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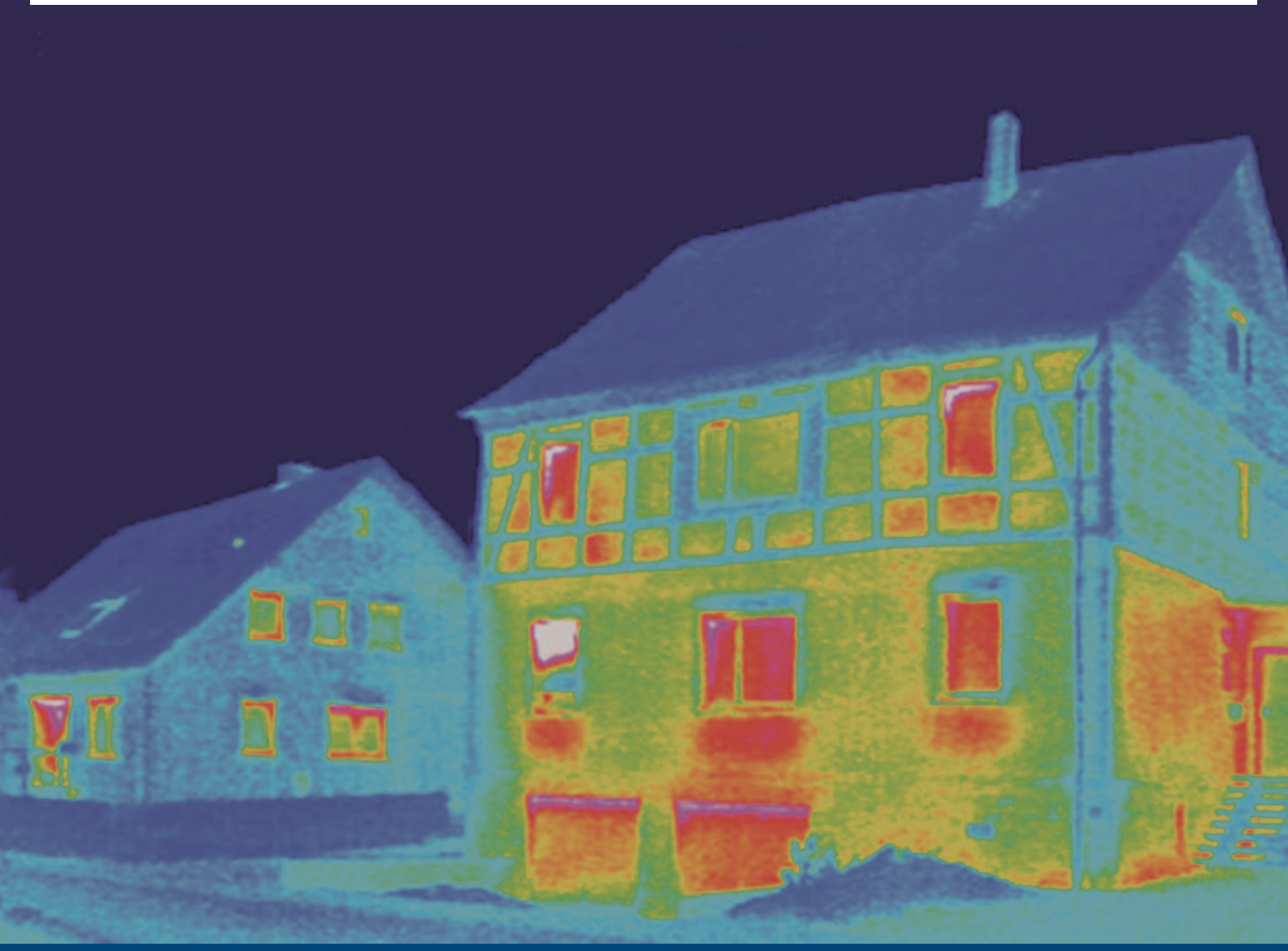

Second National Energy Efficiency Action Plan (NEEAP) of the Federal Republic of Germany

Pursuant to the EU Directive on Energy End-use Efficiency and Energy Services (2006/32/EC)

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List of abbreviations

AGEB	Working Group on Energy Balances
AGEE-Stat	Renewable Energies Working Group statistics
ASEW	Working Group on Economical Energy and Water Usage
BAFA	Federal Office of Economics and Export Control
BDI	German Industry Federation
BfEE	Federal Energy Efficiency Center
BImSchV	Ordinance on execution of the Federal Immission Protection Act (BImSchG)
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMVBS	Federal Ministry of Transport, Building and Urban Development
BMWi	Federal Ministry of Economics and Technology
Buildings Directive	Directive 2010/31/EU of the European Parliament and the Council on the overall energy efficiency of buildings
CEN	European Committee for Standardisation
CF	Conversion factor for electricity
CHP	Combined heat and power generation
CITL	Community Independent Transaction Log
D	Directive
dena	German Energy Agency
DIHK	Association of German Chambers of Industry and Commerce
DVR	German Road Safety Council
eaD	Federal Federation of Energy Conservation and Climate Protection Agencies
EBPG	Law on the environmentally compatible design of energy-using products (Energy-using Products Act)
EC	European Community
EDL-G	Law on energy services and other energy efficiency measures
EEWärmeG	Law on the promotion of renewable energies in the heating sector (Renewable Energies Heating Act)
EigZulG	Homeowner Allowance Act
EMAS	Eco-management and Audit Scheme
EnEG	Law on the saving of energy in buildings (Energy Savings Act)
EnEV	Ordinance on energy-saving thermal insulation and energy-saving systems engineering in buildings (Energy Saving Ordinance)
EnVKV	Ordinance on the labelling of household appliances with information on their consumption of energy and other important resources (Energy Consumption Labelling Ordinance)
EnWG	Law on electricity and gas supply (Energy Industry Act)
ESD	Directive 2006/32/EC of the European Parliament and the Council of 5 April 2006 on energy end-use efficiency and energy services (Energy End-use Efficiency and Energy Services Directive)
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
GDP	Gross domestic product
GJ	Gigajoule
GVFG	Law on financial support provided by the federal government for the improvement of transport facilities in the municipalities (Municipal Transport Financing Act)
ICT	Information and communication technologies
IEKP	Integrated Energy and Climate Programme
IEST	Indicative energy savings target
IHK	Chamber of Industry and Commerce
IREES	Institute of Resource Efficiency and Energy Strategies
KEG	Climate Protection and Energy Efficiency Group of Companies
KfW	KfW banking group
KraftStG	Motor Vehicle Tax Act
kWh	Kilowatt-hour
MAP	Market Incentive Programme for Promotion of the Use of Renewable Energies
NEEAP	National Energy Efficiency Action Plan
NEPE	National Electric Mobility Development Plan

PHH	Private households
PJ	Petajoule
PkW-EnVKV	Ordinance on consumer information regarding fuel consumption and CO_2 emissions of new passenger vehicles (Passenger Vehicle Energy Consumption Labelling Ordinance)
RegG	Law on regionalisation of local public passenger transport (Regionalisation Act)
SMEs	Small and medium-sized companies
TBE	Technical building equipment
TRS	Trade, retail and services
VDA	German Automotive Industry Association
VDMA	German Engineering Association
VgV	Ordinance on the awarding of public-sector contracts (Awarding of Contracts Ordinance)
VKU	Association of Municipal Companies
ZuInvG	Law on the execution of future investments of the municipalities and federal states (Future Investments Act)

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Summary

With the Second National Energy Efficiency Action Plan (NEEAP) the German federal government is demonstrating to the European Commission its achievement of the energy savings targets in accordance with Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) and in addition is providing overall information on the regulatory framework, the current status and the degree of success of energy efficiency policy in Germany.

Requirements of Directive 2006/32/EC (ESD)

The ESD stipulates a national indicative energy savings target for the Member States for the period between the beginning of 2008 and the end of 2016. This figure is 9 % of the average annual consumption of all energy users covered by the ESD during the last five years prior to implementation of the latter. The indicative energy savings target must be achieved by way of energy services and other energy efficiency measures for the period between the beginning of 2008 and the end of 2016. The savings are calculated on the basis of the cumulative annual energy savings achieved during the overall period of application of the ESD.

Pursuant to the methodological requirements of the ESD, for verification of the indicative energy savings target the Member States must use a harmonised calculation model with a combination of top-down and bottom-up calculation methods. As far as possible official statistical data must be used. These calculation methods have been established by the European Commission based on corresponding proposals and form the framework for the measurement and verification of energy savings in the context of the ESD. On this basis the intention is on the one hand to map the respective energy efficiency trend over the course of time in the various sectors, sub-sectors and areas of application with the help of aggregated energy efficiency indicators and to calculate corresponding energy savings (top-down method of calculation). However, as no statements on the causes or factors triggering this trend can be made using these methods, on the other hand it is also the intention to calculate and record those energy savings which are brought about by means of concrete instruments and measures (e. g. regulatory standards, fiscal instruments, or funding programmes) in the various areas for action (for example with buildings and appliances, or in transport).

Implementation and results

The indicative energy savings target required for Germany was established by the federal government for 2016 following an update ordered by the European Commission of the provisional indicative energy savings target calculated in the First NEEAP to 748 petajoules (PJ) taking into consideration a conversion factor for electricity of 1 and to 995 PJ using a conversion factor for electricity of 2.5. The interim target for 2010 was set at 456 PJ based on a conversion factor for electricity of 1 and 607 PJ given a conversion factor for electricity of 2.5.

In the Second NEEAP the federal government demonstrates the achievement of this indicative energy savings target in accordance with the methodological requirements of the ESD and the latter's confirmation by the recommendations of the European Commission. As far as possible existing data and studies were used. In application of the general framework for the measurement and verification of energy savings in the context of the ESD, in order to ensure an overall picture of the energy savings in Germany that is as complete as possible, the results of the two prescribed but differing methods of calculation (top-down and bottom-up) are deliberately used in parallel.

As a result Germany will overfulfil the indicative energy considerably. In the framework of the top-down calculations total energy savings of 2,479 PJ can be achieved in 2016 with a conversion factor for electricity of 1, and 3,123 PJ with a conversion factor for electricity of 2.5. For the period from 2008 to 2016 the energy savings come to 1,418 PJ and for the similarly creditable early action period from 1995 to 2007 they total 1,061 PJ. The calculated savings are therefore higher than the indicative energy savings target by a factor of 3.3, which would be achieved even without taking into account the savings from the early action period. The interim target is similarly greatly exceeded. Thus in the framework of the top-down calculations, energy savings of 1,812 PJ with a conversion factor for electricity of 1 and of 2,240 PJ with a conversion factor for electricity of 2.5 can be achieved in 2010. However, in evaluating these results it needs to be taken into account that the savings calculated by means of top-down methods are arithmetical figures which represent relative energy savings. Also, they are not just attributable

to policy-induced instruments and programmes, but also to predominantly market-induced technical progress. Thus it also becomes clear that besides political instruments, the market and technical progress are of great importance in increasing energy efficiency.

Besides this, the energy savings calculated by means of bottom-up methods must be taken into account. In total the energy-saving effects of 43 individual measures were included in the calculations, exclusively taking into account measures of the government and certain measures of the federal states. As a result, in the framework of the bottom-up calculations energy savings of 819 PJ can be achieved in 2016. Thus more than 30 % of all top-down savings can be accounted for by means of bottom-up methods. Hence the bottom-up savings alone approximately match the indicative energy savings target. This result illustrates the intensive efforts of the state to increase energy efficiency in Germany, especially as the numerous measures implemented independently at state and municipal level and by private agents are either barely taken into account or are not accounted for at all.

The instruments and programmes in the buildings sector in particular contribute to a considerable extent (more than 60 %) to the savings accounted for by bottom-up methods. Regulatory measures such as the Thermal Insulation Ordinance (1995) and the introduction of the Energy Saving Ordinance (EnEV) with its amendments (2002 and 2009) and the KfW banking group's programmes for energy-efficient construction and redevelopment (CO_2 Building Redevelopment Programme) account for 248 PJ, which is more than half the early energy savings of 460 PJ in the early action period from 1995 to 2007. A further important instrument among the early measures is the Ecological Tax Reform, which functions as a horizontal cross-sectoral instrument throughout all the areas for action. Besides the individual measures that are quantitatively evaluated in respect of their energy-saving effects in the Second NEEAP a total of 46 additional measures and projects are represented in qualitative-descriptive form.

Regulatory framework in Germany

The results presented in the Second NEEAP reflect the success of the energy efficiency policy in Germany. It is distinguished by a well-balanced mix of instruments at the level of the federal government, the federal states and the municipalities which takes into account the heterogeneous situation of potential economic savings in all end-user sectors and is adapted to the respective areas for action.

The energy policy of the German Federal Republic is an integral part of the energy policy principles of the European Union. In 2007, in its action plan entitled "An Energy Policy for Europe", the EU set an indicative target to be achieved by 2020 of reducing energy consumption in the EU by 20 % compared to the reference scenario. The ESD forms a part of this implementation strategy. In addition, on 28 September 2010, against the backdrop of the ambitious European and national energy- and climate-policy targets the federal government adopted a new energy concept for environmentally-friendly, reliable and affordable energy supply and in June 2011 supplemented it with further energy policy measures and accelerated its implementation. For the key area of energy efficiency and energy conservation, the energy concept included the target of reducing primary energy consumption by 20 % by 2020 compared to 2008.

In respect of the European and national targets the differences between the types of target need to be taken into account: The ESD set a target for final energy consumption which can be achieved by means of energy services and other efficiency-boosting measures. By contrast, the targets in the European Commission's EU Energy Efficiency Plan of 2011 and in the energy concept are formulated in relation to total energy consumption. Consequently, due to these methodic differences, for verification of the indicative energy savings target the energy savings referred to in the Second NEEAP cannot simply be integrated into the monitoring of the energy savings targets of the energy concept or be compared to the latter. However, the evaluations set out here constitute an important source of information for the future direction of efficiency policy and the energy savings in the Second

NEEAP make a relevant contribution to the achievement of the mid- and long-term energy savings targets of the federal government's energy concept.

It is crucial for the federal government wherever possible to use market-based elements to increase energy efficiency and to realise energy savings among consumers. It is intended that economic incentives and improved information and advice should contribute to enabling companies and private consumers to independently exploit previously unused economic potential in the area of energy efficiency and thus to cut energy costs and reduce damage to the environment. The fundamental approach of avoiding unnecessary administrative spending and direct state intervention as far as possible is just as politically important for the federal government as the budgetary consolidation strategy adopted by the same government.

As the analysis of the German energy services market in the Second NEEAP demonstrates, even now Germany has a very large and well developed market for energy services. A wide variety of energy services are supplied by a multitude of companies in the German Federal Republic. The latter vary greatly in respect of size and specialisation and compete hard with each other. In order that its promotion and further development of the energy services market should also take account of the core objective of the ESD, with its Law on energy services and other energy efficiency measures (EDL-G) and the setting up of the Federal Energy Efficiency Center (BfEE) the federal government has created a supportive regulatory frame-work for this.

In future it will be important to further improve the general environment for positive market growth and to eliminate the remaining obstacles, such as scarcity of capital, investment risks, lack of information, or overinflated transaction costs. The aim is to facilitate market-driven and cost-effective exploitation of the now as previously considerable potential economic energy savings in all areas for action. In this respect the energy concept of the federal government, including the supplementary energy policy resolutions drawn up in June 2011, makes provision for concrete and far-reaching measures. It is thus clear that the federal government will in future continue its ambitious policy of supporting growth in energy efficiency and of realising energy savings among consumers and will further strengthen it by means of additional measures.

1. Procedure for the Second NEEAP

1.1 Requirements of the Energy End-use Efficiency and Energy Services Directive 2006/32/EC

Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) stipulates a national indicative energy savings target for the period between the beginning of 2008 and the end of 2016. This figure is 9% of the average annual consumption of all energy users within the scope of the ESD over the last five years prior to implementation of the ESD for which official data are available. In Germany's case these are the years 2001 to 2005. The savings are calculated on the basis of the cumulative annual energy savings achieved by means of energy services and other energy efficiency measures during the total nine-year period of application of the ESD.

In terms of measures, the ESD leaves it to the Member States to choose between various instruments available to improve energy efficiency and promote the energy services markets. In the framework of three successive national energy efficiency action plans (NEEAPs) the Member States must set forth their policy for implementation of the ESD and for verification to the European Commission of the achievement of the indicative energy savings target.

The First NEEAP was sent to the Commission by the Federal Ministry of Economics and Technology (BMWi) in September 2007. In this document the federal government in particular sets out its strategy for achieving the indicative energy savings target, cites measures by means of which the indicative energy savings target is to be achieved, and assigns these measures ex ante estimates of the expected energy-saving effects.

As defined by Article 14, Para. 2 of the ESD the Second NEEAP is to be submitted to the Commission by 30 June 2011 and must contain the following information:

- a careful analysis and appraisal of the First NEEAP;
- a schedule of the final results in respect of the achievement of the indicative energy savings target including interim target;
- plans for additional measures to be used to deal with established or expected non-fulfilment of the target, and information on the expected effects of such measures.

In addition to this the Second NEEAP

- in accordance with Article 15, Para. 4 of the ESD, is to make increasing use of harmonised efficiency indicators and benchmarks, both in evaluation of previous measures and in forecasting the effects of future measures;
- is to be based on available data supplemented by means of forecasts.

1.2 Structure

The Second NEEAP is based on the targets and specifications of the ESD and is structured as follows:

By way of introduction, in the second section, "Energy efficiency policy", the political context surrounding the Second NEEAP is set out. The focal point of this is the current general political framework for increasing energy efficiency and the realisation of energy savings on the end-user side, which includes requirements and targets at both European and national level.

In the third section, "Strategy for achievement of the indicative energy savings target and methodological requirements and specifications", first of all the strategy of the federal government for the achievement of the national indicative energy savings target, already presented in detail in the First NEEAP and continued in the Second NEEAP, is briefly dealt with. Subsequently, on the one hand the most important methodological requirements of the ESD and its confirmation by means of general guidelines and recommendations of the European Commission on determination and verification of the indicative energy savings target are presented. In addition to this the methodological implementation of these requirements by the federal government is discussed.

Following on from this, the fourth section, "Energy efficiency and energy savings in Germany", contains

1 The Second NEEAP relates exclusively to the final energy sector and to final energy savings and final energy efficiency improvements achieved therein. In view of this, for reasons of improved legibility, in the Second NEEAP the terms "final energy", "energy end-use efficiency" and "final energy saving" etc. are as a rule replaced by the terms "energy", "energy efficiency" and "energy saving" etc. In cases in the Second NEEAP in which the final energy sector is not being referred to (but instead to primary energy or similar, for example), this is explicitly stated.

verification of the indicative energy savings target, taking into account the current and available data for Germany. At the same time an overview is given of the progress made in increasing energy efficiency in Germany and the relevant state-funded instruments in the various areas for action. This applies to the buildings and installations, appliances and lighting, trade and industry, and transport and mobility sectors, as well as the public sector and cross-sectoral measures.

In the fifth section, “The market for energy services in Germany”, by means of analysis of individual market segments such as contracting, energy audits, and energy-efficient building redevelopment, an overview is given of the current state of development of the energy services market and of the latter’s further development potential and market constraints standing in the way of this development. At the same time, in appropriate places individual projects that have been successfully implemented in the market are briefly presented by way of example.

Finally, in the sixth section, an outlook on the federal government’s still ambitious policy on increasing energy efficiency is given. The foundation for this is the 2010 energy concept including the supplementary resolutions of 6 June 2011, which announces numerous additional energy efficiency measures for all areas for action, and on whose concrete implementation the federal government is for the most part already working. These measures are briefly presented for the various areas for action.

