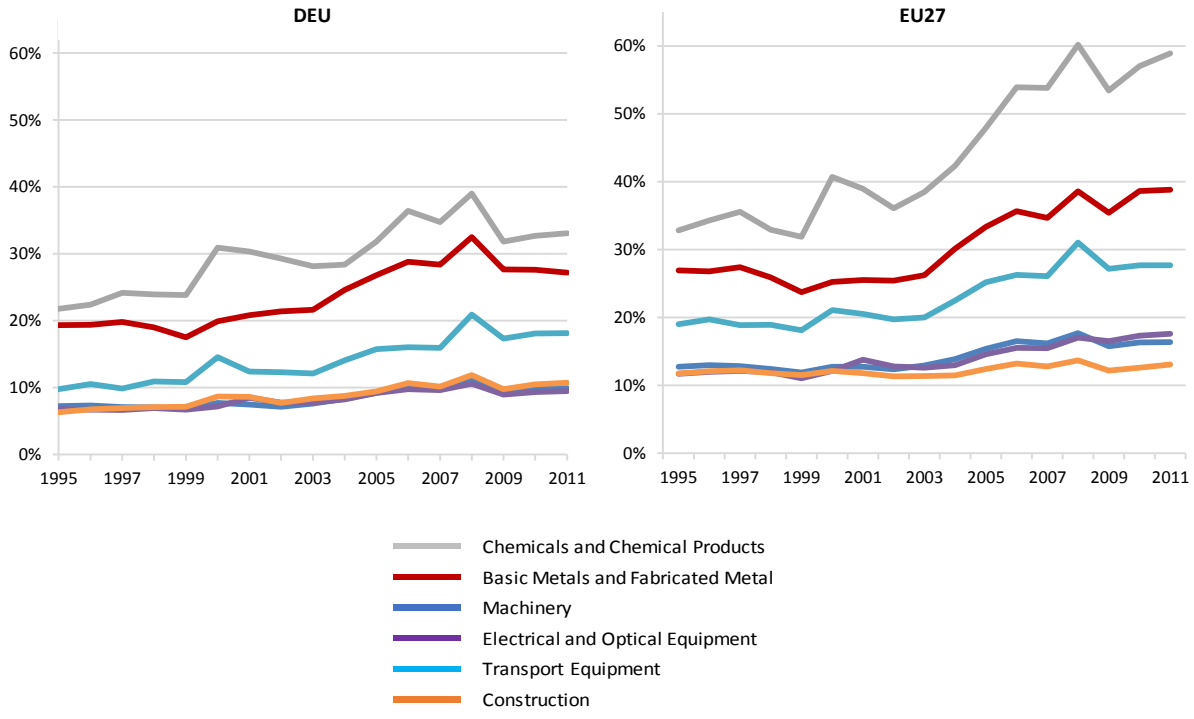
46. In the last statement, the concept of **real unit energy costs** was introduced to monitor the burden on companies caused by energy costs. The Federal Government is recommended to make more use of real unit energy costs. In this regard, this statement presents further developments. Based on a decomposition, the question of what "drivers" were responsible for the development of real unit energy costs in the German and European goods-producing sector is answered. It was found that increased real unit energy costs are mainly down to secondary energy sources. Increased added value counteracts this effect. It can also be seen that the German energy transition has little effect on some real unit energy costs in domestic industry. It is also notable that the product group "electricity, gas, district heating", which is important in the context of the energy transition, generated a lower rise in costs in Germany (at least until 2011) than in Europe. The tertiary sector is also investigated in more detail. Real unit energy costs in the services sector rose by less than in the primary and secondary sector.

47. The real unit energy costs indicator is being developed to include "indirect", i.e. energy costs embedded in intermediate inputs. These have been increasing on a very broad basis for years, and are (now) much more

significant for most sectors than "direct" energy costs. This is true, for example, of the goods-producing sectors. The **indirect energy costs** in the six key goods-producing sectors studied by us in greater depth amount to between €5 and 11 billion per sector, and are thus in some cases higher than the direct energy costs, which only amount to €2 to 8 billion per sector.

48. The real unit energy costs indicator becomes meaningful especially in the transnational view. The comparison of the German **total real unit energy costs** with the European average in Figure 6 illustrates three things here: domestic total real unit energy costs in the relevant sectors are structurally at a lower level than in Europe. Secondly, total real unit energy costs in Europe have seen a more dynamic upward development over the period than in Germany. And, thirdly, Germany easily outperformed the European average following the last economic crisis in terms of reducing total real unit energy costs. The reason for the latter factor is that the relevant sectors of the German goods-producing industry were generally able to expand their added value between 2008 and 2011, and at the same time to reduce total energy costs. In the European average, in contrast, total energy costs fell by less in some cases, and in particular the added value by industry did not develop as well as in Germany. "Total energy costs", or the yardstick of "total real unit energy costs" proposed by us, are thus more favourable for German goods-producing sectors than for the European average.