2. Energy efficiency policy

2.1 The importance of energy efficiency

Among other things by means of a timely and long-term-oriented energy efficiency policy – for example through introduction of energy standards in the construction of new buildings with the First Thermal Insulation Ordinance in 1977 – even now Germany has achieved a high level of energy efficiency. Over the past few years primary energy consumption per €1,000 of gross domestic product (GDP) has only amounted to just over six gigajoules (GJ) per annum. Thus in terms of energy consumption, too, Germany is among the most productive industrialised countries in the world. Germany's energy intensity has significantly diminished over time. Less and less energy is required to produce one euro of GDP. The period from 1990 to 2009 saw an average improvement in specific energy consumption (energy intensity) of 1.7 % per annum based on national figures. In terms of an international comparison Germany therefore remains one of the leaders among the industrialised nations. Even though this trend has slowed down somewhat currently – in the period 2000 to 2010 energy productivity rose by 1.1 % as an annual average – there has been an increasing decoupling of energy consumption from economic growth over the past few years in Germany. Moreover, a similar picture emerges in respect of the trend in energy consumption per inhabitant. Here too, energy consumption has fallen over the past few years. The energy consumption figures for 2009 are especially low due to the global economic and financial crisis.

This high degree of energy efficiency has also to a by no means insignificant extent contributed to Germany meeting its international obligations in respect of reduction of CO_2 emissions. At the same time innovative, energy-efficient and thus cost-saving production methods have played a crucial part in strengthening Germany's position as a leading exporting nation in a global economy and contribute generally to strengthening Germany's status as an economic and manufacturing location.

Increasing energy efficiency is also one of the main keys to a successful energy policy in the future, because:

- → Energy efficiency makes a large contribution to affordable energy supply for companies and private consumers and is at the same time a key competitive factor and element of regional policy.
- → Energy efficiency makes an important contribution to greater security of supply and increasing the range of the exhaustible energy sources.

Table 2.1 Data on energy efficiency

Indicator	Unit	1995	2007	2009
Primary energy consumption (PEC)[1)]	PJ	14,269	14,128	13,398
Final energy consumption (FEC)1) Energy consumption (EC)[1)]	PJ	9,322	9,317	8,714
Gross domestic product (GDP)	€bn	1,867	2,255	2,169
Population	In 1000	81,817	82,218	81,802
PEC/GDP	GJ/€1000	7.6	6.3	6.2
FEC/GDP	GJ/€1000	5.0	4.1	4.0
PEC/Inhabitant	GJ/Inhabitant	174	172	164
FEC/Inhabitant	GJ/Inhabitant	114	113	107

Not temperature-adjusted; EEV 2007 CORRECTED
(SEE METHODOLOGICAL ACCOMPANYING DOCUMENT TO THE SECOND NEEAP, SECTION 2.4.2.)

Sources: AGEB, AGEE-Stat, Federal Statistical Office (FS 18, R 1.4)

→ Energy efficiency is applied environmental conservation policy and the most effective means, from the point of view of cost, of achieving energy policy targets.

Against this backdrop Germany's energy efficiency policy and thus also the strategy for increasing energy efficiency are developed on an ongoing basis and are adapted to meet the latest challenges and requirements related to energy policy objectives.

2.2 Framework for increasing energy efficiency

Energy efficiency policy in Germany features a wide variety of very successful instruments at the level of the federal government, the federal states and the municipalities. At federal level, besides legal regulations (e.g. the Energy Saving Ordinance) use is also made of fiscal rules (e.g. the Ecological Tax Reform) and funding measures (e.g. the funding programmes of the state-owned KfW banking group in the buildings sector), not to mention the provision of information and consulting services (e.g. on-site energy consultation for residential building owners).

The main objective is wherever possible to use market-based elements to increase energy efficiency and to realise energy savings among consumers. This is also an important fundamental approach in the energy concept of the federal government. It is intended that economic incentives and improved information and advice should contribute to enabling companies and private consumers to independently exploit previously unused potential in the area of energy efficiency and thus to cut energy costs and reduce damage to the environment.

2.2.1 European level

For the above reasons the greatest possible efficiency in utilisation of energy has high priority for Germany and is therefore being driven forward with great commitment at both national and European level. The energy policy of the Federal Republic is on the whole an integral part of the energy policy principles of the European Union, whose main objectives are improving the competitiveness of European industry, securing European energy supply, and climate protection.

Thanks to the important mediation of the German Council Presidency, in 2007 the European Council laid the foundation for an integrated European climate and energy policy. As a key element, in its action plan "An Energy Policy for Europe", besides the quantitative targets for reduction of greenhouse gas emissions and for increasing the share of renewable energies the EU has also set a concrete target for increasing energy efficiency. Accordingly, by 2020 energy consumption in the EU should have decreased by 20 % compared to the reference scenario.

Key instruments at European level include several EU directives, which must be implemented by the Member States in national law. These include general guidelines for increasing the energy efficiency of buildings (Directive 2010/31/EU of 19 May 2010 on the overall energy efficiency of buildings – Buildings Directive) and products (Directive 2009/125/EC of 21 October 2009 on the creation of a framework for the establishment of requirements in respect of environmentally compatible design of products relevant to energy consumption), on the promotion of energy services (Directive 2006/32/EC on energy end-use efficiency – ESD), and on energy consumption labelling (Directive 2010/30/EU). Nevertheless, the European Commission anticipates that with the instruments implemented only half of the 20 % target will have been achieved by 2020. In March 2011 it therefore published a comprehensive energy efficiency plan and in which it announced further proposals for legislation, and on 22.6.2011 submitted the draft of an energy efficiency directive.[2]

2.2.2 National level

On 28 September 2010 the federal government adopted a new energy concept for environmentally-friendly, reliable and affordable energy supply. With a view to achieving energy supply that meets these criteria, the energy concept formulates guidelines for the development of an integrated longterm overall strategy up to 2050. Increased energy efficiency and the realisation of

2 Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND COUNCIL on energy efficiency and annulment of directives 2004/8/EC and 2006/32/EC of 22.6.2011 (com(2011) 370).

energy savings among consumers are key elements of this. Thus, for example, it is planned to exploit the high potential of measures designed to increase energy efficiency in the buildings sector taking into consideration the efficiency principle.

The federal government has designed the energy concept taking into consideration the scientific results of various different energy scenarios and on the basis of its climate protection targets. It sets out what must be done in all the important areas for action in order to ensure efficient, secure and environmentally-friendly energy supply for industry and consumers. At the same time the energy concept lays down a development path to guide all participants in respect of achievement of the climate protection targets. Thus industry and consumers are provided with landmarks for the targeted development, and a clearly-delineated and reliable regulatory environment is created. However, this does not mean that a precision landing is intended. That would not be consistent with the diverse economic and technical developments that can be expected. By contrast, both in general and in the various different sectors the development path provides a guide as to whether, in the course of actual development, the targets are achieved or need to be readjusted.

In terms of energy efficiency and energy saving the following concrete national targets have been formulated in the energy concept:

- Reduction in primary energy consumption by 20 % by 2020 compared to 2008 and by 50 % by 2050.
- Increase in energy productivity by an average of 2.1 % per annum by 2050 in terms of primary energy consumption.
- Reduction in electricity consumption of the magnitude of 10 % by 2020 and 25 % by 2050.
- Reduction of the heating requirement of the building stock by 20 % by 2020 and of the primary energy requirement by 80 % by 2050 with the objective of having an almost climate-neutral building stock by 2050.
- Reduction of the heating requirement requires doubling of the redevelopment rate for buildings from the current figure of less than 1 % of the total building stock per annum to the new figure of 2 %.
- Reduction in final energy consumption in the transport sector by about 10 % by 2020 and by about 40 % by 2050 compared to 2005.

Taking 2010 as a base, the chosen development paths and target ranges impressively demonstrate the great importance of increasing energy efficiency for achievement of the targets of the energy concept.

At the same time it is clear that the ambitious targets of the energy concept up to 2020 also require additional effort in the area of energy efficiency. With this in mind, a series of additional concrete measures is being established in the energy efficiency areas of the energy concept for the various respective areas for action. These are intended to contribute to further exploitation of the still considerable potential for energy and electricity savings within the bounds of the economic possibilities. To this end it is intended to develop and implement successful existing instruments and promising new measures. The additional concrete measures foreseen in the federal government's energy concept are described in greater detail in Section 6. The faster phase-out of nuclear energy initiated by the federal government with its resolutions of 6 June 2011 requires in addition that the fundamental reorganisation of energy supply and the increasing of energy efficiency in Germany already set out in the energy concept of autumn 2010 needs to be accelerated and intensified. For this purpose the federal government has planned supplementary measures, which are similarly described in Section 6. Implementation of this programme of measures is reviewed annually on the basis of an in-depth monitoring process.

In addition to this the measures from the Integrated Energy and Climate Programme (IECP), which was adopted in two packages by the federal government on 5 December 2007, have taken effect in the energy concept. The IECP comprised 29 measures, aimed in particular at greater energy efficiency and more renewable energies. Numerous existing measures were developed further, though new measures were also introduced. The measures carried out in connection with the IECP in the area of energy efficiency, which in some cases were already contained in the First NEEAP, are also listed in the Second NEEAP and – where possible – quantified in respect of their energy saving effect (cf. Section 4).

2.2.3 Relationship of the European targets to the national energy savings targets of the energy concept

The targets defined at European level for increasing energy efficiency are based on a comparison between the energy consumption actually achieved and the energy consumption forecast for this point in time. On this basis the objective is a reduction in consumption compared to the trend.

This applies on the one hand to the quantitative target for increasing energy efficiency stated in the action plan entitled "An Energy Policy for Europe". This stipulates that primary energy consumption in the EU would be reduced by 20 % by 2020 compared to the reference scenario. On the other hand this type of relative target-setting also applies to the indicative target set for the Member States in the framework of the ESD with verification of achievement of a national indicative energy savings target. Fulfilment of this target is demonstrated by proving that a given amount of energy savings have been achieved by means of suitable measures. It is of no significance whether, despite the identified energy savings, absolute energy consumption falls, remains unchanged, or, due to a rising activity and comfort level, even increases further. To this extent, due to the methodology underlying the Directive no statements on absolute reduction of energy consumption are possible.

Also in respect of the setting of targets for energy savings the federal government has based its energy concept not on the ESD, but instead on the EU Council Resolution of March 2007. The main objective of German energy policy is reduction of absolute energy consumption.

The differing approaches and the varying objectives of ESD and energy concept make specific methodological-analytical methods for verification of achievement of the prescribed savings necessary. Thus verification of the achievement of the national indicative energy savings target as defined by the ESD takes place according to the methodological general guidelines defined in the NEEAPs of the Member States, which are set out in the ESD and were finalised by the European Commission taking into account the requirements of the ESD (cf. Section 3 and the Methodological Accompanying Document to the Second NEEAP). These requirements are fully taken into account by the federal government in the Second NEEAP.

Consequently, however, the results in respect of verification of achievement of the national indicative energy savings target described in the present Second NEEAP cannot necessarily be used for monitoring the energy savings targets for measurement of the degree of achievement of the energy concept or be compared to the latter's targets. Accordingly, both for methodological-analytical reasons and also due to the proximity in time to the resolution on the energy concept the present Second NEEAP does not yet provide a concrete measurement in respect of the energy concept of the federal government. However, it is true that the energy savings verified in the Second NEEAP make a relevant contribution on the end-user side.

2.3 Framework for the energy services market

The purpose of the ESD is to increase in a cost-effective manner the efficiency of energy use in the Member States, among other things through establishment of the necessary regulatory environment and by means of creation of the prerequisites for the development and promotion of a market for energy services. For this purpose the federal government has established the regulatory framework at national level and hence has enacted the ESD in national law.

2.3.1 Law on energy services and other energy efficiency measures (EDL-G)

On 12 November 2010, in the framework of implementation of the ESD, the Law on energy services and other energy efficiency measures (EDL-G) came into force, which represents an important step towards the necessary improvement in energy efficiency and towards further development of the energy services market in Germany. The main elements of the EDL-G are as follows:

- → It authorises the federal government to establish a general national indicative energy savings target for 2017. For Germany this indicative figure – in line with the requirements of the ESD – corresponds to a 9 % reduction in energy consumption by 2017 compared to the average for 2001 to 2005. This corresponds to energy savings of 748 PJ at a con-

version factor for electricity of 1.0, or 995 PJ at a conversion factor for electricity of 2.5 (cf. Section 3 and the Methodological Accompanying Document to the Second NEEAP).

- → The public sector is expected to fulfil an exemplary role in respect of improvement of energy efficiency. The federal government, the federal states and the municipalities are expected to set a good example regarding demand for energy services and other energy efficiency measures.
- → The Federal Energy Efficiency Center (BfEE), which was established at the Federal Office of Economics and Export Control (BAFA) in 2009, has been given a series of additional tasks in connection with the implementation of the ESD. These are described in greater detail in the following section.
- → However, development and promotion of the market for energy services and other energy efficiency measures is also the responsibility of the energy utilities. The EDL-G obliges them to inform their end-user customers about the products available to them and the effectiveness of efficiency-boosting measures and to provide them, alongside contract documents, statements or invoices, with the contact details of authorities from which they can obtain further information about energy efficiency packages, end-user comparative profiles, and technical specifications of energy-using products. In addition to this the energy utilities are obliged to provide an adequate amount of independently executed energy audits with a competitive pricing structure where these are not already available to a sufficient extent.

2.3.2 Federal Energy Efficiency Center (BfEE)

The BfEE, which was set up in 2009 in the BAFA, on the one hand takes on the tasks provided for by articles 4 and 5 of the ESD, i.e. playing a key national role in verifying achievement of the indicative energy savings target, preparation of the NEEAPs, and being a role model in terms of energy efficiency in the public sector. On the other hand, with the coming into effect of the EDL-G in November 2010 a large number of concrete tasks and duties were added to its responsibilities. The fundamental focus of the work of the BfEE is the monitoring and further development of the market for energy services, energy audits, and other energy efficiency measures. Taking into consideration this objective and in view of the tasks that have been conferred upon it under the law, its main areas of activity currently include the following tasks:

Market observation, market evaluation and market activation
A functioning energy services market is an essential prerequisite for growth in energy efficiency and achievement of the ambitious national and European energy and environmental targets. The BfEE therefore works on proposals for meeting the prerequisites for further development and promotion of the market for energy services, energy audits, and other energy efficiency measures as well as proposals for overcoming existing market constraints. The objective is facilitating market-driven exploitation of economic energy efficiency potential by consumers by means of the beneficial development and expansion of corresponding proposals by market participants. In its work the BfEE, in the spirit of the EDL-G, relies on a fundamental approach which is free market-oriented and as unbureaucratic as possible and it promotes cooperation between the market participants. Moreover, an essential requirement for the drawing up of suitable proposals is the surveying, monitoring and analysis of the market with its various segments. Improvement of the market data and information base will therefore be a focal point of the work of the BfEE in the short and medium term.

Maintenance of a supplier list
Providers of energy services, energy audits or energy efficiency measures can be registered in a supplier list publicly maintained by the BfEE. The main objective of the supplier list, which is based on the principles of voluntary participation and self-disclosure, is increasing market transparency for the consumer and thus promotion and further development of the market. By means of reference to this supplier list, in the course of invoicing their customers energy suppliers can meet part of their duty to provide information pursuant to Section 4 of the EDL-G.

Notification of the public and market participants
It is incumbent on the public sector to fulfil an exemplary role in the improvement of energy efficiency. The BfEE informs the public about the measures that the public sector takes in respect of energy efficiency in order to fulfil its exemplary role. In addition it informs

market participants about energy efficiency mechanisms and the established regulatory framework and regularly publishes reports on this. The BfEE also makes available model contracts on financial instruments and lists with energy efficiency criteria for the technical specifications of various product categories.

Setting of the national indicative energy savings targets and preparation of the NEEAPs
For achievement of the objective prescribed by the ESD and EDL-G of achieving a cost-effective increase in energy efficiency among consumers by means of energy services and other energy efficiency measures, the BfEE calculates the indicative energy savings targets for the federal government and monitors and supports achievement of the targets and implementation of the strategy established to this end. In addition, building on the First NEEAP of 2007 it prepares the subsequent NEEAPs for the federal government.

Scientific support by the BMWi and representation of Germany in the concerted action
Besides a series of additional tasks the BfEE supports the BMWi in all matters relating to energy saving and energy efficiency and also represents Germany in the concerted action for implementation of the ESD. The aim of this EU-financed project is the informal exchange of experience between the Member States for the purpose of implementation of the ESD, for example by means of identification and communication of good examples of implementation.

3. Strategy for achievement of the indicative energy savings target and methodological requirements and stipulations

3.1 Continuation of the strategy from the First NEEAP for achievement of the indicative energy savings target

In the First NEEAP the federal government set out in detail its strategy for achievement of the national indicative energy savings target (cf. Section 2 of the First NEEAP) and will continue in future to pursue this consistently. The principles shown below in particular will guide the future actions of the federal government.

The federal government will continue to implement the ESD in cooperation with the market participants and pursue a free market-oriented fundamental approach. The purpose of the ESD continues to be to increase energy efficiency by means of establishing the indicative energy savings target and the interim target as well as the mechanisms and incentives required to eliminate any existing market impediments; in addition its role is to create the conditions necessary for development and promotion of the energy services markets. Thus the basic principles derived from this in the First NEEAP for the creation and content of the NEEAPs remain valid:

- Focusing of the measures on (sub-)sectors and energy uses with high absolute energy saving potential that is economically viable.
- Development and expansion of ranges of services for the efficient use of heat, power and lighting for consumers.
- Expansion and creation of markets and increasing sales of energy-efficient products, techniques and processes.
- Strengthening the marketing facilities, including financing services for energy-efficient products, techniques and processes.
- Provision of qualified information, target group-oriented consultation and audits, and the drawing up and establishment of standards and norms which support the above activities, simplify their broad application and motivate the agents.
- Utilisation of synergy effects by networking the market agents in the drawing up and implementation of measures.

For the purpose of achieving targets in a cost-effective manner, state initiatives and activities aimed at reducing energy consumption will continue to concentrate on those areas where, due to existing market constraints such as scarcity of capital, investment risks, lack of information or excessive transaction costs, economically viable potential energy savings have not yet been exploited or have not yet been exploited in their entirety.

At the same time the federal government is addressing the problem of providing sustainable support for energy saving and energy efficiency with a well-balanced selection of instruments ranging from funding to making regulations which takes into account the heterogeneity of the potential savings in all end-user sectors and is tailored to the respective areas for action. The fundamental approach of limiting unnecessary administrative spending and direct state intervention as far as possible continues to be an important part of the economic policy of the federal government. As has been shown by many examples from industry, among other areas, the most effective measures relating to energy saving and efficiency are those which successfully find a market for themselves on the basis of their price and cost ratios.

In view of this the federal government's measures and initiatives designed to increase energy efficiency on the demand side will continue to concentrate essentially on the following areas of application:

- Accelerated exploitation of the extensive potential for energy savings in the buildings sector, especially involving existing residential buildings.
- Increased exploitation of the extensive economic energy efficiency potential in the public sector, especially through measures involving public buildings and in public-sector procurement.
- Support for measures designed to increase energy efficiency in the trade, retail, services, agricultural and industrial sectors, in particular in small and medium-sized enterprises (SMEs).
- Promotion of the technical development of vehicles, with the main emphasis on energy-related optimisation of conventional drive units in cars and heavy goods vehicles, and support of greater

market penetration by energy-efficient vehicles and components such as low-resistance tyres and oils.
→ Further development in terms of informing and motivating consumers on increasing energy efficiency on the demand side and improving training and education for providers and disseminators.

For all the funded measures it is always necessary to weigh up their effectiveness in respect of cost and benefit and with legal requirements to bear the efficiency principle in mind.

As was the case in the First NEEAP, the Second NEEAP is not required to show in detail how the viable energy efficiency potential can be fully exploited. Nor does it contain a comprehensive description of Germany's energy efficiency measures. Under Article 14 of the ESD in the Second NEEAP in particular those measures are listed that make a contribution to fulfilment of the energy efficiency targets stipulated by the ESD together with measures for fulfilment of the exemplary role of the public sector and for provision of information and counselling of consumers. For many of these measures the previous energy-saving effects were also quantified in the Second NEEAP in respect of verification of the indicative energy savings target and in addition to this projections were quantified in respect of the additional energy-saving effects to be achieved up to 2016. It should be borne in mind that compared to the ex ante estimates of the savings achieved by individual measures presented in the First NEEAP differences are possible in principle. This is due among other things to the fact that for the First NEEAP there were no sufficiently concrete specifications for the methods of calculation of the energy savings. Thus in contrast to the present calculation of energy savings in the Second NEEAP, which follow the methodological recommendations of the European Commission, for the estimates in the First NEEAP different methodological approaches were chosen in some cases.

Moreover, in view of the various objectives of the ESD the federal government has also decided not to include in the Second NEEAP only those measures whose energy-saving effects can be quantified in respect of the indicative energy savings target. Instead, additional measures in qualitative form are also included which address the various areas of application and similarly lead to an increase in energy efficiency and to energy savings on the demand side.[3] This applies in particular to measures and projects which aim at improvement of information and the strengthening of market transparency for the consumer. Such measures are of great importance, also in view of the objectives of the ESD to develop the energy services markets and to promote exchange of experience between public-sector institutions in fulfilment of their exemplary role.

As a result, in the Second NEEAP a total of 89 individual measures are listed, of which 43 are also quantified in respect of their energy-saving effects. It should be borne in mind that these are predominantly measures at national level. The large number of measures implemented independently at the level of the federal states, municipal level or by private actors are not listed in the Second NEEAP. It can however be assumed that the latter will give rise to considerable additional energy savings in Germany.

For those measures in the Second NEEAP which also remain effective in future, attention must be paid in particular to the general provisions in respect of the legal stipulations proviso, of the financial proviso, and of the consideration of instrument-related options and alternatives already set out in the First NEEAP. These general provisions also apply accordingly for additional deliberations of the federal government contained in the Second NEEAP on the possible introduction of additional new measures in the framework of the energy concept (cf. Section 6).

3.2 Updating of the national indicative energy savings target and of the interim target for 2010

The ESD stipulates a national indicative energy savings target for the Member States for the period between the beginning of 2008 and the end of 2016. This figure is 9 % of the average annual consumption of all energy users within the scope of the ESD over the last five years prior to implementation of the ESD for which official data are available. For Germany this was the period from 2001 to 2005, for which data on domestic energy consumption were available from the national energy

3 With respect to drawing up the qualitative measures described preparation of the Second NEEAP was aided by the German Energy Agency.

balance prepared by the Working Group on Energy Balances (AGEB). On the basis of the data situation at that time a provisional indicative energy savings target was established in the First NEEAP. However, in the course of its evaluation of the First NEEAP the European Commission explicitly ordered the latter's retrospective updating in the framework of the Second NEEAP. The European Commission has in particular given notice of the updating of final official data[4] and of noninclusion of energy consumption of undertakings that come under emissions trading and of the armed forces.

The indicative energy savings target for Germany will therefore be updated in the Second NEEAP in accordance with the demands of the European Commission and, based on this, finally established. Compared to the provisional calculation in the First NEEAP the following updates now apply:[5]

- As in the First NEEAP the base period for calculation of average annual energy consumption in the last five years before implementation of the ESD continues to be the period from 2001 to 2005. However, calculation is carried out on the basis of current – and thus final – consumption data from the national energy balance (AGEB 2010).
- The average energy consumption of the armed forces, which is to be deducted from the area of application of the ESD, was updated on the basis of internal data of the Working Group on Energy Balances (AGEB 2007) and only the fuel consumption of the armed forces was deducted.
- After an extensive review of various different correction variations the share of industrial energy consumption subject to emissions trading was determined on an approximate basis in the Second NEEAP and the corresponding energy consumption left out of the indicative energy savings target. Emissions trading in the delimitation up to 2012 is used as a basis for this. The fuel consumption of industry is only corrected to account for the emissions trading share, while electricity consumption is allocated in full to the area of application of the ESD.

Following these required updates the national indicative energy savings target for Germany at a conversion factor for electricity of 1 is now 748 PJ and at a conversion factor for electricity of 2.5 is now 995 PJ[6] (cf. Table 3.2).

On the basis of these required updates the interim target for 2010 must also be modified. In the First NEEAP differing methods were used for calculation of the indicative energy savings target and the interim target: Whilst the indicative energy savings target was derived from average annual energy consumption in the base period 2001–2005, the interim target for the year 2010 was estimated on the basis of a "bottom-up approach" based on the energy savings achievable from the options available in terms of measures set out in the First NEEAP. On this basis, in the First NEEAP – incl. early savings already achieved – it was set at 510 PJ with a conversion factor for electricity of 1 and at 659 PJ with a conversion factor for electricity of 2.5.

For the sake of consistency with the First NEEAP the interim target for 2010 is now adjusted in the Second NEEAP on the basis of the ratio between the indicative energy savings target and the interim target in the First NEEAP. Given that the interim target for 2010 in the First NEEAP, at 510 PJ with a conversion factor for electricity of 1, was 61 % of the indicative energy savings target of 833 PJ, this ratio is also retained in the Second NEEAP. On this basis the interim target for 2010, with an indicative energy savings target now of 748 PJ taking into account a conversion factor for electricity of 1, is now 456 PJ. Using a conversion factor for electricity

4 At the time of creation of the First NEEAP, due to the peculiarities of German energy statistics the available data were still only provisional, so the calculations for the indicative energy savings target in the framework of the First NEEAP based on them were also only of a provisional nature.

5 A comprehensive explanation of the methodological approach used for updating the indicative energy savings target can be found in the first section of the Methodological Accompanying Document to the Second NEEAP.

6 Annex II EEE-ESD defines conversion factors used to convert the various energy sources into equivalent units in order to be able to compare the energy savings. However, electricity is a special case, and in accordance with Article 4, Para. 1 and Annex II of the EEE-ESD the Member States can use for its conversion a factor of 1 or 2.5 or a figure somewhere between. In the First NEEAP the indicative energy savings target and the quantitative energy savings were calculated based on both power coefficient 1 and power coefficient 2.5. In principle this procedure is retained in the Second NEEAP.

Table 3.2 Updating of the national indicative energy savings target (base period: 2001–2005)

Indicative energy savings target Base period: 2001–2005	Unit	Fuels (incl. district heat)	Electricity	Total energy
		Average 2001–2005		
		Calculation with conversion factor for electricity[1]		
Average annual energy consumption in the five-year period	PJ	7,491	1,828	9,319
Energy consumption of the armed forces not included in the area of application of Directive 2006/32/EC	PJ	13	0	13
Energy consumption of facilities governed by the EU-ETS not included in the area of application of Directive 2006/32/EC	PJ	992	0	992
	%	58	0	58
Total of the energy consumption to be taken into account under Directive 2006/32/EC	PJ	6,486	4,570	11,056
Indicative energy savings target: 9 % of the energy consumption to be taken into account under Directive 2006/32/EC	PJ	584	411	995

DATA SOURCES:
Energy consumption 2001–2005:
AGEB 2010 (calculated on the basis of the evaluation tables relating to the energy balance; valid as at: July 2010)
Energy consumption of armed forces:
AGEB 2007 (only fuels)
Energy consumption of undertakings subject to the EU-ETS:
Estimate Fraunhofer ISI based on CITL data for 2007, AGEB 2010, Federal Environment Agency (UBA) 2009, Federal Statistical Office FS 4, R. 6.4

of 2.5 and a corresponding indicative energy savings target of 995 PJ, the interim target is consequently 607 PJ.

3.3 Methodological stipulations and procedure for verification of the national indicative energy savings target[7]

The concrete methodological stipulations for verification of the national indicative energy savings target in the framework of the NEEAPs are essentially contained in articles 4, 15 and 16 and annexes I and IV of the ESD. Pursuant to the general framework for the measurement and verification of energy savings prescribed in Annex IV of the ESD the Member States are to use a harmonised calculation model with a combination of top-down and bottom-up calculation methods for the purpose of verification.

In general top-down and bottom-up calculation methods, being two fundamental methodological approaches to the measurement of energy savings and energy effi-

7 In the conception and execution of the methodological approach to verification of the national indicative energy savings target the federal government was supported by Prognos AG and the Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI) in the course of several projects (Prognos/Fraunhofer ISI 2011, 2010).

ciency, can be differentiated from each other as follows:[8]

- In a top-down evaluation one considers energy consumption at a highly aggregated level such as the energy consumption of a nation, of a federal state, or of a macro-economic sector, for example the entire industrial sector. As a rule one bases the consumption on a reference variable such as the number of households or on an activity factor such as the economic output of the territory under consideration. Ideally it is possible to determine the movement over the course of time of a top-down indicator of this type and to show that specific energy consumption per unit under consideration is falling. At the same time, however, one does not obtain any information as to the causes or factors triggering this development.
- By contrast, in a bottom-up evaluation one considers an individual measure, such as the introduction of a regulatory standard or the implementation of a funding programme. One calculates the energy savings of a representative individual case and extrapolates the energy savings on the basis of programme statistics that are as detailed as possible. Nevertheless, an individual appraisal of this type is very time-consuming and expensive. In addition to this, the required data are frequently not available.

Pursuant to Art. 15, Para. 4 ESD the European Commission has until 30 June 2008 to propose the specifications of this general framework required for this purpose as well as harmonised efficiency indicators. Therefore the European Commission submitted various discussion papers which, pursuant to Article 16, Para. 2 ESD, were discussed with the Member States in the framework of a comitology process. These proposals by the European Commission, in particular in the latest version of 2 July 2010 (European Commission 2010), constitute the fundamental orientation for calculation of the energy savings in the Second NEEAP.

Against the backdrop of these general methodological guidelines and recommendations, in the procedure used for verification of the indicative energy savings target in Germany in the framework of the Second NEEAP the following points are to be taken into account:[9]

Firstly, in verifying the indicative energy savings target the federal government has availed itself of scientific support provided by several prominent and independent institutions. The BMWi, the body responsible for leading the project, and the BfEE have cooperated closely and awarded projects and study assignments at an early stage. Both in respect of the decision on the chosen methodological approach and in particular of the top-down and bottom-up calculations carried out and the clarification and creation of the required foundation of data, these research activities form the essential basis for verification of the indicative energy savings target in the framework of the Second NEEAP.

Secondly, for the top-down calculation of energy savings in the Second NEEAP full use is made of the recommendations of the European Commission of 2 July 2010. The following essential points are to be taken into account:[10]

- The recommendations of the European Commission contain top-down indicators at the level of individual end-user sectors (private households, services, transport, and industry).
- Exclusive use is made of comparatively detailed indicators preferred by the European Commission (preferred indicators): P (P1-14).The utilisation of these involves a sig-nificantly higher data requirement than for the highly aggregated minimum indicators, M (M1-M8), alternatively proposed by the European Commission and having a relatively low requirement in terms of statistical data availability. Consequently the P-indicators are better suited to illustrating the overall improvement in energy efficiency than the M-indicators.

8 It should be noted that energy savings calculated both by means of top-down and bottom-up methods for verification of the indicative energy savings target are relative and not absolute energy savings (both in this respect and in general in respect of the methodological approach in the top-down and bottom-up calculation of energy savings see the Methodological Accompanying Document to the Second NEEAP).

9 A comprehensive explanation of the methodological requirements of the EEE-ESD for verification of the indicative energy savings target, the associated general guidelines and recommendations of the European Commission, and the resulting methodological stipulations and the selected approach to verification of the indicative energy savings target can be found in Section 2 of the Methodological Accompanying Document to the Second NEEAP.

10 The calculation methods proposed therein are described in the Methodological Accompanying Document to the Second NEEAP (see Section 2.4.). On the basis of the calculation methods proposed by the European Commission which were included in the Second NEEAP, the energy savings are shown in the following calculations as positive values, while additional energy consumption is given a negative sign.

- From a methodological point of view the indicators used are statistics-based top-down indicators with which the annual statistical data for the measurement of the energy savings – as required in Annex IV, Point 1.1 of the ESD – are adjusted for external factors such as volume and temperature effects and structural changes.
- The indicators proposed and recommended by the European Commission and used here for top-down calculation of the energy savings are not adjusted for the influence of energy prices or of autonomous technical progress.[11] However, this foregoing of adjustment recommended by the European Commission means that the top-down energy savings calculated in the Second NEEAP inevitably greatly exceed the bottom-up energy savings determined at the level of individual measures. By contrast, in the bottom-up calculations of the energy savings of individual measures, for methodological reasons these price- and technology-related influences are not included in the savings from the outset. This should be taken into account in interpretation of the calculations carried out here.
- For Germany the calculation of most of the preferred top-down indicators proposed by the European Commission in its recommendations of 2 July 2010 is achievable. The required data are available to a large extent on an annual basis from a wide range of statistical sources, from empirical surveys on energy consumption or, with certain individual indicators, at least from models. For reasons of quality and consistency of the data only national data sources are used for calculation of the top-down indicators.
- All the top-down indicators are calculated for various periods of time and the energy savings determined are shown in table form in Section 4. Nevertheless, the data required for the top-down calculations are currently predominantly only available from the statistics up to 2009 (and in some cases only up to 2008). Therefore the Fraunhofer ISI, which carried out the top-down calculations for preparation of the Second NEEAP, has made use of current scenarios of scientific institutions (Prognos et al. 2010; Prognos/Öko-Institut [Institute of Applied Ecology] 2009) available for Germany for the ex ante calculations up to the target year 2016 of the ESD and related these figures to the latest respective year for which statistics are available. Consequently the ex ante estimates are not a forecast by the federal government of the actual development of energy efficiency in Germany up to 2016.

Thirdly, for the bottom-up calculation of energy savings in the Second NEEAP the recommendations of the European Commission of 2 July 2010 and additional bottom-up calculation methods are similarly used. The following essential points are to be taken into account:

- The bottom-up calculation methods proposed by the European Commission predominantly relate to measures in the buildings and installations and appliances and lighting areas for action. They have been formulated by the European Commission as non-binding proposals and recommendations in order to give the Member States the freedom to be able to adjust the calculation methods in a suitable manner according to the large differences between the national information and data situations of the member states.
- The recommendations of the European Commission do not include all the areas for action in which measures for increasing energy efficiency have been carried out. In the recommendations of the European Commission it is therefore explicitly stated that for those instruments for which no recommendations of the European Commission for calculation of the resulting energy savings are available the Member States develop and use additional national bottom-up calculation methods. This relates in particular to instruments and measures in the transport and mobility and cross-sectoral measures areas for action. The federal government has made use of this explicitly stated option.
- In addition, in these cases use was made of existing evaluations of funding measures and programmes in which they were available in a suitable form. In programme evaluations such as these bottom-up-based methods of calculation are similarly carried out. Nevertheless, as a rule they involve additional

11 A comprehensive justification for not carrying out adjustments for price- and technology-related effects can be found in the Methodological Accompanying Document to the Second NEEAP (see Section 2.4.).

empirical components such as standardised surveys or expert interviews and can in principle therefore provide – with a greater amount of work and consequently at higher evaluation cost – more precise estimates about the energy-saving effects achieved.

- Complete quantification of the measures implemented in Germany for increasing energy efficiency by means of bottom-up methods of calculation cannot be achieved at justifiable cost. Therefore, besides the most important measures implemented at federal level, the Second NEEAP is limited to the designation and quantification of the most important measures within the German federal states.
- The implementation of an energy-saving measure is embedded in a complex causative network of supporting or inhibiting individual factors (values, motives, interests, education, specialist know-how, financial situation, etc.). More complex interdependencies such as innovative behaviour, market transformation, rebound effects, freeriding and exemplary effects (multiplier effects) are not taken into account in this simplifying appraisal.
- In the bottom-up calculation of energy savings in the Second NEEAP various correcting variables are used in order to keep errors distorting the result as small as possible.[12] On the one hand so-called instrument factors are intended to prevent double counts in order to ensure that the identified energy saving is only counted once in the total saving. On the basis of empirical experience and expert estimates the energy saving in a given sector is split on a pro rata basis between the measures aimed at this sector.[13] On the other hand the introduction of so-called implementation factors is intended to reflect, among other things, non-consideration or non-fulfilment of legal requirements (non-compliance). It is of no significance whether the deviation from the required or calculated situation is due to wilful disregard, non-execution, inadequate consideration of rules, ignorance, or technical failings in implementation.[14]
- As the technical lifetimes of buildings, installations and appliances is limited, limited lifetimes are also assumed in the evaluation of instruments and measures. Accordingly, in its recommendations the European Commission has proposed a harmonised list with lifetimes of individual measures which dates back to a list agreed upon by the European Committee for Standardisation (CEN) in 2007. The lifetimes established in this list are used as a basis for the calculations in the Second NEEAP.[15] From this it follows that savings resulting from individual measures cannot then be counted towards the indicative energy savings target if they are no longer effective in 2016 as defined by their respective lifetimes. Besides the lifetime, this mainly depends on the time of implementation of a measure. Thus (with an assumed lifetime of five years), for example, the purchase of an energy-efficient electric appliance in 2008 could not be counted, whereas purchase in 2013 could be counted.

Fourthly, top-down and bottom-up methods represent different but complementary methodological approaches to calculation and estimation of energy savings. While the top-down methods make a view of the overall development in a sector under consideration or area for action possible, the bottom-up methods allow observation of the effectiveness and intensity of individual measures or programmes. The two approaches thus examine different aspects and both are necessary for monitoring and evaluation of energy efficiency policy. Accordingly, therefore, in the present Second NEEAP the federal government pursues the approach of using both methodological procedures in a complementary manner in accordance with the recommendations of the European Commission.

In the Second NEEAP each area for action is viewed individually. The overall development of the area for action is recorded by means of top-down methods and the effect of individual measures or groups of measures is recorded using bottom-up methods and these

12 A more detailed explanation of such errors which distort the result and the correcting variables working counter to these errors can be found in the Methodological Accompanying Document (see Section 2.5.).

13 The instrument factors used in the Second NEEAP are listed in the Methodological Accompanying Document (see Section 2.5.).

14 The implementation factors used in the Second NEEAP are similarly based on empirical experience as well as expert estimates and are listed in the Methodological Accompanying Document (see Section 2.5.).

15 The average technical lifetimes used in the Second NEEAP are listed in the Methodological Accompanying Document to the Second NEEAP (see Section 2.5.4.).

results are quantified in respect of the energy savings achieved. However, the respective results of the two methodological approaches are not added together (this would be incorrect from a methodological point of view), but consciously placed in parallel in order thus to ensure an overall picture of the energy savings in Germany which is as complete as possible. For the methodic reasons referred to above (e.g. restriction to measures with an adequate data situation and non-consideration of technical progress) the bottom-up savings are well short of the top-down figures as a rule.

Fifthly, for presentation of the energy savings for verification of the indicative energy savings target in the Second NEEAP, for methodic reasons the strictly sectoral structure from the First NEEAP was not used, and instead a structure was chosen which was partly sectoral and partly application-oriented. The objective was a more pronounced focus on areas for action such as buildings and installations, in order to be able to better take into account the stronger technical application-based orientation of the proposed formulae for calculation towards the individual groups of measures (bottom-up). Top-down indicators and bottom-up measures were therefore allocated to the following areas of application:

- Buildings and installations
- Appliances and lighting
- Trade and industry
- Transport and mobility
- Cross-section
- Public sector (in the framework of its exemplary role)

Correspondingly, Section 4 below is structured as follows: In the first section a general overview is given of the energy savings calculated by means of top-down and bottom-up methods, and then the corresponding savings are shown in the individual sectors or areas for action. In each case, the savings from the top-down calculations are shown first of all, followed by the savings from individual instruments or programmes from the bottom-up calculations. The savings identified by means of bottom-up calculations are shown in a table with five columns. The first column contains the savings from early programmes and measures (i.e. up to 2007, early action). The saving shown is the difference between the specific consumption coefficient of the new technology and the specific consumption coefficient of the market average in 1995 or the last valid regulatory standard before 1995. In the next three columns the savings from all the programmes and measures implemented after 2007 are shown. The year 2007 is taken as a baseline for the savings. In the fifth and last column the total savings between 1995 and 2016 are shown. As a rule this represents the total savings from the early action and the implementation phase (2008-2016) of the ESD.[16] The calculation of the energy savings of the ESD up to the target year 2016 is based on exante estimates. In addition to this bottom-up summary table the individual quantified measures are each described in detail in measures sheets. Finally, in addition, in each area for action further relevant measures and projects which are similarly likely to have led in some cases to considerable energy savings are qualitatively mapped, though it is not possible to quantify these energy savings in detail.