Figure 6: Total real unit energy costs in selected sectors of the German and European goods-producing industry between 1995 and 2011



Source: In-house calculations based on WIOD data

49. In addition to the energy costs in the manufacturing sector/goods-producing sector, **energy costs in the German services sector** are also analysed. Between 1995 and 2011, average direct real unit energy costs in the services sector rose by less than in the primary or secondary sector. This means that service providers are less affected by the general increase in energy cost burdens in the German economy.

50. As the Monitoring Report on the energy transition shows, a lack of **data** prevents a more up-to-date comparison of international real unit energy costs. The expert commission therefore makes a proposal to update the data basis.

Macroeconomic and societal impact of the energy transition

51. Many measures entailed by the energy transition involve additional costs. For policymakers, it is very **important to share these costs fairly** amongst various groups of the population and businesses. The expert commission has already commented on this in detail in its preceding responses, and addresses the issue once again here. Corresponding considerations should play a greater role at policy level with regard to the future shape of the energy transition.

52. This statement does not aim to develop a comprehensive solution for this problem, but to provide examples of **how the distributional effects might be handled** on a scientific basis. In redistribution debates, the first consideration should be whether the status quo can be improved in terms of pareto efficiency. In this case, it is possible to improve the situation of a group or of individuals without anyone else needing to be worse off. The report presents a few examples, some of which offer considerable potential for improvement. For example, if it is possible to cut the overall rental costs (including heating) by **retrofitting buildings**, the landlord will not suffer any disadvantage, because he can recoup the refurbishment costs via the basic rent, and the tenant will benefit from the lower overall rental costs (including heating). However, many measures in the context of the energy transition cannot be financed in this way. Taking the retrofitting of buildings as an example, non-recoverable costs can arise which have to be borne by the landlord (if the basic rent is too low), tenant (higher overall rent including heating costs) or taxpayer (state subsidies). This represents a central conflict of redistribution. The Federal Government should therefore analyse the pareto inefficiencies and develop proposals for solutions.

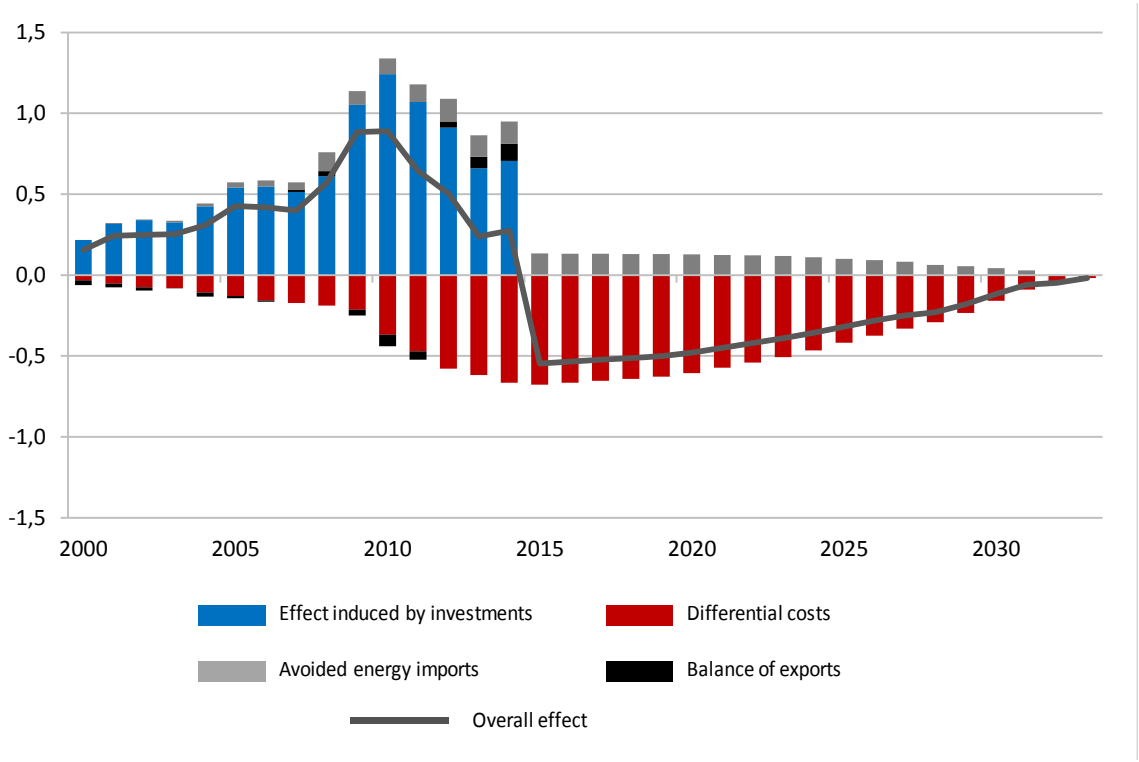
53. There are also distributional effects **at company level**. Whilst the construction sector in particular will profit from refurbishment work, energy suppliers will lose out. Quantitative analyses can highlight the distributional effects between sectors. We provide an example for this. The expert commission takes the view that such a structured understanding of the distributional effects is a key factor for the success of the energy transition.