The quantitative and qualitative measures shown in the individual areas for action are allocated to the various types of measure, for example “regulatory law”, “fiscal”, “funding”, “self-imposed commitment”, “training and education”, or “information, motivation, communication”.

16 Deviations from this result in the bottom-up calculations with the following measures: With the EnVKV the total is lower due to the lifetime approach referred to above. With the Ecological Tax Reform and mission E, which among other things focus on measures causing behavioural change, annual effects were calculated. With the environmental tax and the heavy goods vehicle toll, due to the approach selected of using price elasticities as the basis for calculation for quantifying the energy savings, annual effects are stated. The stated total value (1995–2016) is the overall effect remaining in 2016 based on the respective measures – with price inflation as assumed in the 2007 energy scenarios (EMI/Prognos 2007).

4. Energy efficiency and energy savings in Germany

4.1 General summary of the energy savings for verification of the indicative energy savings target

4.1.1 Summary and overview

The indicative energy savings target applicable to Germany is 748 PJ. This figure is based on a conversion factor for electricity of 1.0. In order similarly to gain insights into primary energy consumption and primary energy savings in Germany, in addition an indicative energy savings target was calculated with a conversion factor for electricity of 2.5. For Germany this figure is 995 PJ.

In Germany, both the indicative energy savings target with a conversion factor for electricity of 1 and the target with a conversion factor for electricity of 2.5 are greatly exceeded by the calculated energy savings. The same applies to the interim target for 2010. Calculation of the savings in the top-down and in the bottom-up area produce the following picture:

Top-down calculations:

- In Germany energy savings totalling 2479 PJ (with an indicative energy savings target of 748 PJ) can be achieved by 2016. Calculations with a conversion factor for electricity of 2.5 result in savings to the value of 3,123 PJ (with an indicative energy savings target of 995 PJ).
- Based on assessment of the top-down indicators the energy savings for Germany between 2008 and 2016 are 1,418 PJ. For the early action period (1995 – 2007) savings to the value of 1,061 PJ were calculated.
- The calculated savings are higher than the indicative energy savings target (748 PJ) for Germany by a factor of 3.3. This corresponds to an energy saving of 29.8% for the total period under review and an energy saving of 17.1% for the period 2008-2016. It should be taken into account that arithmetical values are involved here. These are not only attributable to policy-induced instruments and programmes, but also to predominantly market-induced technical progress (cf. the observations in Section 3.3 and in the Methodological Accompanying Document to the Second NEEAP).
- The 2010 intermediate target for Germany is 456 PJ with a conversion factor for electricity of 1 (607 PJ with a conversion factor for electricity of 2.5) and is greatly exceeded with a saving of 1,812 PJ in total, or even just taking the period 2008–2010 (751 PJ).

Bottom-up calculations:

- The energy savings that were determined using bottom-up methods for the individual areas for action for 2016, and taking into account the lifetime approach are still effective there, amount to 819 PJ. Of these just 460 PJ of savings were initiated in the period 1995–2007. More than 60% of these savings can be attributed to activities in the buildings and installations area for action. This confirms the effectiveness of political instruments and programmes in this area, in particular where – as in Germany – they are introduced and implemented at an early stage.
- In terms of cross-sectoral instruments a further important contribution is provided by the implementation of the Ecological Tax Reform. Even for 2007 this measure results in an arithmetical saving of 103 PJ. That is more than a fifth of all the bottom-up savings calculated for this point in time. Since 2003 no further tax increases have taken place in the framework of the Environmental Tax Reform. The price stimulus therefore weakens by 2016, but still has an accounting impact of 96 PJ. In 2016 this still corresponds to an eighth of all savings accounted for by bottom-up methods.
- Approximately a third of all top-down savings totalling 2,479 PJ can be covered by means of bottom-up methods. However, the cover in the trade and industry area for action (more or less corresponds to the industry, trade, retail and services sectors – TRS) and in the transport and mobility area for action (corresponds to the transport sector) is not as high. This is also an indication that in these sectors many savings are market driven and therefore due to technical progress. It should be taken into account that ultimately political instruments and programmes cannot be viewed in isolation from technical progress. By contrast, political instruments constitute an important driver of technical progress in all areas for action. Without appropriate political measures and the creation of

a suitable regulatory framework technical progress could be expected to slow down.

→ In calculation of the savings with a conversion factor for electricity of 2.5 we obtain, with slight fluctuations in respect of the importance of the contributions of individual areas, a very similar overall picture (cf. Table 4.1.2. and the extensive descriptions on this in the Methodological Accompanying Document to the Second NEEAP).

4.1.2 Top-down: trend

Table 4.1.2. shows Germany's total energy savings calculated with the top-down method. With a conversion factor for electricity of 1.0 (2,479 PJ compared to an indicative energy savings target of 748 PJ) and a conversion factor for electricity of 2.5 (3,123 PJ compared to an indicative energy savings target of 995 PJ) Germany exceeds the requirements of the ESD by a wide margin.

In the early action period, which lasted until 2007, top-down energy savings were achieved in all consumption sectors. The highest savings contributions were recorded in the industry and transport sectors. In total these savings alone are well in excess of the national indicative energy savings target.

Considerable additional top-down savings can be expected between now and 2016. It should be taken into account that these ex ante calculations from 2010 (for many indicators, due to a lack of data availability, from 2009) are based on estimated figures and do not constitute forecasts by the federal government on the development of energy efficiency in Germany up to 2016. The interim target for 2010 of 456 PJ (conversion factor for electricity 1) and 607 PJ (conversion factor for electricity 2.5) would be achieved based on these calculations without even taking into account early action. The same applies to the national indicative energy savings target in 2016.

Table 4.1.2 Overview of total top-down savings in the various sectors[18] at conversion factor for electricity 1 and conversion factor for electricity 2.5

Energy saving		2007	2010	2013	2016	Total
Unit				PJ/a		
Top-down		vs. 1995	vs. 2007			vs. 1995
Total	**Conversion factor for electricity 1**	**1061**	**751**	**1113**	**1418**	**2479**
	Conversion factor for electricity 2.5	**1304**	**936**	**1413**	**1819**	**3123**
Private households	Conversion factor for electricity 1	238	404	539	671	909
	Conversion factor for electricity 2.5	332	482	652	820	1152
TRS[17]	Conversion factor for electricity 1	73	153	210	228	301
	Conversion factor for electricity 2.5	70	196	270	298	368
Industry	Conversion factor for electricity 1	334	100	159	205	539
	Conversion factor for electricity 2.5	436	155	268	363	799
Transport	Conversion factor for electricity 1	416	94	205	314	730
	Conversion factor for electricity 2.5	466	103	223	338	804

17 The savings described for the TRS sector also include savings of 47 PJ that were achieved in the public sector.

18 In the following sections the top-down calculations are shown on the basis of areas for action. In summary table 4.1.2. this method of presentation was not possible, as the top-down indicators are not always available in the corresponding differentiation according to area for action. Therefore the classical sectoral classification is chosen for the general summary.

4.1.3 Bottom-up: quantified measures

Table 4.1.3. shows Germany's total energy savings calculated with the bottom-up methods. The bottom-up savings up to 2016 add up to 819 PJ (conversion factor for electricity 1). Based on a conversion factor for electricity of 2.5 a figure of 1,011 PJ is achieved.

The energy savings achieved highlight the intensive efforts by the federal government to increase energy efficiency in Germany. By means of the bottom-up evaluation of individual state-funded measures alone energy savings were accounted for which exceed the indicative energy savings target both for conversion factor for electricity 1 and for conversion factor for electricity 2.5. The numerous activities at federal state and municipal level and by private actors are either barely taken into account or are not accounted for at all. In particular the instruments and programmes in the buildings sector make a considerable contribution (significantly in excess of half) to the identified savings. Regulatory measures such as the introduction of the Energy Saving Ordinance (EnEV) and its amendments (EnEV 2002 and EnEV 2009) and funding measures, in particular the KfW programmes in the buildings sector (CO_2 Building Redevelopment Programme), totalling 248 PJ account for more than half the early energy savings of 460 PJ in the early action period (1995–2007). A further important instrument among the early measures is the Ecological Tax Reform, which functions as a cross-sectoral instrument throughout all the areas for action.

Table 4.1.3 Overview of the bottom-up savings of selected measures at conversion factor for electricity 1 and 2.5

Energy saving (conversion factor for electricity = 1 and 2.5)[19]		**2007**	**2010**	**2013**	**2016**	**Total**
Unit				PJ/a		
Bottom-up		1995-2007	2008-2010	2008-2013	2008-2016	1995-2016
Total	**Conversion factor for electricity 1**	**1061**	**751**	**1113**	**1418**	**2479**
	Conversion factor for electricity 2.5	**1304**	**936**	**1413**	**1819**	**3123**
Buildings and installations	Conversion factor for electricity 1	247.7	75.5	162.5	251.0	498.7
	Conversion factor for electricity 2.5	278.2	84.6	182.3	281.7	559.7
Appliances and lighting	Conversion factor for electricity 1	8.2	5.2	24.6	44.0	49.8
	Conversion factor for electricity 2.5	19.4	12.5	60.3	108.3	121.9
Public sector	Conversion factor for electricity 1	1.1	9.1	14.3	16.4	17.2
	Conversion factor for electricity 2.5	1.4	11.2	17.3	20.2	21.5
Trade and industry	Conversion factor for electricity 1	40.4	2.9	15.0	27.1	67.5
	Conversion factor for electricity 2.5	53.6	-0.8	19.1	39.2	92.9
Transport and mobility	Conversion factor for electricity 1	59.4	16.8	25.8	34.6	89.2
	Conversion factor for electricity 2.5	62.6	17.7	27.5	37.0	94.9
Cross-section	Conversion factor for electricity 1	103.2	89.1	89.4	89.5	96.3
	Conversion factor for electricity 2.5	129.6	110.6	110.9	111.0	120.3

19 Due to taking into account the lifetimes the total amount can differ as a result of addition of the savings from the early action and the implementation phases (2008-2016) of the EEE-ESD. See footnote 15 for explanation.

20 These totals are based on addition of the identified total savings per area of application. Due to rounding errors slight but insignificant deviations from the total of all individual measures are possible.

We should also like to point out at this juncture that the federal government views these positive findings as vindication of its existing efficiency policy. They form an important basis for designing further measures for the achievement of the significantly more ambitious objectives of the energy concept.

4.2 Energy savings in buildings (residential and non-residential buildings) and installations

On the one hand we set out in the following section the savings achieved and expected in residential and non-residential buildings and in building services installations for achievement of the indicative energy savings target under the ESD.

On the other hand the overviews in sections 4.2.3. and 4.2.4. also relate to fulfilment of the commitment under Art. 10, Para. 2, Sub-paragraph 1 of the revised version of the Buildings Directive. On this basis the Member States are obliged to draw up a directory of the existing and, where applicable, planned measures and instruments which are not prescribed by the above Directive but which help achieve its objectives. The measures in question are highlighted in the following overviews by means of a corresponding reference at the right-hand edge of the measures headings.

4.2.1 Summary and overview

Top-down calculations:

- Based on the long-term trend the total savings for the buildings and installations sector in the period 1995-2016 amount to 775 PJ.[21]
- The savings expected in the buildings sector for the commitment period 2008-2016 add up to 610 PJ based on evaluation of the top-down indicators.
- The savings in the buildings sector already achieved in the early action period add up to 164 PJ based on evaluation of the top-down indicators. Additional consumption in the water heating area is also taken into account in this period.

Bottom-up calculations:

- In the evaluation of individual instruments, in the buildings and installations sector significantly more than the total ESD requirement of a third of the indicative energy savings target to be achieved can be verified by means of bottom-up methods. For the commitment period this figure is 251 PJ; energy savings of 248 PJ were already initiated in the early action period.
- According to this evaluation the most effective instruments for buildings prove to be the EnEV with its 2002 and 2009 amendments and its predecessors – the Thermal Insulation Ordinance and the CO2 Building Redevelopment Programme (KfW funding programmes for energy-efficient construction and redevelopment).
- In the installations sector the BAFA component of the Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP) proves to be the most important instrument, also in respect of its effects in terms of reducing energy consumption, with a saving[22] of just under 40 PJ.

4.2.2 Top-down: trend

Table 4.2.2. shows the energy savings in buildings and installations calculated by means of the top-down methods. The trend indicates a sharp increase in savings compared to the base year 2007, so according to the current forecasts 610 PJ of savings are generated up to 2016 based on top-down calculations. On the basis of the savings of 164 PJ from the 1995-2007 early action period there are 775 PJ of savings in the buildings sector, and these can exclusively be attributed to efficiency gains in heating of buildings. However, also in water heating the figures in the period under review 2008-2016, after negative movement in the early action period, reflect a positive trend.

21 In this and the following sections on the individual areas of application the savings are always shown taking into account power coefficient 1. For all areas of application the savings taking into account power coefficient 2.5 can be found in the Methodological Accompanying Document to the Second NEEAP.

22 Only heat pumps and solar energy installations were taken into account from the market incentive programme. Biomass heating systems were not included in the calculation.

Table 4.2.2 Overview of total top-down savings in buildings and installations at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit		PJ/a (conversion factor for electricity 1)			
Top-down	vs. 1995	vs. 2007			vs. 1995
Total heating of buildings and water heating	**164.3**	**380.5**	**496.5**	**610.4**	**774.7**
Heating of buildings	230.6	329.7	443.8	554.3	784.9
Water heating	-66.3	50.8	52.7	56.1	-10.2

4.2.3. Bottom-up: quantified measures

Table 4.2.3 Overview of the bottom-up savings of selected measures for buildings and installations at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit		PJ/a (conversion factor for electricity 1)			
Bottom-up – quantified	1995-2007	2008-2010	2008-2013	2008-2016	1995-2016
Total buildings and installations	**247.7**	**75.5**	**162.5**	**251.0**	**498.7**
Energy Saving Ordinance (non-residential buildings)	63.2	8.8	21.9	35.1	98.3
Energy Saving Ordinance (residential buildings)	127.9	27.2	66.9	108.1	236.1
KfW CO_2 Building Redevelopment Programme	16.6	6.9	6.9	6.9	23.4
KfW CO_2 Reduction	13.9	–	–	–	13.9
KfW Energy-efficient Redevelopment	–	13.0	32.5	52.0	52.0
KfW Energy-efficient Redevelopment	8.3	4.4	4.4	4.4	12.7
KfW Housing Modernisation Programme 2003	1.2	–	–	–	1.2
KfW Housing Modernisation Programme II	4.2	–	–	–	4.2
KfW Energy-efficient Construction	–	1.7	4.3	6.9	6.9
KfW Energy-efficient Construction	0.8	0.7	0.7	0.7	1.5
BAFA On-site Consultation	0.5	0.6	1.2	1.8	2.3
Market Incentive Programme (MAP) – BAFA component	9.9	10.4	20.2	30.0	39.9
Market Incentive Programme (MAP) – KfW component	0.01	0.04	0.07	0.1	0.1
Federal states' activities in the buildings sector	1.2	1.8	3.4	5.0	6.2

Table 4.2.3. shows the energy savings in buildings and installations calculated by means of bottom-up methods. With a total of 499 PJ the instruments evaluated by means of bottom-up methods cover significantly more than a third of the savings identified by means of top-down methods. This result underlines the importance of the state-funded instruments listed in Table 4.2.3. for the total savings and emphasises in particular the importance of the Energy Saving Ordinance (with a total of well in excess of 50 % of the savings deter-

mined by means of bottom-up methods), of the Market Incentive Programme (including efficient heat pumps and solar energy installations), and of certain KfW programmes. The measures listed in the summary table are described individually below.

M 01: Energy Saving Ordinance (residential buildings)			
Regulatory law	Start: 2002	End: not planned	Tightening-up 2009 and 2012 (planned)
Description	The Energy Saving Ordinance (EnEV) – like the Heating Systems Ordinance (1998) and Thermal Insulation Ordinance (1978) it replaced in 2002 – makes minimum requirements in terms of the energy quality of cladding and of systems engineering in new buildings and in major redevelopment work on existing buildings. Planned buildings must not exceed the annual primary energy requirement of a corresponding reference building and must be executed such that the cladding and the systems engineering comply with prescribed minimum standards. Where changes are made to existing buildings the affected component must meet minimum energy requirements. At the latest amendment in 2009 the minimum energy requirements were tightened up by an average of 30%. A further amendment to the EnEV is planned for 2012. The basis for authorisation of the EnEV is the Energy Savings Act (EnEG) of 1976, last amended in 2009.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **236.1 PJ**	127.9 PJ	27.2 PJ	108.1 PJ
Reference	*Federal Statistical Office (FS5, R1 [2002–2009], FS5 R1-Z2006); Prognos AG model; techem AG 2009; ZUB (Centre for Environmentally Conscious Construction) 2006; Prognos/IER (Institute of Energy Management and Rational Energy Use) 2004; IWU (Institute of Housing and the Environment)/ifeu (Institute of Energy and Environmental Research) 2005*		

M 02: Energy Saving Ordinance (non-residential buildings)			
Regulatory law	Start: 2002	End: not planned	Tightening-up 2009 and 2012 (planned)
Description	Minimum requirements in respect of the energy quality of the cladding and the systems engineering in planned and existing non-residential buildings on which major renovation is being carried out are prescribed with binding force by the Energy Saving Ordinance (EnEV) (see Energy Saving Ordinance [residential buildings] above). Calculation of the primary energy requirement of non-residential buildings is based on the method of calculation pursuant to DIN V 18599.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **98.3 PJ**	63.2 PJ	8.8 PJ	35.1 PJ
Reference	*Prognos et al. 2010a; Fraunhofer ISI et al. 2009; Federal Statistical Office (FS5, R1 [2002–2009]); BMVBS 2010; Prognos model*		

M 03: KfW Energy-efficient Redevelopment		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding	Start: 2009	End: not determined	
Description	The programme involves the funding of building stock redevelopment in which the prevailing building standard is exceeded (KfW efficient building standards 55, 70, 85, 100 and 115) and of individual measures which meet fixed minimum requirements. The funding is carried out by means of an investment subsidy or alternatively in the form of low-interest loans. Depending on the KfW efficient building standard achieved the subsidy is up to €13,125 per residential unit. With individual measures the subsidy is up to €2,500 per residential unit.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **52.0 PJ**	–	13.0 PJ	52.0 PJ
Reference	*KfW 2010; BMVBS/Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) 2009*		

M 04: KfW CO_2 Building Redevelopment Programme		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding	Start: 2001	End: 2009	
Description	Assistance for energy-efficient redevelopment of building stock units with low-interest loans. The programme is a component of the National Climate Protection Programme and of the Growth and Employment Programme. From 2007 onwards, under certain conditions direct subsidies were awarded as an alternative to the low-interest loans. A condition of the assistance was the carrying out of several individual measures (so-called packages of measures), with minimum technical requirements being made in some cases. Continuation of the programme as KfW Energy-Efficient Redevelopment Programme (see M 03).		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **23.4 PJ**	16.6 PJ	6.9 PJ	6.9 PJ
Reference	*KfW 2010; BEI et al. 2007-2009; BMVBS/BBSR 2009*		

M 05: KfW CO_2 reduction			Measure within the meaning of Art. 10, ara. 2 of the Buildings Directive	
Funding		Start: 1999	End: 2004	
Description		In the framework of the programme long-term low-interest loans were extended for individual energy-saving measures for existing residential buildings (thermal insulation, updating of heating, windows, etc.). In addition to this use of renewable energy sources for new residential buildings and the construction or purchase of energy-saving houses were promoted.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**13.9 PJ**	13.9 PJ	–	–
Reference		*Prognos/GWS 2009*		

M 06: KfW Housing Modernisation Programme – Eco Plus (CO_2 Building Redevelopment Programme)			Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding		Start: 2005	End: 2009	
Description		Between 2005 and March 2009 the "Housing Modernisation Programme" subsidised individual measures in the buildings sector with long-term low-interest loans: replacement of windows, thermal insulation, updating of heating on the basis of renewable energies, combined heat and power generation or local/district heating. Continuation of the programme as a component of the KfW Energy-efficient Redevelopment Programme (see M 03).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**12.7 PJ**	8.3 PJ	4.4 PJ	4.4 PJ
Reference		*KfW 2010; BBSR 2007*		

M 07: KfW Housing Modernisation Programme II			Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding		Start: 2000	End: 2002	
Description		Funding of modernisation of residential units in building stock units up to year of construction 1948, listed buildings and buildings with a minimum of nine storeys with year of construction after 1948; upgrading with elevators of buildings with a minimum of five storeys and industrial residential property construction buildings without previous modernisation/restoration funding. Of the total lending amount about 15 % was attributable to energy-saving measures in the period under review.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**4.2 PJ**	4.2 PJ	–	–
Reference		*Prognos/GWS 2009*		

M 08: KfW Housing Modernisation Programme 2003		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2003	End: 2004	
Description		Funding of modernisation of residential units in building stock units up to year of construction 1948, listed buildings and buildings with a minimum of nine storeys with year of construction after 1948; upgrading with elevators of buildings with a minimum of five storeys and industrial residential property construction buildings without previous modernisation/restoration funding. Of the total lending amount about 15 % was attributable to energy-saving measures in the period under review.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**1.2 PJ**	1.2 PJ	–	–
Reference		*Prognos/GWS 2009*		

M 09: KfW Energy-efficient Construction		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2009	End: not determined	
Description		Funding of new buildings which exceed the prevailing building standard: KfW energy-efficient building 70, 55, 40 and low-energy building standard. Financing is provided to a maximum of €50,000 per residential unit, to a maximum of 100% of the eligible costs. Continuation of the KfW Ecological Construction Programme (see M 10).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**6.9 PJ**	–	1.7 PJ	6.9 PJ
Reference		*KfW 2010; Federal Statistical Office (FS5, R1-Z2006); Prognos model; techem 2009*		

M 10: KfW Ecological Construction		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2005	End: 2009	
Description		Funding of new buildings which exceed the prevailing building standard: KfW energy-saving building 60, 40 and low-energy building standard. Financing is provided to a maximum of €50,000 per residential unit, to a maximum of 100% of the eligible costs. Continuation from April 2009 as KfW Energy-efficient Construction Programme (see M 09).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**1.5 PJ**	0.8 PJ	0.7 PJ	0.7 PJ
Reference		*KfW 2010; Federal Statistical Office (FS5, R1-Z2006); Prognos model; techem 2009*		

M 11: Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP) – BAFA component		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 1999	End: not determined	
Description		The objective of the programme is to boost the sale of renewable energy technologies by means of investment incentives and to improve their efficiency. The funding takes the form of a subsidy provided by BAFA. Among other things efficient heat pumps and solar energy installations are subsidised. The simultaneous construction of a solar energy installation and a heat pump is subsidised by means of a combination bonus. Since 2010 the funding has almost exclusively been aimed at the building stock.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**39.9 PJ**	9.9 PJ	10.4 PJ	30.0 PJ
Reference		*BAFA 2010; German Aerospace Center (DLR) et al. 2009*		

M 12: Market Incentive Programme for Promotion of the Use of Renewable Energies (MAP) – KfW component		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2007	End: not determined	
Description		The objective of the programme is to boost the sale of renewable energy technologies by means of investment incentives and to improve their efficiency. Funding takes place by means of low-interest loans and repayment subsidies on the part of KfW (programme component “Premium”). Among other things large solar energy installations are subsidised (>40 m² gross collector surface).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**0.1 PJ**	0.01 PJ	0.04 PJ	0.11 PJ
Reference		*KfW 2010; Centre for Solar Energy and Hydrogen Research (ZSW) 2008-2010*		

M 13: Federal states' activities in the buildings sector		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 1995	End:	
Description		→ Bavarian modernisation programme (Bavaria); → Major modernisation programme – Programme B, (Hamburg); → Climate protection programme plus component funding – Programme A (Hamburg); → Thermal insulation in the building stock (Hamburg); → State programme for housing funding, modernisation/restoration (Mecklenburg-Western Pomerania); → Funding of subsidised housing (Lower Saxony, North-Rhine Westphalia, Rhineland-Palatinate); → Schleswig-Holstein fund: energy-optimised building redevelopment (Schleswig-Holstein); → progres.nrw, market launch (North-Rhine Westphalia); → Climate Protection Plus Programme, General CO_2 Reduction Programme (Baden-Württemberg)		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**6.2 PJ**	1.2 PJ	1.8 PJ	5.0 PJ
Reference		*Prognos/German Institute of Urban Affairs (DIFU) 2011*		

M 14: BAFA On-site Consultation		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Information, motivation, communication		Start: 1998	End: not determined	
Description		Funding is provided for an on-site consultation by accredited energy advisors dealing comprehensively with structural thermal insulation as well as heat generation and distribution including water heating and use of renewable energies. Additional funding has been available since October 2009 if the consultation is supplemented by means of recommendations for saving electricity, thermographic surveys, or airtightness inspections pursuant to DIN 13829 (so-called blower-door tests). The funding is granted as a part-financing package in the form of a non-repayable contribution which is paid to the applicant consultant. This is approved as project funding.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**2.3 PJ**	0.5 PJ	0.6 PJ	1.8 PJ
Reference		*ifeu/emnid (opinion poll research institute) 2008*		

4.2.4 Further measures and projects

M 15: Energy certificate	
Type of measure: regulatory law	Term: since 1995
Since 1995, every owner of a new building has been obliged in principle to issue an energy certificate. In addition to this, since 1 January and 1 July 2009 respectively, the seller, landlord or lessor is obliged to make an energy performance certificate available to interested parties in the event of sale, letting or leasing, and at the latest on demand. Among other things the performance certificate contains information on the year of construction, use of the building, usable surface area, type of heating, water heating, and type and percentage of renewable energies. In addition the energy certificate contains recommendations for modernisation, where a building has economically viable potential for energy savings. Two types of energy certificate are available: the needs-oriented performance certificate is issued on the basis of the calculated energy requirement, while the consumption-oriented performance certificate is based on the recorded energy consumption. In principle both types of energy certificate are permissible, but only the requirement certificate for new buildings. The legal basis for issue and utilisation of the energy certificate was formerly the Thermal Insulation Ordinance (1977), though since 2002 it has been the Energy Saving Ordinance. The period of validity of each performance certificate is 10 years.	
Further information: *www.bmwi.de*, *www.bmvbs.de*, *www.zukunft-haus.info*	

M 16: Law on the promotion of renewable energies in the heating sector	
Type of measure: regulatory law	Term: since 2009
The Renewable Energies Heating Act (EEWärmeG) is designed to increase use of renewable energies in the heating and cooling sector in respect of supply of energy to buildings. It requires utilisation of renewable energies, including solar energy installations or heat pumps, in construction of new buildings (so-called obligatory usage under Section 3, Para. 1 of the Renewable Energies Heating Act [EEWärmeG]). Compensatory measures such as utilisation of waste heat or improvement of thermal insulation may also be carried out. The objective is to increase energy efficiency.	
Further information: *www.bmwi.de*, *www.bmvbs.de*, *www.zukunft-haus.info*	

M 17: Heating Costs Ordinance	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: regulatory law	Term: since 1981
The purpose of the Heating Costs Ordinance, which is based on the Energy Savings Act (EnEG), is the creation of incentives to encourage economical use of energy by means of consumption-based metering and billing of heating and water heating usage. With the coming into force of the revised version of the Ordinance on 1 January 2009 the consumption-based component of the billing of heating costs increased to 70 % for certain buildings. This should create additional incentives for energy-saving and thus also for reduction of CO_2 emissions in the buildings sector. In addition building owners are obliged to record, for connected heating systems by 1 January 2014 at the latest, the percentage of energy consumption accounted for by water heating, in principle by means of a heat meter. In addition the provisions of the Heating Costs Ordinance create an incentive to comply with the so-called low-energy building standard (thermal heat requirement of less than 15 kWh/m²) in the construction or redevelopment of apartment buildings.	
Further information: *www.bmwi.de*, *www.bmvbs.de*	

M 18: Ordinance on small and medium-sized firing installations	
Type of measure: regulatory law	Term: since 1988
The Federal Immission Protection Act (BImSchG) is the German law on protection against harmful environmental effects from air pollutants, noise, shocks or vibration, or similar phenomena. An energy-saving effect is produced among other things due to its extensive approval requirements in respect of installations, such as the stipulation of a degree of firing efficiency. The concrete technical standards have been enacted in a total of 39 implementing orders. Of particular relevance, among others, is the First Ordinance on small and medium-sized firing installations (1. BImSchV). This is intended to guarantee a significant reduction in particulate matter emissions from small firing installations. To counteract further increases in pollution and to reduce the existing high level of pollution, the emissions from firing installations within the scope of application of the First Federal Immission Protection Ordinance (1. BImSchV) must be reduced on a sustainable basis over the long term. This leads to a situation in which where new installations are required a new generation of firing installations is used and based on the statutory provisions for installations already in existence corresponding regulations have been made in respect of renovation. The last amendment to 1. BlmSchV was made in 2009, and the resulting new requirements have been in force since March 2010.	
Further information: *www.bmu.de*	

M 19: Low-energy building in the building stock	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: promotion	Term: since 2003
The “low-energy building in the building stock” pilot projects of the German Energy Agency on behalf of the German Federal Ministry of Transport, Building and Urban Development (BMVBS) for residential- and non-residential buildings are targeted with the help of planning aids, public relations work, guides and brochures at specialist designers, architects, craftsmen and construction project sponsors. The aim is to speed up transfer of knowledge about construction of low-energy buildings, to establish exacting energy-efficient redevelopment standards on the market, and to advertise, develop and launch on the market innovative technologies related to energy-efficient building redevelopment. The aim is to encourage imitation by means of transferable, economically viable redevelopment recommendations and examples. The residential property construction companies carry out their restructuring measures themselves. A bandwagon effect in energy-efficient redevelopment is observable and efficient building standards have been established in the market. More than 350 residential buildings and over 90 non-residential buildings have demonstrated that energy-saving construction methods can significantly reduce the energy requirement. A total of 6,300 residential units with about 350,000 m² of floor space were optimised for energy efficiency in the course of the project. On average the latter undercut the energy consumption requirements of comparable new buildings by 62 %.	
Further information: *www.zukunft-haus.info*, *www.bmvbs.de*	

M 20: Eco allowances within the framework of the homeowner allowance	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: funding	Term: 1995-2002
The eco allowance was aimed at construction project sponsors and owner-occupied property holders. Under the Homeowner Allowance Act (EigZulG) subsidies were awarded in addition to the homeowner allowance for the inclusion of installations using renewable energies for the heating of buildings, water heating or power production, for example solar heating systems, heat pumps and heat recovery systems in buildings. Additional subsidies were available for low-energy buildings. The objective was reduction of energy consumption to below current standards in new residential buildings. The eco allowance was introduced by the federal government in the framework of the 1995 homeowner allowance. With the coming into effect of the Energy Saving Ordinance on 1 January 2002 the homeowner allowance expired. Besides the systems engineering funding selected thermal insulation measures were also subsidised. Funding of low-energy buildings in particular was successful. Due to the economic incentive effect of the eco allowance the subsidised volume increased over the course of the term. The eco allowance therefore proved its value as an essentially suitable funding concept.	
Further information: *www.bbsr.bund.de*	

M 21: Energy hotline and internet platform	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2001
The free energy hotline and an internet platform of the German Energy Agency is designed to provide consumers and specialist agents with clear and immediately understandable information on forms of energy production, efficient energy use and renewable energies. Besides provision of general information, the focal point is concrete proposals for action and practical assistance. The ultimate objective is targeted referrals to further sources and information as well as consultations and funding. There is heavy demand for information on the subject of energy. In 2010 alone there were more than 2,600 written enquiries and approximately 9,700 telephone enquiries.	
Further information: *www.thema-energie.de*	

M 22: Energy saving guidelines	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2000
The energy saving guidelines drawn up by the federal government and the federal states for areas of application such as buildings, energy efficiency, energy management, mobility, procurement and financing are aimed at private households, private enterprise and the public sector. The guidelines are designed to motivate the respective target group and provide information about how to increase energy efficiency. The guidelines thus contribute to creating awareness and changing user behaviour and act as a springboard for energy efficiency investments. The information on energy-efficient technologies, financing and procurement options together with special subject areas and pragmatic approaches to finding ways of exploiting energy efficiency potential are being well received by all sectors. For example, the guidelines are leading to support for the execution of concrete contracting projects and the implementation of other energy efficiency measures in the municipal sector.	
Further information: *federal government and state ministries and regional energy agencies*	

M 23: Energy Efficiency Initiative	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2002
With the support of intensive public relations work such as provision of information brochures and internet services, the German Energy Agency's Energy Efficiency Initiative is essentially targeted at about 40 million private households, trade and industry, and service providers. The aim is to direct the attention and awareness of consumers in all areas of application of electricity to the issue of efficient use. The objective is to increase awareness for and the popularity of energy-efficient techniques for using electricity. In the results of the representative opinion surveys which have been carried out by the forsa research institution since 2003 alongside the project we are increasingly seeing positive changes in the attitude and behaviour of consumers in key subject areas communicated by the sub-campaigns. For example, by their own admission 61 % of the households surveyed took measures to save electricity in 2009. The initiative has succeeded in gaining the support of a strong network of agents, such as retail sales outlets and energy utilities, as active campaign partners.	
Further information: *www.initiative-energieeffizienz.de*	

M 24: "future of housing" campaign	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2002
The German Energy Agency's "future of housing" motivation and information campaign is targeted – by means of press and public relations work, internet services, trade show appearances and the national "future of housing" congress – at house owners, tenants, engineers, architects as well as the construction sector, municipalities and residential property companies. The aim is to inform and motivate consumers, persons and companies involved in construction, industry, and the public sector about energy-efficient construction. The purpose is to establish products and services which make energy-efficient construction and redevelopment simple, reliable and affordable. In cooperation with the BMVBS the German Energy Agency initiates and manages projects concerned with the development of energy efficiency potential in the buildings sector. Under the "future of housing" umbrella brand a large number of projects for the improvement of energy efficiency in buildings are being carried out – from the development and launch of the "efficient building" seal of quality for residential buildings through national pilot projects, in which model buildings are redeveloped on an energy-efficient basis, to consumer information. Significant progress has been made in the market in promoting the relevance of the subject of energy efficiency in the buildings sector.	
Further information: *www.zukunft-haus.info*	

M 25: Municipal and national heating schedules	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: 2008-2011
Heating schedules and heating assessments in the framework of the federal government's Climate Protection Initiative motivate agents to carry out heat-engineering improvement measures in the buildings sector. The 40,000 heating assessments and accompanying information campaigns applied for from co2online could allow the avoidance of 160,000 tonnes of CO_2 per year (4 tonnes per expert report), or 3.2 million tonnes based on the lifetime of the components, and could generate additional sales of €860m and 12,000 man-years employment in the construction trade. The avoidance costs amount to about €1.50 per tonne of CO_2. Between 2008 and 2010 45 municipal heating schedules with comparison charts for heating energy consumption and heating costs were drawn up in cooperation with municipal agents for each municipality and individual year, as was an annual nationwide heating schedule for smaller municipalities and 40,000 written heating schedules for tenants and owners. Regular project monitoring and an overall evaluation were similarly carried out.	
Further information: *www.heizspiegel.de, www.bmu-klimaschutzinitiative.de*	

M 26: Heat from renewable energies	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2006
The German Energy Agency's "heat from renewable energies" project uses intensive public relations work, information brochures and internet services to target property-owners, tenants, energy advisors and other technical experts. The aim is to enlighten the relevant market participants about the use of renewable energies in the buildings sector and to provide extensive information. The project was initiated by the German Energy Agency with support from the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) as a follow-up project to the "Solar Heat Plus Initiative" in 2006 and provides a basis for planning together with information in respect of funding options and the relevant regulatory framework. These services are designed to increase motivation to use renewable energies and boost their acceptance. By means of competitions for property owners like "More value – heat from renewable energies" and "Germany's most beautiful efficient buildings. Energy from wood-earth-sun" numerous detailed practical examples have been presented to a wide audience. A communication campaign on the market incentive programme and on the EEWärmeG similarly contributed to increasing demand for renewable energies. This also results in growth in energy efficiency.	
Further information: *www.dena.de*	

4.3 Energy savings with appliances and lighting

4.3.1 Summary and overview

Top-down calculations:

- → Based on the long-term trend the total savings for the appliances and lighting sector work out at 134 PJ. Appliances account for the bulk of the savings.
- → According to an evaluation of the preferred top-down indicators the savings expected in the appliances and lighting sector in the 2008–2016 commitment period add up to 61 PJ.
- → Based on evaluation of the preferred top-down indicators the savings already achieved in the early action period in the appliances and lighting sector come to 74 PJ. A small amount of additional consumption in lighting is taken into account.

Bottom-up calculations:

- → In the evaluation of individual instruments significantly more than a third of the savings calculated for appliances and lighting by means of top-down indicators can also be accounted for using bottom-up methods. For the commitment period this figure is 44 PJ; energy savings of 8 PJ were already initiated in the early action period.
- → According to this evaluation the most effective instruments prove to be the Energy-using Products Act (EBPG) and the Energy Consumption Labelling Ordinance (EnVKV).

4.3.2 Top-down: trend

Table 4.3.2. shows the energy savings with appliances and lighting calculated by means of the top-down methods. The appliances sector typically includes air conditioning and electrical household appliances. However, based on the current data situation for Germany it is not possible to calculate an energy efficiency indicator for air conditioning, so the savings figures determined reflect the situation with respect to electrical household appliances. Compared to the base year 2007 the trend with appliances and lighting indicates a moderate increase in the overall savings, so according to the current forecasts a total of 61 PJ of savings are generated up to 2016 using top-down calculations. On the basis of the somewhat higher savings of 74 PJ from the 1995–2007 early action period a total of 134 PJ of energy savings can be reported for the appliances and lighting sector. The main driver here is the appliances sector, which with a saving of 116 PJ accounts for more than 85% of the total savings.

Table 4.3.2 Overview of total top-down savings in the appliances and lighting sector at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit		PJ/a (conversion factor for electricity 1)			
Top-down	vs. 1995	vs. 2007			vs. 1995
Total appliances and lighting	**73.7**	**23.5**	**42.1**	**60.5**	**134.2**
Appliances	75.7	14.0	26.5	39.9	115.6
Lighting	-2.0	9.5	15.6	20.6	18.6

4.3.3 Bottom-up: quantified measures

Table 4.3.3. presents the energy savings of selected measures in the appliances and lighting sector calculated using bottom-up methods. The savings for the instruments reviewed identified by means of bottom-up methods add up to 50 PJ. In addition to this the quantitative bottom-up evaluation does not take into account further energy-saving effects brought about by the Eco-design Directive in product areas in which no implementing measures had previously been adopted. The measures listed in the summary table are described individually below.