54. In last year's statement, the expert commission took a critical view of the statements by the Federal Government regarding the effects of the energy transition on **growth and jobs**, and particularly objected to the methodological approach taken. Since the 2015 Monitoring Report simply repeats the statements from last year, the expert commission feels the need to take up this issue once again, and presents the findings of an investigation on the economic impact of the Renewable Energy Sources Act. The growth effect is mainly due to the fact that the investment triggered by the Act is largely funded by differential costs, most of which will be refinanced by the end-users in the form of the EEG surcharge in the coming years.

55. Figure 7 shows the **effects of the Renewable Energy Sources Act** as a percentage change in GDP in the energy transition scenario compared with the counterfactual scenario. Basically there is a build-up phase and a financing phase. The build-up phase between 2000 and 2014 is characterised by ongoing build-up of additional capacity, high investment in renewable energy installations and related secondary effects. The differential costs initially rise slowly, but increase in volume from 2010 on. The balance of exports and the avoided energy imports initially assume a subordinate role. The curve showing the resulting overall effect (solid line) is above zero until 2014 and attains a peak value of 0.9% of GDP in 2010. Without the Renewable Energy Sources Act, the growth effect would have been correspondingly lower. The growth effect is mainly due to the fact that the differential costs are not entirely activated in the year of the investment in renewable energy via the EEG sur-

charge, but generally accrue in later years. The negative growth effect of higher electricity prices on economic growth will thus only occur with some delay; initially, the positive effect dominates as a consequence of the additional demand stimulated by the investment in renewables.

Figure 7: Macroeconomic effects of the EEG-installations erected in the 2000-2014 period and financed via the Renewable Energy Sources Act



Source: In-house calculations following Ensys (2015)

Outlook up to 2030

56. In its monitoring reports and the first Progress Report of December 2014, the Federal Government concentrates on the period up to 2020. There are only five years left until then, and the expert commission therefore recommends that the analysis in future monitoring reports should be extended to **cover the period up to 2030**. One reason for this is that, since the Energy Concept was drawn up in 2010, there have been a number of changes, and current reference scenarios suggest that the 2030 climate target could be missed by a long way if no further measures are introduced.

57. In this context, consideration should also be given to completing the **rather non-granular target catalogue** for 2030 contained in the Energy Concept. In the Federal Government’s target hierarchy, this means the addition of a core objective for energy efficiency and the inclusion of steering goals for renewable energy and energy efficiency in the fields of electricity, heat and transport. However, it is also possible to set up indicative targets at this level.

58. Targets can be set on the basis of existing **scenarios**, or of scenarios yet to be undertaken. On the one hand, there should be a conscious focus on robust development strategies, and, on the other, consideration should be given to what alternative approaches are feasible, should unexpected developments take place

which necessitate a correction to the approach in order to ensure that the core objectives and, in particular, the primary target for 2030 can be attained.

Conclusion

59. The energy transition is making progress, albeit not so quickly across the board as initially planned and necessary. In certain areas, such as renewables-based electricity generation, the 2020 targets will probably be met or overshot, the progress made so far in other areas is still insufficient. In particular, the latter applies to the goal of cutting greenhouse gas emissions by 40% by 2020. In the transport sector, the development is actually pointing in the wrong direction.

60. Last year, the Federal Government launched a comprehensive package of legislation and measures in order to prevent the impending failure to meet the greenhouse gas reduction target. However, it has not proved possible so far to attain parliamentary majorities, particularly for what would probably be especially effective instruments like tax breaks for energy refurbishments. The main deficiencies now lie in the timely and effective implementation of the decisions. This is true, for example, for the expansion of the power grid and for improvements in energy efficiency.

61. In the view of the independent expert commission, potential failures to attain specific targets in the Energy Concept should not be deemed the fault of policymakers alone. In addition to economic and social conflicts, exogenous causes such as the low international market prices for fossil fuels and CO_2 emissions rights are making it more difficult to attain the energy transition targets. But this is no reason to categorise the targets in general as being over-ambitious. Instead, the energy transition monitoring process should undertake a realistic analysis both of the causes of possible failures to attain targets and of the measures and their contributions to target attainment, so that where necessary, and with a view to ensuring a secure, economic and environmentally acceptable energy supply, “finetuning” can take place.

62. The expert commission presents suggestions for this in its comments on the Federal Government’s annual monitoring reports. The expert commission will continue the constructive and, in some parts, critical dialogue with the Federal Government, especially in those areas where progress on the energy transition is more difficult than expected. That this cooperation is fruitful is also reflected in the fact that the Federal Government has already taken up and implemented many of our suggestions.