Table 4.3.3 Overview of the bottom-up savings of selected measures in the appliances and lighting sector at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Bottom-up	1995–2007	2008–2010	2008–2013	2008–2016	1995–2016
Total appliances and lighting	**8.2**	**5.2**	**24.6**	**44.0**	**49.8**
Energy consultations at the consumer advice centres	0.9	0.5	0.9	1.4	2.3
Energy-using Products Act (EBPG): implementing measure for electric motors	–	0.1	1.8	10.5	10.5
Energy-using Products Act (EBPG): implementing measures for electrical appliances in the private household (PHH) sector	–	3.5	10.8	16.4	16.4
Energy-using Products Act (EBPG): implementing measures for electrical appliances in the trade, retail and services (TRS) sector	–	0.0	8.4	10.5	10.5
Energy Consumption Labelling Ordinance (EnVKV) (historical)	7.3	1.0	2.2	3.4	8.3
Energy Consumption Labelling Ordinance (EnVKV): delegated ordinances on electrical appliances in private households	–	0.1	0.5	1.8	1.8

27: Energy-using Products Act (EBPG): implementing measure for electric motors			
Regulatory law	Start: 2009	End: not planned	
Description	The federal government has implemented the EU's Eco-design Directive (2005/32/EC) in German law by means of the Energy-using Products Act (EBPG). The Eco-design Directive constitutes the framework for the establishment of harmonised standards in respect of environmentally compatible design of energy-using products within the EU. With the revised version of the Eco-design Directive (2009/125/EC) its area of application has been extended to include all products relevant to energy consumption. The Energy-using Products Act (EBPG) essentially deals with rulings on the implementation of the product-specific implementing measures issued by the European Commission, which specify to the manufacturers of energy-using products targets for improvement of their products and minimum requirements in respect of environmentally-friendly design of products. Besides this the Act contains regulations about market supervision in Germany. The bill seeking to adapt the Energy-using Products Act (EBPG) to comply with Directive 2009/125/EC is currently going through parliament (coming into effect expected in November 2011). With the implementing measure on electric motors, minimum standards in respect of the efficiency of electric motors were stipulated in several stages (2011, 2015, 2017). From 2015/2017 there is the option, instead of highly efficient (IE3) engines, to use variable-speed drive units in combination with IE2 engines. The measure affects all engines put into circulation in the EU.		
Energy saving (total, power = 1)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
10.5 PJ	–	0.1 PJ	10.5 PJ
Reference	*EBPG 2008; Fraunhofer ISI 2011*		

M 28: Energy-using Products Act (EBPG): implementing measures for electrical appliances in private households			
Regulatory law	Start: 2009	End: not planned	
Description	Implementation in German law of the revised EU Eco-design Directive (2009/125/EC) (not yet carried out). Implementing measures for the setting of minimum requirements for the following energy-using appliances in private households: → Simple set-top boxes (02/2009) → Lighting (03/2009) → Televisions (07/2009) → Heating loop recirculation pumps (07/2009) → Domestic refrigerators and freezers (07/2009) → Domestic washing machines (11/2010) → Domestic dishwashers (11/2010) The implementing measure for standby (12/2008) is included in the calculation of the appliances' energy savings; the implementing measure for external power supply (04/2009) is not taken into account by contrast.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **16.4 PJ**	–	3.5 PJ	16.4 PJ
Reference	*Fraunhofer ISI 2011, based on Schmidt-Sercander 2010*		

M 29: Energy-using Products Act (EBPG): implementing measures for electrical appliances in the TRS sector				
Regulatory law		Start: 2009	End: not planned	
Description		Implementation in German law of the revised EU Eco-design Directive (2009/125/EC) (not yet carried out). Implementing measures with setting of minimum requirements for the following energy-using appliances in the TRS sector: → Lighting (03/2009) → Heating loop recirculation pumps (07/2009) The implementing measure for standby (12/2008) is included in the calculation of the appliances' energy savings; the implementing measure for external power supply (04/2009) is not taken into account by contrast. In addition to this energy savings from other household appliances used in the TRS sector for which an implementing measure already exists were not taken into account due to lack of data availability.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**10.5 PJ**	–	0.0	10.5 PJ
Reference		*Fraunhofer ISI 2011, based on Schmidt-Sercander 2010*		

M 30: Energy Consumption Labelling Ordinance (EnVKV) (historical)				
Information, motivation, communication		Start: 1998	End: not planned	
Description		Labelling requirement for large electrical domestic appliances (refrigerators and freezers, combination appliances, washing machines, clothes driers, domestic washer-driers, dishwashers, household lamps, air conditioners, electric ovens) pursuant to the Energy Labelling Ordinance of 30.10.1997 to show energy consumption, consumption of other important resources, and additional performance data. Classification in efficiency categories from "A++" to "G". Implementation of Directive 92/75/EEC.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**8.3 PJ**	7.3 PJ	1.0 PJ	3.4 PJ
Reference		*GfK market research agency 2010*		

M 31: Energy Consumption Labelling Ordinance (EnVKV): delegated ordinances on electrical appliances in private households			
Information, motivation, communication	Start: 2010	End: not planned	
Description	Implementation in German law of the revised EU Directive on energy consumption labelling (2010/30/EC) (not yet carried out). Delegated ordinances on the introduction of energy labels and the introduction of new label categories for the following appliances (all enacted in 07/2010): → Television sets → Domestic refrigerators and freezers → Domestic washing machines → Domestic dishwashers		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **1.8 PJ**	–	0.1 PJ	1.8 PJ
Reference	*Fraunhofer ISI 2011, based on Schmidt-Sercander 2010*		

M 32: Energy counselling in consumer advice centres			
Information, motivation, communication	Start: 1978	End: not determined	
Description	As a rule a half-hour specialist consultation on energy issues (solar energy, photovoltaics, geothermal energy, biomass, CHP, energy-efficient redevelopment/ new building construction, and energy-saving behaviour) which is offered to consumers at a charge of €5 at the information points in the consumer advice centres. As a rule several topics are dealt with in a consultation.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **2.3 PJ**	0.9 PJ	0.5 PJ	1.4 PJ
Reference	*Federation of Consumer Organisations (vzbv) 2010; ifeu 2005*		

4.3.4 Further measures and projects

M 33: E-Energy – ICT-based energy system of the future	
Type of measure: funding	Term: since 2007
In the framework of the "E-Energy – ICT-based Energy System of the Future Programme" the federal government is funding six pilot projects up to 2013 which are designed to research and test the benefits of using information technologies such as smart metering in the energy sector. In view of the great importance of E-Energy for the development of renewable energies and for increasing energy efficiency, funding of the pilot projects is taking place in a cross-departmental partnership between the BMWi and the BMU. The BMWi is providing up to €40m for four pilot regions and the BMU is paying up to €20m to fund two additional pilot regions. Thus taken together with the contributions of the participant companies a total of about €140m is being mobilised for the development of the six E-Energy pilot regions. The objective of E-Energy is the development of new solutions	

which take account of the requirements of the transformation to liberalised markets, to decentralised and volatile generation structures, and to electric mobility, and at the same time guarantee the highest possible degree of efficiency, security of supply and environmental compatibility. Among other things information and communication technologies (ICT) play a key role in this. ICT can be used to operate intelligent energy systems in which a large number of power generation facilities communicate with both the power grids and the power-consuming end-user appliances. These intelligent energy systems include intelligent metering systems, so-called smart-meters. By means of improved information about energy consumption and the related costs these can to a certain extent form a basis for behaviour-based energy savings by energy consumers.

Further information: *www.bmwi.de*, *www.e-energy.de*

M 34: EU ENERGY STAR

Type of measure: information, motivation, communication — Term: since 2002

EU-ENERGY STAR is a programme for voluntary labelling of energy-saving office equipment. The ENERGY STAR quality seal (label) is displayed on energy-saving computers, displays, printers, photocopiers and other items of office equipment. Under an agreement with the USA the EU has been participating in the ENERGY STAR programme for office equipment since 2002. EU Regulation EC 2422/2001 regulates the ability of European manufacturers to register office equipment for ENERGY STAR. The criteria are regularly reviewed and adapted to match the technical standards. The label helps consumers and procurement managers in the commercial and public sectors to identify energy-efficient appliances and thus motivates them to buy energy-saving equipment. The programme allows considerable energy savings to be achieved, among other things with computer monitors.

Further information: *www.eu-energystar.org/de*

M 35: Energy check-up for low-income households

Type of measure: information, motivation, communication — Term: since 2011

The aim of the measure is the training of 800 long-term unemployed persons as so-called energy-saving assistants to demonstrate to consumers in 52,000 low-income households ways of saving money and conserving the environment by means of a careful approach to energy (in particular through reduction of CO_2 emissions). The German Federation of Energy Conservation and Climate Protection Agencies (eaD) is responsible for the functional energy aspects and trains the participants, supervises the checks, monitors the database, and orders the necessary energy-saving items. The participant associations organise the measure by, for example, recruiting the participants through the competent employment agencies. In addition to this they find the households wishing to receive counselling, support the participants during the measure with their personal affairs and problems, and co-operate with the local employment agencies and consumer advice centres. The locations are networked and supported by the charitable services, by regional advisors in regional groups.

Further information: *www.bmu.de*

4.4 Energy savings in trade and industry

4.4.1 Summary and overview

Top-down calculations:

- → Based on the long-term trend the total savings for the trade and industry sector work out at 840 PJ.
- → According to an evaluation of the preferred top-down indicators the savings expected in the trade and industry sector in the 2008-2016 commitment period add up to 434 PJ.
- → Based on evaluation of the preferred top-down indicators the savings already achieved in the early action period in the trade and industry sector come to 407 PJ.

Bottom-up calculations:

- → In the evaluation of individual instruments approximately 8% of the energy savings calculated by means of top-down methods can be accounted for using bottom-up methods. These total 68 PJ. Savings of 27 PJ are attributable to the commitment period, while 40 PJ of savings were initiated in the early action period.
- → For the most part the small share of energy savings accounted for by means of bottom-up calculations and induced by means of state-funded instruments compared to the top-down savings can be explained by the high share of autonomous (market-driven) savings in the industrial sector. This underlines the great importance of market-driven realisation of potential energy savings in the trade and industry area for action in Germany. These savings cannot be recorded individually by means of bottom-up methods in the Second NEEAP. Moreover, part of the savings is included in other areas for action (e.g. Energy Saving Ordinance as it applies to non-residential buildings in the buildings and appliances area for action). In addition it was not possible to quantitatively evaluate the energy-saving effects of certain political instruments relevant to the trade and industry sector such as the Federal Immission Protection Act (BImSchG).
- → After preliminary assessment the most effective quantified instruments have proved to be the voluntary agreements by industry, the ERP Environmental Protection and Energy Efficiency Programme, and the Special Fund for Energy Efficiency in SMEs.

4.4.2 Top-down: trend

Table 4.4.2. shows the energy savings made by trade and industry calculated by means of the top-down methods. Compared to the base year 2007 the trend for trade and industry indicates a high figure, so according to the current forecasts a total of 434 PJ of savings are generated up to 2016 using top-down calculations. On the basis of the somewhat lower savings of 407 PJ from the 1995-2007 early action period a total of 840 PJ of energy savings can be reported for the industry and TRS sectors.

Table 4.4.3. presents the energy savings of selected measures in the trade and industry sector calculated using bottom-up methods. A total of 68 PJ of savings can be accounted for by means of bottom-up calcula-

Table 4.4.2 Overview of the total top-down savings in the industry and TRS sectors at conversion factor for electricity 1

Saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Top-down	vs. 1995	vs. 2007			vs. 1995
Total trade and industry	**406.6**	**252.8**	**368.7**	**433.7**	**840.3**
TRS (fuels)	75.3	147.1	202.4	219.6	294.9
TRS (electricity)	-2.2	5.4	7.5	8.7	6.5
Industry (fuels)	264.8	63.7	85.9	100.6	365.4
Industry (electricity)	68.7	36.6	72.9	104.8	173.5

tions. The voluntary agreements by industry are responsible for significantly more than half of the identified savings. In addition to energy efficiency counselling and the ERP Environmental Protection and Energy Efficiency Programme, two KfW programmes relating to energy savings in the trade and industry sector are of importance. The measures listed in the summary table are described individually below.

4.4.3 Bottom-up: quantified measures

Table 4.4.3 Overview of the bottom-up savings of selected measures in the industry and TRS sectors at conversion factor for electricity 1

Saving	2007	2010	2013	2016	Total
Bottom-up – quantified	1995–2007	2008–2010	2008–2013	2008–2016	1995–2016
Total trade and industry	**40.4**	**2.9**	**15.0**	**27.1**	**67.5**
ERP Environmental Protection and Energy Efficiency Programme A	-	1.4	3.6	5.7	5.7
ERP Environmental Protection and Energy Efficiency Programme B	-	2.9	6.2	9.5	9.5
Stimulus Programme for Commercial Refrigeration Facilities	-	-	0.1	0.1	0.1
KfW Environmental Programme, ERP predecessor programmes	3.8	1.3	1.3	1.3	5.1
Voluntary agreements between German industry and the federal government	36.6	-5.8	-2.4	1.2	37.8
KfW Special Fund for Energy Efficiency in SMEs	-	3.1	6.2	9.3	9.3

M 36: KfW Environmental Programme, ERP predecessor programmes			
Funding	Start: 2003	End: 2009	
Description	Besides measures not directly relevant to energy efficiency such as noise protection, fresh water savings and wastewater reduction, soil and groundwater protection, efficient energy production, renewable energies, and reclamation of hazardous sites and landfills, measures for increasing energy efficiency are also being funded: construction of new buildings with a low energy requirement, building and energy technology, heat recovery/utilisation of waste heat, and procurement of low-emission commercial vehicles. Funding takes the form of low-interest loans.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **5.1 PJ**	3.8 PJ	1.3 PJ	1.3 PJ
Reference	*KfW 2010*		

M 37: ERP Environmental Protection and Energy Efficiency Programme B			
Funding	Start: 2009	End: not determined	
Description	The programme provides financing for energy efficiency measures, for example in areas such as building and energy technology, cladding, machinery pools, process cooling and heating, heat recovery systems, measurement and control technology, and information and communications technology, including the accompanying cost of planning and implementation support for SMEs. The expected energy savings must be determined before the application is made; there are minimum requirements in respect of the size of the savings (for new investments: 15 % less than the sector average; for replacement investments: 30 % of the average consumption for the last three years).		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **9.5 PJ**	–	2.9 PJ	9.5 PJ
Reference	*KfW 2010*		

M 38: ERP Environmental Protection and Energy Efficiency Programme A			
Funding	Start: 2009	End: not determined	
Description	Besides measures not directly relevant to energy efficiency (for example noise protection, fresh water savings and wastewater reduction, soil and groundwater protection, efficient energy production, and reclamation of hazardous sites and landfills) funding is provided for measures designed to increase energy efficiency: construction of new buildings with a low energy requirement, building and energy technology, heat recovery/utilisation of waste heat, and procurement of low-emission commercial vehicles. Funding takes the form of low-interest loans.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **5.7 PJ**	–	1.4PJ	5.7 PJ
Reference	*KfW 2010*		

M 39: Stimulus programme for funding climate protection measures for commercial refrigeration facilities			
Funding	Start: 2008	End: not determined	
Description	The funding is for a status check for functioning refrigeration facilities from a specified minimum size, both modernisation as well as construction of efficient new refrigeration facilities (basic funding) and measures for utilisation of waste heat (bonus funding).		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **0.1 PJ**	–	–	0.1 PJ
Reference	*Öko-Institut et al. 2010*		

M 40: Voluntary agreements between German industry and the federal government designed to increase energy savings and reduce CO_2 emissions			
Self-imposed commitment	Start: 1995	End: 2012	New self-imposed commitment for the period after 2012
Description	Voluntary agreement between German industry and the federal government designed to increase energy savings and reduce CO_2 emissions. Objective: CO_2 emissions reduction of 20 % between 1987 and 2005 (voluntary agreement). Update (voluntary agreement on climate protection): climate protection commitment by the German Industry Federation (BDI) and 16 member associations to subsidise the expansion of CHP plants, to reduce specific CO_2 emissions by 28% by 2005, and to reduce the specific emission of all Kyoto greenhouse gases by 35% by 2012 compared to 1990. Further update (supplement to the voluntary agreement on climate protection): reduction of emissions by the energy sector totalling up to 45m tonnes/year by 2010.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **37.8 PJ**	36.6 PJ	-5.8 PJ	1.2 PJ
Reference	*RWI research institute 2008–2010a; Prognos 2008*		

M 41: KfW Special Fund for Energy Efficiency in SMEs			
Information, motivation, communication	Start: 2008	End: not determined	
Description	By means of energy efficiency counselling weak spots in the use of energy are identified and proposals and concrete schedules of measures for energy- and cost-saving improvements are made. Subsidies are granted for qualified and independent energy efficiency counselling sessions in small and medium-sized companies (SMEs). SMEs can receive funding for an initial consultation and/or a detailed consultation of several days' duration.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **9.3 PJ**	–	3.1 PJ	9.3 PJ
Reference	*IREES/Fraunhofer ISI 2010*		

4.4.4 Further measures and projects

M 42: Federal Programme for Increasing Energy Efficiency in Agriculture and Horticulture	
Type of measure: funding	Term: since 2009
The Federal Programme for Increasing Energy Efficiency in Agriculture and Horticulture is designed to fund highly energy-efficient investment measures for the reduction of environmentally harmful CO_2 emissions in agriculture and horticulture. The programme supports investment measures in companies in this sector producing agricultural and horticulture products which lead to significant energy savings and funds investment measures for processing and marketing.	
Further information: *www.ble.de*	

M 43: Environment Innovation Programme	
Type of measure: funding	Term: since 1997
Under this programme demonstration projects funded on a large scale will for the first time show how progressive processes for avoidance or reduction of adverse effects on the environment can be realised. The objectives are progressive development of the environmental legislation and of the state of technology together with promotion of measures with a high demonstrative effect and resulting disseminator effect. In addition to this the demonstration projects are intended to highlight opportunities for manufacturing and using environmentally-compatible products and environmentally-friendly substitute materials. Priority for funding is given to SMEs. As a rule the BMU grants an interest subsidy on a loan from the KfW banking group.	
Further information: *www.bmu.de*	

M 44: Partnership for Climate Protection, Energy Efficiency and Innovation	
Type of measure: self-imposed commitment	Term: since 2009
The Partnership for Climate Protection, Energy Efficiency and Innovation is intended to make clear that the exacting objectives of climate protection and energy policy can be more effectively achieved if the state and industry cooperate. The objective is to identify excellence in companies' performance and proliferate this to the maximum possible extent. Identification of excellence is achieved by setting up a Climate Protection and Energy Efficiency Group of Companies (KEG) together with a Chamber of Industry and Commerce (IHK) Information and Skills Campaign. The member companies of the KEG are active in climate protection and are keen to convince other companies that climate protection is worthwhile. In the framework of the information offensive businessmen can take advantage of a company visit and an energy efficiency counselling session with an IHK energy coach. In the consultation the company's situation is analysed and appropriate funding programmes, roadshows and regional skills-upgrading programmes are pointed out. The aim is to recruit approximately 10,000 companies by means of company visits and events geared to climate protection and efficiency improvement. With the Skills Campaign and in the framework of the partnership between the BMU, the BMWi and the DIHK a subsidy is provided of up to 33 % of the cost of participation in courses leading to the qualification of energy manager (IHK) and energy representative (IHK) as well as of consolidation modules in the subject areas of climate protection, energy efficiency and innovation. Persons employed by a company and not providing energy efficiency counselling for third parties are eligible for the subsidy. The company not only benefits from the subsidy, but in addition the training and education leads to more efficient and therefore more cost-effective energy management within the company. The partnership and the KEG are supported by a "Climate Protection and Energy Efficiency" project office at the DIHK. The function of the latter is to build the group and publicise the excellent performance of the companies. Events and the construction of an internet platform are foreseen for this purpose.	
Further information: *www.klimaschutz.ihk.de*, *www.bmu.de*	

M 45: German Energy Agency (dena) Compressed Air Campaign	
Type of measure: information, motivation, communication	Term: since 2005
The German Energy Agency's Compressed Air Campaign is the successor campaign to "Efficient Compressed Air", aimed at industrial companies, small businesses and the plant engineering sector and using brochures, tools and internet portals together with extensive press and public relations work. The aim is to inform the respective agents about the energy optimisation of existing compressed air systems and the energy-optimised production of new compressed air systems. The campaign focuses on topics such as the provision of specialised technical information on compressed air systems, from compressed air production to heat production and life-cycle costs, as well as e-learning in the framework of a tool for the energy optimisation of compressed air systems. Since 2008 this measure has been an integral part of the "Energy Efficiency Initiative" umbrella campaign, more precisely the "Efficient Electricity Usage in Trade and Industry" section. The campaign has indirectly strengthened market penetration of energy-efficient compressed air systems and their components and companies have been increasingly sensitised to this issue. In addition, growth in demand has boosted the development of innovative energy-efficient compressed air systems.	
Further information: *www.initiative-energieeffizienz.de*, *www.industrie-energieeffizienz.de*	

M 46: "Energy-efficient Systems in Trade and Industry" campaign	
M 46: "Energy-efficient Systems in Trade and Industry" campaign	Term: 2004–2007
With a range of consultations, seminars, information materials, and in some cases direct mailings, the information campaign for energy optimisation of existing pump systems and energy-optimised construction of new pump systems in trade and industry is directed at companies from trade and industry, suppliers, service providers, and disseminators such as energy agencies and industry associations. The campaign was developed, sponsored and executed by the German Energy Agency and the VDMA Pumps + Systems Association and subsidised by the BMWi. Among other things the focus is on analysis of life-cycle costs, carrying out consultations in industrial companies, and standardisation of energy consultations for pump systems. From a commercial point of view energy consultations for increasing energy efficiency in pump systems are particularly worthwhile. This effect is increased by rising electricity prices, leading to an additional increase in efficiency. The consultations show that considerable potential savings are available in both SMEs and large companies and that energy efficiency improvements pay dividends irrespective of the sector in which a company operates. The campaign contributes indirectly to increased market penetration of energy-efficient pump systems and components. The experience gained from the campaign shows that 70% of companies can achieve amortisation periods of four years or less. Indeed, for 42 % of companies the amortisation period is under two years. The campaign ended in 2007. The follow-up project is the project module entitled "Beacons of Energy-efficient Pump Systems" in the framework of the "Energy Efficiency" initiative.	
Further information: *www.initiative-energieeffizienz.de*, *www.industrie-energieeffizienz.de*	

M 47: Smart Energy Efficiency and Climate Protection Networks	
Type of measure: information, motivation, communication	Term: since 2008
The aim of the project is the creation of 30 energy efficiency networks in the framework of which an organisational infrastructure is developed with which initiators such as chambers of industry and commerce can independently manage and use these networks in respect of existing obstacles and overcoming the same, reduction of transaction costs, and identification of innovation effects. Thanks to previous knowledge it was possible to begin creation of the networks in 2009. The main thrust of the project is the development of computer-based evaluation programmes for energy efficiency measures. Another focal point of the project is regular moderated exchange of experience between the energy managers of the participant companies and an individual initial consultation for each participant company. As a result the transaction costs of the companies are reduced, the profitable energy cost-cutting measures are identified, and at the same time the performance and productivity of the external counselling is increased. The 30 networks are receiving continuous scientific support between 2009 and 2013. Every effort is being made to use potential cross-network synergies (for example: joint hotline, and exchange of successful individual measures).	
Further information: *www.bmu-klimaschutzinitiative.de*, *www.isi.fraunhofer.de*	

M 48: Mod.EEM – “Modular Energy Efficiency Model”	
Type of measure: information, motivation, communication	Term: since 2009
The aim is the preparation and implementation of an adaptable, web-based energy management system, respectively tailored to companies with differing structures and sizes in the pilot region of North-Rhine Westphalia (NRW) taking into account normative peripheral conditions (DIN EN 16001, EMAS). It is planned to make the results available to all companies in Germany. This should put them in the position to improve energy performance continuously by means of a systematic approach. Initially approximately 100 companies in NRW are being recruited for the project. The project is being supported by means of an annual “energy manager” competition in consultation with the DIHK.	
Further information: *www.bmu.de*, *www.ea-nrw.de*	

4.5 Energy savings in transport and mobility

4.5.1 Summary and overview

Top-down calculations:

- Based on the long-term trend the total savings for the transport and mobility sector are 730 PJ. Motorised private transport and road freight transport account for by far the largest share.
- According to an evaluation of the preferred top-down indicators the savings expected in the transport and mobility sector in the 2008–2016 commitment period add up to 314 PJ.
- Based on evaluation of the preferred top-down indicators the savings already achieved in the early action period in the transport and mobility sector come to 416 PJ.

Bottom-up calculations:

- In the evaluation of individual instruments, at 89 PJ only just over 12 % of the savings calculated by means of top-down methods can be accounted for using bottom-up methods. For the commitment period this figure is 35 PJ; savings of 59 PJ were already initiated in the early action period.
- On the one hand the small share of savings identified by means of bottom-up methods compared to the top-down savings highlights the great importance of the market-driven realisation of energy savings in the transport and mobility area for action in Germany. However, on the other hand it should be borne in mind in this connection that data in respect of energy savings in the transport and mobility sector, for example, are currently available to a much smaller and less precise extent than for the buildings sector. As a result statements for example about the proportion of energy savings resulting from autonomous technical progress or of energy savings realised by means of individual instruments or statements on the size of the concrete savings from individual instruments are in some cases subject to a relatively large degree of uncertainty. Thus in principle every effort is made to achieve an improvement in the data situation in the mobility and transport sector in order to be able to make more exact and more valid estimates in the framework of future reports.

Essentially energy efficiency improvements in the mobility sector are driven and implemented in the market by a bundle of instruments consisting of regu-

4.5.2 Top-down: trend

Table 4.5.2 Overview of total top-down savings in the transport and mobility sector at conversion factor for electricity 1

Saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Top-down	vs. 1995	vs. 2007			vs. 1995
Total transport and mobility	**415.8**	**93.4**	**204.5**	**314.1**	**729.9**
Motorised private transport	183.4	52.0	113.1	171.9	355.3
Road freight transport	217.1	33.1	78.5	127.0	344.1
Passenger rail transport	15.3	1.4	7.0	9.6	24.9
Rail freight transport	27.6	6.9	8.5	10.5	38.1
Proportion of total passenger transport on land accounted for by public transport	2.5	3.0	2.2	1.4	3.9
Proportion of total freight transport accounted for by railway and inland waterway freight transport	-30.1	-3.0	-4.8	-6.3	-36.4

latory requirements together with fiscal and informational instruments. This is complemented by public-sector and considerable private-sector research spending on technology development, which is reflected in the very positive savings figures for the top-down indicators.

Table 4.5.2 shows the energy savings made by the transport and mobility sector calculated by means of the top-down methods. A total of 730 PJ of energy savings was identified, of which the greater part by means of early action. At 355 PJ and 344 PJ respectively, efficiency improvements in motorised private transport and road freight transport made a particularly large contribution to the energy savings achieved in the transport sector. By contrast the overall impact of passenger rail transport and rail freight transport is comparatively small. Shifts in traffic volume to public local passenger transport account for less than 1 % of the top-down savings. Indeed, in freight transport the total freight transport volume accounted for by the more energy-intensive road freight transport has increased compared to the less energy-intensive rail and inland waterway transport, meaning that as far as this indicator is concerned additional energy consumption, i. e. negative energy savings, must be reported. According to current estimates this trend is likely to continue until 2016.

Table 4.5.3 shows the energy savings of selected measures in the transport and mobility sector calculated by means of bottom-up methods. Germany can account for a total of 89 PJ of energy savings by means of bottom-up methods. On the whole major technology-based savings are also generated by private sector-driven developments in the area of energy efficiency, which among other things due to the data situation in the transport and mobility sector just described are difficult to identify as effects of individual measures but are ultimately included in the energy savings calculated by means of top-down methods. The measures listed in the summary table are described individually below.

4.5.3 Bottom-up: quantified measures

Table 4.5.3 Overview of the bottom-up savings of selected measures in the transport sector at conversion factor for electricity 1

Programme	2007	2010	2013	2016	Total
Unit		PJ/a (conversion factor for electricity 1)			
Bottom-up – quantified	vs. 1995	vs. 2007			vs. 1995
Total transport and mobility	**59.4**	**16.8**	**25.8**	**34.6**	**89.2**
The German federal government's fuel strategy	14.7	2.4	4.8	7.1	21.8
Motor vehicle tax 2009	14.7	4.0	10.0	15.7	30.4
Heavy goods vehicle toll	4.5	5.2	5.2	5.2	5.0
Environmental bonus	4.3	4.1	4.0	4.0	38.1
Activities of Deutsche Bahn	3.5	0.9	1.7	2.6	6.0
Voluntary agreement of the German automotive industry	22.0				22.0

M 49: The federal government's fuel strategy				
Regulatory law		Start: 2004	End: 2020	
Description		In 2004, in the framework of the national sustainability strategy and in view of international developments the federal government announced a strategic concept for the period up to 2020. This concept supports the market launch in Germany of alternative or renewable fuels as well as innovative drive technologies which seen from today's perspective are economical and environmentally beneficial in the long term. Furthermore, amendment of the Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV) forms part of the strategy.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**21.8 PJ**	14.7 PJ	2.4 PJ	7.1 PJ
Reference		*BPA 2004; BMVBS 2004; Prognos 2008*		

M 50: Motor vehicle tax				
Fiscal		Start: 1985	End: not determined	Since 1985 three pollutant classes, and from 1997 six pollutant classes. Since 2009 CO_2 emissions-dependent component
Description		The Motor Vehicle Tax Act (KraftStG) was amended in 2009. For calculation of the tax charge on all newly-registered passenger vehicles, besides the engine capacity the size of CO_2 emissions is also considered. In order to encourage the purchase of passenger vehicles with low CO_2 emissions, for passenger vehicles with a CO_2 output of 120 g/km or less no CO_2-based motor vehicle tax is payable until the end of 2011. The limit will be reduced to 110 g/km in 2012 and to 95 g/km in 2013 or 2014: pursuant to amendment of the Motor Vehicle Tax Act (KraftStG) of 2009, where first registration takes place between 2011 and 2013 owners of diesel passenger vehicles of emissions standard Euro 6 receive a maximum motor vehicle tax exemption of €150. To create an incentive to purchase electric vehicles, even before the amendment of the KraftStG there was a tax exemption for these vehicles which was limited to five years. In 2009 CO_2 emissions of motor vehicles fell by 6.4%. In July 2009 the number of new passenger vehicle registrations with a CO_2 figure in the tax-exempted range increased by 175.2% compared to the same month in the previous year. By contrast there was a fall in the number of new registrations of passenger vehicles with high CO_2 emissions.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**30.4 PJ**	14.7 PJ	4.0 PJ	15.7 PJ
Reference		*Prognos 2008; KraftStG 2009*		

M 51: Heavy goods vehicle toll				
Fiscal		Start: 2005	End: not determined	
Description		Mileage-based road toll for heavy commercial vehicles on federal motor-ways and some heavily used trunk roads. Spreading of the toll rate to account for pollutant class.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**5.0 PJ**	4.5 PJ	5.2 PJ	5.2 PJ
Reference		*Transport, Logistics and Waste Management Association (BGL) 2009; Federal Office for Freight Transport (BAG) 2010*		

M 52: Environmental bonus				
Funding		Start: 2009	End: 2009	
Description		In January 2009, in the framework of the Economic Programme II, the federal government adopted a funding programme for the award of an environmental bonus to the value of €2,500. This was granted as a once-off subsidy on application to BAFA where a private car owner bought a new or one-year-old car and at the same time could prove that he or she had had a car scrapped that was at least nine years old. The objective of this bonus was to replace old passenger vehicles with high emissions of classical pollutants with new, more efficient vehicles. The funding amount was increased to €5bn due to the very high level of demand. A total of approximately two million passenger vehicles were subsidised.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**4.0 PJ**	–	4.3 PJ	4.0 PJ
Reference		*ifeu 2009*		

M 53: Voluntary agreement of the German automotive industry [23]				
Self-imposed commitment		Start: 1995	End: 2008	
Description		In a voluntary agreement between the government of the Federal Republic of Germany and the automotive industry, the industry took on the self-imposed commitment to reduce the fuel consumption of newly registered cars manufactured in Germany by 25 % from 1990 to 2005. The agreement was concluded in 1995.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**22.0 PJ**	22.0 PJ	–	–
Reference		*Prognos 2008; Prognos/GWS 2009*		

23 In addition to the self-imposed commitment of the automotive industry for estimation of energy savings, in future the effect of Regulation (EC) no. 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emissions standards for new passenger vehicles in the framework of the overall concept of the Community for the reduction of CO_2 emissions of passenger vehicles and light commercial vehicles will be included in this area (cf. M 56).

M 54: Activities of Deutsche Bahn			
Self-imposed commitment	Start: 2006	End: 2020	
Description	For the period 2006 – 2020 Deutsche Bahn has defined a specific CO_2 reduction target relating to traffic volume in 2006. The passenger transport, rail freight transport and logistics business areas have their own subsumed energy and CO_2 reduction targets. The business areas are themselves responsible for definition and control of the measure.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **6.0 PJ**	3.5 PJ	0.9 PJ	2.6 PJ
Reference	*DB 2011; Prognos calculations*		

4.5.4 Further measures and projects

M 55: Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV)	
Type of measure: regulatory law	Term: since 2004, amendment 2011
Since 2004 – under European Directive 99/94/EC – manufacturers and dealers which exhibit, offer for purchase or leasing, or advertise new passenger vehicles must provide information on their fuel consumption and CO_2 emissions pursuant to the Ordinance on consumer information regarding fuel consumption and CO_2 emissions of new passenger vehicles. With the amendment of the Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV), which comes into force at the end of 2011, the existing numerical CO_2 figures are to be supplemented by a coloured CO_2 efficiency scale. This provides consumers with clearly laid out and easily discernible differentiated information on CO_2 efficiency. This will be accompanied by adaptation to account for new developments, in particular in the field of electric mobility. In addition to consumption and efficiency information the label must in future also include information on the annual tax and the average annual cost of energy sources (fuel and electricity) in order to provide consumers with an additional important aid to making their buying decisions.	
Further information: *www.bmwi.de*	

M 56: EU Regulation on the CO2 emissions of new cars	
Type of measure: regulatory law	Term: since 2009
Pursuant to Regulation (EC) no. 443/2009 of 23 April 2009 on the setting of emissions standards for new passenger vehicles in the framework of the overall concept of the Community on reduction of CO_2 emissions of passenger vehicles and light commercial vehicles, from 2012 onwards every manufacturer of passenger vehicles must ensure that the CO_2 emissions of new cars do not exceed a limit of 130 g/km on average. This limit must be achieved by 65 % of new cars in 2012, by 80 % in 2014, and by 100 % in 2015. Provision is made for amendment of the specific emission levels depending on the weight of the vehicles. It is intended that the figures be achieved by means of improvements in engine technology and other innovative technologies. Exceptions are foreseen in some cases, in particular for very small manufacturers. Under certain conditions manufacturers may form emissions pools in order to meet the requirements in terms of reduction of CO_2 emissions. From 2012 onwards, where the limits are exceeded the European Commission will be levying a charge for violation of emission limits. Moreover, an average CO_2 emissions figure of 95 g/km for new cars is planned for 2020, and the European Commission plans to announce the arrangements for this by the beginning of 2013 in the framework of a review of the specific emissions targets and exceptions. The Regulation comes in the wake of the voluntary commitment of the automotive industry (see M 53). Its implementation will lead to considerable additional energy savings in the transport sector in Germany over the next few years, and these savings will as far as possible also be estimated and quantified in the framework of future reports and be taken into account in verification of the indicative energy savings target.	

M 57: Fiscal consideration of commuting expenses	
Type of measure: fiscal	Term: since 2001
The commuter flat rate is aimed at the 30 million income tax-paying commuters in Germany and is awarded irrespective of the mode of transport. This is intended to remove the incentive to use passenger vehicles, which were previously given preferential treatment for tax, and reduce the number of car journeys. At the same time the incentive for full or partial use of more energy-efficient modes of transport such as local public passenger transport will be increased. The fact that this measure does not focus on any one specific mode of transport means that it is possible to avoid structural disadvantages to the users of public and combined modes of transport.	

M 58: National Innovation Programme for Hydrogen and Fuel Cell Technology	
Type of measure: funding	Term: since 2008
With the “National Innovation Programme for Hydrogen and Fuel Cell Technology” (NIP) the federal government is funding the development and implementation of hydrogen and fuel cell technology with the objective, over the total programme duration, of bringing about market readiness of the respective technologies, creating value chains and value-added shares, contributing to considerable growth in experience, and making a contribution to the federal government’s energy- and climate-policy targets. To achieve this industrial research and experimental development is to be funded in the above areas of application. The programme includes both transport sector-related and stationary applications. The total programme volume is €1.4bn. A sum of €500m is being provided by the BMVBS, €200m by the BMWi, and the other half is being co-financed by industry.	
Further information: *www.bmvbs.de*, *www.bmwi.de*, *www.now-gmbh.de*	

M 59: Government Electric Mobility Programme	
Type of measure: funding	Term: since 2009
Electric mobility is contributing to implementation of the energy- and climate-policy targets of the Federal Republic of Germany. Thus, among other things electric mobility is helping implement the "Away From Oil" strategy. The aim of the Government Electric Mobility Programme is to drive forward research and development for and the market preparation and launch of battery-operated vehicles in Germany. Development of the market is expected to take until 2020, with the market ramp-up phase taking place between now and 2017 and the high-volume market phase from 2017 onwards. The aim is for there to be a million electric vehicles on the German market by 2020. Funds totalling €500m have been made available from the Second Economic Package for the electric mobility sector. A further €1bn is being made available for research and development measures between now and the end of the legislative period. Not least in order to secure and expand the leading role of the German automotive and automotive supply industry, the aim is to make Germany the lead market and lead supplier for electric mobility. To achieve this it is necessary to dovetail industry as closely as possible with the scientific community in respect of research and to create a suitable regulatory environment for electric mobility.	
Further information: *www.bmvbs.de*, *www. bmwi.de*, *www.bmbf.de*, *www.bmu.de*	

M 60: Funding Programme for Electric Mobility Pilot Regions	
Type of measure: funding	Term: since 2009
The BMVBS "Electric Mobility in Pilot Regions" focus programme, which is being subsidised with about €130m from the Second Economic Package, combines application-oriented research and development for battery technology with an emphasis on everyday- and user-oriented demonstration and application. Electric mobility is being holistically developed in eight pilot regions with various focal points and a large number of different agents. The core of the programme is the integration of battery technology with mobility, spatial and urban development.	
Further information: *www.bmvbs.de*, *www.now-gmbh.de*	

M 61: Funding Programme for Electric Mobility	
Type of measure: funding	Term: since 2009
In the framework of the Funding Programme for Electric Mobility, for which about €100m has been made available from the Second Economic Package, the BMU is above all funding field tests in passenger vehicle traffic and goods transport and research and development on the recycling of traction batteries as well as an investigation of the ecological and economic benefit of electric mobility in the course of an ancillary research project. The BMU is further supporting the cross-linking of electric vehicles and energy systems by means of state-of-the-art information and communication technology in the E-Energy pilot regions and the purchase of diesel-hybrid buses by municipalities.	
Further information: *www.bmu.de*, *www.erneuerbar-mobil.de*	

M 62: Municipal Transport Financing Act (GVFG) and Regionalisation Act (RegG)	
Type of measure: funding	Term: GVFG since 1971, RegG since 1993
The Regionalisation Act stipulates that in return for guaranteeing public local passenger transport in consequence of assuming responsibility for local passenger rail transport, the federal states receive a share of the federal government's petroleum tax receipts. In 2008 regionalisation funds of approximately €6.7bn were estimated for the federal states, rising by 1.5% per annum from 2009. The Municipal Transport Financing Act contains provisions on financial aid for investments in the improvement of infrastructure and passenger transport in cities and municipalities. The predominant objective of the statutory provisions is to achieve a behavioural change in favour of local public transport. This can also lead to effects increasing energy efficiency.	
Further information: *www.bmvbs.de*, *www.dipbt.bundestag.de* (Bulletin 16/6310)	

M 63: Improving the infrastructure for using bicycles	
Type of measure: funding	Term: since 2002
To promote cycling the federal government adopted a National Cycling Plan, designed to initiate new strategies for and improvements to the promotion of cycling up to 2012. In addition the federal government has also made a financial commitment to cycling: in 2008 the government invested about €100m in the construction and maintenance of cycle paths on trunk roads, in the implementation of the National Cycling Plan, and in cycling safety work. Moreover, there are many packages of measures and individual projects initiated by cities and municipalities at local level which are designed to promote cycling further.	
Further information: *www.nationaler-radverkehrsplan.de*, *www.bmvbs.de*	

M 64: Mobility Management Action Programme	
Type of measure: information, motivation, communication	Term: since 2008
With the help of regional co-ordinators, regional roadshows, initial consultations, information materials, two national competitions, public relations and an online portal the "Mobility Management Action Programme" of the German Energy Agency is aimed at companies and organisations (including public administration departments, hospitals, universities, etc.), municipalities and mobility providers. The objective is improved coordination between supply and demand of private mobility, a shift from passenger vehicle transport to more efficient forms of transport, and improvement of communication about mobility. In the framework of the National Climate Protection Initiative the BMU is supporting the German Energy Agency's "Mobility Management Action Programme", which was launched in 2008 and under which local agents in 15 pilot regions have been informed in a focused manner about mobility management. Besides a comprehensive on-site situation review, the consultations focus on development of a basic concept together with start-up assistance for implementation. Implementation of the action plan has greatly improved awareness of mobility management on a nationwide basis. In the course of 100 initial consultations concepts for operational mobility management have been developed for 85 locations. According to the regional co-ordinators more than 360 disseminators have been recruited for participation in the Action Programme. The average absolute potential reduction per location investigated is 1.4 million passenger vehicle kilometres and 248 tonnes of CO_2 per annum. The estimated saving for the total Action Programme is thus more than 133 million passenger vehicle kilometres and 23,000 tonnes of CO_2 per annum.	
Further information: *www.effizient-mobil.de*, *www.bmu-klimaschutzinitiative.de*	

M 65: Me and my car. Drive smart and save fuel	
Type of measure: information, motivation, communication	Term: since 2008
The campaign entitled "Me and my car. Drive smart and save fuel" of the German Energy Agency addresses all car drivers with brochures and similar information material on the subject of fuel-saving, an online portal with interactive tools, appropriate events such as days of action and training courses on fuel-saving driving techniques, and finally by means of public relations. The initiator of the campaign is the German Energy Agency with the support of the BMU and partners from industry. The aim is to make information on energy- and cost-saving products and behaviour available on a nationwide basis in order to make a contribution to increasing energy efficiency and to reducing CO_2 emissions. In a corresponding survey the majority of drivers said they had changed their driving and usage behaviour. Demand for energy-saving low-resistance tyres and oils was also stimulated.	
Further information: *www.ichundmeinauto.info*	

M 66: "A new way to drive" campaign	
Type of measure: information, motivation, communication	Term: since 2000
Under the patronage of the BMVBS the German Automotive Industry Association (VDA), the German Road Safety Council (DVR), and other agents from the automotive industry and motoring and environmental associations have initiated the campaign entitled "A new way to drive – smart, safe, further". An online portal has been set up to support the campaign. Further information is given on extensive information materials on fuel-saving, public relations and corresponding days of action. The stated aim is to make premium-quality information and training courses available to all drivers in order to encourage them to adopt a fuel-saving driving style. Drivers are in addition encouraged to purchase fuel-saving products such as low-resistance tyres and low-friction oils. Fuel consumption and emissions depend critically on individual driving styles. A fuel-saving driving style makes fuel consumption savings of up to 25 % possible. As early as 1999 the federal government stipulated an energy-saving driving style as a compulsory part of driver training and the driving test in its Driving Licence Ordinance.	
Further information: *www.bmvbs.de*, *www.neues-fahren.de*	

4.6 Energy savings by means of horizontal measures

4.6.1 Summary and overview

A large part of the state-funded measures for increasing energy efficiency are directed at specific sectors. Thus, for example, the motor vehicle tax only has an effect in the transport and mobility sector. By contrast, the KfW funding programmes for energy-efficient construction and redevelopment (CO_2 Building Redevelopment Programme) and other KfW programmes in the buildings sector only have an effect on the buildings sector. However, besides these instruments, which are definable in terms of their objectives, there are also important horizontal measures which affect several or all areas for action.

A significant horizontal instrument which affects all sectors and areas of application in Germany is the Ecological Tax Reform. This makes the greatest contribution to the energy savings identified here by means of bottom-up methods.

Table 4.6.2. shows the energy savings of the Environmental Tax Reform, a key individual cross-sectoral measure, calculated by means of bottom-up methods. Total savings of 96 PJ are being achieved with the Environmental Tax Reform. The savings calculated for 2007 amount to 103 PJ, while only 90 PJ of savings are applicable in 2016.[24] Due to the use of price elasticities in quantifying energy savings in the framework of the

24 Due to the chosen calculation methodology the savings figures for the Ecological Tax Reform are annual averages.

Environmental Tax Reform annual effects are shown here. The stated total figure for the 1995-2016 period is the overall effect remaining in 2016 from the respective measures (with corresponding assumed price inflation on the basis of the 2007 energy scenarios).

4.6.2 Bottom-up: quantified measures

Table 4.6.2 Overview of the bottom-up savings of selected horizontal measures at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Bottom-up – quantitative	vs. 1995	vs. 2007			vs. 1995
Motorised private transport	183.4	52.0	113.1	171.9	355.3
Ecological Tax Reform	103.2	89.1	89.4	89.5	96.3

M 67: Ecological Tax Reform			
Fiscal	Start: 1999	End: 2003	
Description	On 1 April 1999, with the law on the introduction of the Ecological Tax Reform of 24 March 1999, the first stage of the Ecological Tax Reform came into force. This increased petroleum tax rates on motor and heating fuels and implemented the electricity tax. The law on continuation of the Environmental Tax Reform of 16 December 1999 made provision for increases in four further steps of the petroleum tax rates on fuels and of the electricity tax rate on 1 January 2000 to 2003 respectively. In addition, on 1 January 2000 the then varying petroleum tax rates on heavy fuel oil for heat and power production were amalgamated into a single petroleum tax rate. Besides this, on 1 November 2001 spreading of the petroleum tax rates for petrol and diesel depending on the sulphur content was introduced. The difference of 1.53 cents per litre compared to sulphurised fuel was initially applicable to low-sulphur fuel with a sulphur content up to 50 mg/kg and from 1 January 2003 to sulphur-free fuel with a sulphur content up to 10 mg/kg. The fifth environmental tax bracket was modified on 1 January 2003 by the coming into force of the law on progressive development of the Environmental Tax Reform of 23 December 2002. Among other things the petroleum tax rates on natural gas and liquid petroleum and on heavy fuel oil were increased.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **96.3 PJ**	103.2 PJ	89.1 PJ	89.5 PJ
Reference	*Prognos/GWS 2009*		

4.6.3 Further measures and projects

M 68: Stimulus Programme for Mini CHP Plants	
Type of measure: funding	Term: since 2008
In 2008 the BMU started a funding programme, implemented by the BAFA, for small and highly efficient combined heat and power generation installations. The objective of the funding is to increase the use of mini-CHP plants in the heating market segment up to 50 kW by means of investment incentives. Besides SMEs the funding programme is also targeted at freelance professionals, private individuals and municipalities, as well as municipal regional authorities and special-purpose associations. There has so far been very strong demand for the programme and it has had a positive impact on the further development of mini-CHP plants. A forward-looking market has emerged in which innovative CHP technologies can flourish.	
Further information: *www.bmu.de*, *www.bafa.de*	

M 69: Climate Needs Protection Campaign	
Type of measure: information, motivation, communication	Term: since 2004
The Climate Needs Protection Campaign of co2 online addresses the following issues: provision of information by means of interactive information platforms and brochures on energy-efficient building redevelopment, energy-efficient heating and cooling systems, and rational use of transport systems. co2 online was formed in 2003 as a non-profit-making consultancy for climate protection.	
Further information: *www.co2online.de*	

M 70: Execution of climate protection campaigns at schools, educational institutions and German schools abroad	
Type of measure: information, motivation, communication	Term: since 2008
The aim is to motivate schools, educational institutions and German schools abroad to achieve a significant contribution to the reduction of CO_2 emissions by means of simple measures and behavioural changes. Thus 2,400 schools have received a climate kit (portable energy consumption calibrator) and 1,700 schools are being given the opportunity – with a budget of up to €500 – to carry out in-school climate protection campaigns. Out of the concrete measures of the participant schools a catalogue is being drawn up which formulates the criteria of practicable and successful measures for reduction of CO_2 emissions and for saving energy. They can contribute their ideas and measures on a website. With the help of experts a list of criteria is being developed from the projects executed with which the schools can qualify as "climate protection schools".	
Further information: *www.bmu-klimaschutzinitiative.de*, *http://klima.bildungscent.de*	

M 71: ESD communication platform	
Type of measure: information, motivation, communication	Term: since 2008
The German Energy Agency is supporting the BMWi and the BfEE in the BAFA in implementation of the ESD in Germany, in particular by means of making available a well-founded information service with the objective of promoting the energy efficiency market. The intention is to exploit the large potential synergy effects in respect of dissemination of information, networking and knowledge transfer by means of continuous further development of the central communication platform. The focal points include creation of awareness, provision of relevant information, motivation of actors to act in an energy-efficient manner, and exchange of information between actors.	
Further information: *www.energieeffizienz-online.info*	

M 72: Minus 40 Per Cent Club for private households	
Type of measure: information, motivation, communication	Term: since 2008
92,000 households are being recruited for the Online Energy Saving Account (ESA) of the Minus 40 Per Cent Club. The software calculates the CO_2 figures for the heating energy and electricity consumption figures read off and records how the minus 40 per cent target (1990-2020) is achieved and exceeded. Participants are reducing their CO_2 emissions by an average of 1.69 % p.a. Interim results, examples and solutions to problems are communicated on an ongoing basis. An in-depth study is being carried out of a thousand households with internal energy production (photovoltaics, CHP) and another thousand with automated monitoring. In just under two-and-a-half years from September 2008 the number of ESAs was increased from 8,000 to 100,000 by means of partnerships, for example with energy utilities, and media work. Online and e-mail consultations provide motivation by means of benchmarks, individual cost reduction potential, etc. Both reasons for success and problems are being identified for 1,000 ESA users as well as for the 1,000 users of automatic monitoring and for the 100 users of building energy management. The federal government is demonstrating the achievability of its target of a 40 % cut in CO_2 from 1990 to 2020.	
Further information: *www.bmu-klimaschutzinitiative.de, www.co2online.de*	

M 73: Buy Smart project	
Type of measure: information, motivation, communication	Term: since 2009
The aim of the "Buy Smart" project is to promote the purchase of energy-efficient products. The project is targeted at public-sector and private buyers. In "Buy Smart" guides, performance sheets and computational aids created in the predecessor project for the office equipment, lighting, vehicles, domestic appliances, building components and green electricity product groups are being revised. These tender aids are being offered for free download on a new internet site, which also contains information on green procurement, labels, and a good practice database. The information is included in e-procurement platforms, making use of environmentally-friendly criteria free of additional expenditure for buyers. A further area of emphasis is intensive public relations work with the focus on assessment of life-cycle costs. Buyers and environmental managers are being addressed in a targeted manner by means of cooperation with networks. A quarterly newsletter is provided. Free consultations on green procurement have led to supervision of ten pilot projects. This EU-subsidised project is being carried out in Germany by the Berlin Energy Agency and it is being co-financed under the National Climate Protection Initiative.	
Further information: *www.buy-smart.info*	

M 74: TOP 100 – Environmental symbol for climate-related products	
Type of measure: information, motivation, communication	Term: since 2009
This project involves identification of the "best product" criteria for the 90 most important products from the point of view of climate protection as well as creation of the award criteria for the Blue Angel environmental symbol. This is intended to form the basis for a rapid change in the market to energy-efficient and climate-friendly best products. For the 90 particularly climate-relevant products indicative ecological assessments, life-cycle cost analyses and benefit analyses are carried out, then they are examined in respect of further critical environmental aspects (such as toxic effects, noise or radiation), after which the product carbon footprint is drawn up and the criteria for awarding of the Blue Angel are derived and agreed upon in-process with the partners on the ground. By way of support for the assessment key ecological assessment modules (e.g. for electricity or transport) are updated and the international standardisation process for the product carbon footprint is monitored.	
Further information: *www.bmu-klimaschutzinitiative.de*	

M 75: "Blue Angel" environmental symbol	
Type of measure: information, motivation, communication	Term: since 1977
The environmental symbol is targeted at both consumers and companies. The Blue Angel supports the concerns of environmental and consumer protection. Accordingly, those products and services are labelled which are especially environmentally friendly based on a holistic appraisal. Since 2008 the "Blue Angel" has focused on climate-relevant products, but it also continues to be a means of identifying products which primarily protect resources, water or health. The environmental symbol was introduced in 1977 to identify energy-saving and environmentally-friendly products and it is similar to the European eco-label.	
Further information: *www.blauer-engel.de*	

4.7 Energy savings in the public sector

The primary purpose of the following section is to describe the achieved and expected savings for meeting the indicative energy savings target pursuant to the ESD in the public sector.

At the same time – in fulfilment of the duty under Art. 10, Para. 2, Subparagraph 1 of the revised version of the Buildings Directive – an overview will be given of which optional measures and instruments for the public sector itself have been made use of in order to achieve the targets pursued by means of the Buildings Directive. The measures involved are indicated in overviews numbers 4.7.6. and 4.7.7. below by means of a corresponding reference at the right-hand edge of the measures heading.

4.7.1 Exemplary role of the public sector

Article 5 ESD and Section 3, Para. 3 of the EDL-G give the public sector an exemplary role in respect of the improvement of energy efficiency. To fulfil this role the public sector is expected to take energy efficiency measures which lead in the shortest possible time to extensive energy savings. The measures can be based on various different foundations such as legislative initiatives or certain voluntary agreements. In addition the public should be kept fully informed about the activities.

The exemplary role of the public sector is firstly due to its considerable energy consumption and the significant potential for energy savings. Secondly, the market dominance of the public sector is also of importance. By means of buying decisions energy-efficient technologies and services can be promoted and their overall market positioning improved. Thirdly, besides its economic importance the public sector also fulfils an exemplary role for society. Implementation by the public sector of its own exemplary energy efficiency measures gives its desire to encourage energy-efficient behaviour among private agents additional legitimacy and persuasiveness.

4.7.2 Procedure for determination of energy consumption and energy savings to be adopted by federal government, federal states and municipalities

Due to Germany's federal structure, besides the federal government, the 16 states and the approximately 13,000 municipalities are also very important in fulfilling the exemplary role of the public sector in respect of increasing energy efficiency. Taken together the latter account for approximately two-thirds of the total energy consumption of the public sector. This should be taken into account in any description and assessment of the exemplary role. Due to the lack of reliable existing data for all three relevant levels and due to the major importance of the exemplary role of the public sector in the framework of the implementation of the ESD, in preparation of the Second NEEAP two studies were commissioned to examine the energy savings at federal, state and municipal level (Prognos 2011, Prognos/DIFU 2011). The aim of the study was to be able to draw conclusions in respect of energy consumption, of the measures taken for increasing energy efficiency, and of the energy-saving effects at federal, state, and municipal level.

Measurement of the energy consumption and the energy savings of the public sector was very time-consuming

and constituted a major methodological challenge. Besides certain required methodological-conceptual clarifications such as delimitation of the public sector this is due to the large number of stakeholders to be taken into account, who act at various levels and with a relatively large amount of autonomy (e.g. own competencies and possible courses of action). The level of the municipalities is particularly affected, as due to the decentralised nature of the public sector in Germany there are no authorities to collect and process data on energy consumption from the municipalities on a centralised basis and according to uniform criteria. An investigation of municipal data on energy consumption and energy savings is therefore a very time-consuming project due to the large number of municipalities with very heterogeneous databases in terms of quality and quantity (the possibilities range from the existence of very few or no qualitatively satisfactory data up to systematically collected and processed quantitative data).

In spite of these challenges, on the basis of the results of the two studies reliable statements can be made about energy consumption, energy-saving measures and their effects in the public sector.[25] At the same time, to a large extent the methodological requirements and stipulations explained in Section 3 for determination of energy savings by means of top-down and bottom-up methods of calculation can be applied. It was possible to generate the required data for the federal government, the states, and the municipalities in the following manner:

- In the federal administration, on the basis of the monitoring implemented as early as 2006 in the framework of the self-imposed commitment of the federal government to reduce energy-related CO_2 emissions use was made of a comparatively good database to determine the energy consumption and energy savings of the federal government properties by means of the top-down approach. On the basis of the data collected and evaluated (about a third of the civil properties and all of the non-civil properties) an estimate of the total surface area of the federal administration's properties together with a projection of the energy consumption of the entire real estate stock was possible. Moreover, where possible on the basis of the data situation, instruments were identified with which energy savings could be achieved within the federal administration and the energy-saving effects of these instruments were quantified by means of appropriate bottom-up methods of calculation.
- As far as the federal states are concerned, the top-down calculations for determination of the energy consumption and energy savings are essentially based on data provided by the property administration departments of the federal states. Ideally this would have involved property data over several years. In addition some states provided aggregated data or energy reports. On the basis of these data building categories were established for the properties and specific consumption values set for these categories. In addition certain instruments with which energy savings are achieved within the state administration department were identified and quantified in respect of their energy-saving effects by means of appropriate bottom-up methods of calculation.
- As far as the municipalities were concerned no central source was available which determines and provides the time series of energy consumption figures of municipal properties. A survey of just under 1,400 municipalities was therefore carried out here. In the course of the survey specific energy consumption figures and specific surface areas of municipal areas of operation were determined. On the basis of these data a projection was carried out and the representativeness of the results for the municipal sector confirmed. For capacity reasons no qualitative or quantitative description of the diverse individual energy-saving activities and instruments of the municipalities was made.

4.7.3 Summary of results

The analysis of the public sector shows that it has already for a long time been fulfilling its exemplary role in a variety of ways. Top-down and bottom-up analyses make it clear that this is also reflected in the energy savings. Due to data availability the focus of the savings made by the public sector is on real estate and

25 A detailed explanation of the procedure used for data collection and calculation of the energy consumption figures and energy savings at federal government, federal state and municipal levels as well as further information are given in the two studies referred to (Prognos 2011, Prognos/DIFU 2011).

street lighting. In summary the following statements can be made on the energy savings in the public sector:

Top-down calculations:
- → Based on the long-term trend the total savings for the public sector add up to 48 PJ.
- → The savings expected in the public sector for the 2008–2016 commitment period add up to 16 PJ based on evaluation of top-down indicators.
- → The savings in the public sector already achieved in the early action period add up to 32 PJ based on evaluation of the top-down indicators.

Bottom-up calculations:
- → The results of the bottom-up calculations compare well with the savings identified by means of the top-down method, and the instrument-related coverage is similarly positive. In some cases the savings identified by means of bottom-up methods even exceed the top-down savings. Possible explanations for this are double counts, rebound effects, the difficulty of precisely defining funding areas, or even the delayed implementation and impact of individual measures. In the commitment period the savings amount to 17 PJ; in the early action period savings of 1 PJ were initiated.
- → Based on this assessment the most effective quantitative instruments prove to be the Future Investments Act (ZuInvG), followed by the KfW programmes.

4.7.4 Energy consumption of the public sector

In the framework of the above two studies determination of the energy consumption of the public sector in Germany was broken down between federal government, federal states and municipalities (not counting vehicle fleet, municipal enterprises or hospitals). Summation of these figures would give total consumption for the public sector of 212 PJ/a in 2007. The energy consumption for 2016 estimated ex ante in the framework of the two studies would be 198 PJ/a, thus much lower than the energy consumption in 2007–2013.

Broken down by federal government, states and municipalities, the importance of the municipal level is apparent: at 135 PJ/a the municipalities consumed more than four times as much energy as the federal government in 2007 (32 PJ/a) and about three times as much as the federal states (45 PJ/a). For the 2007–2016 period an overall fall in energy consumption was estimated for the federal government and at municipal level, and unchanged energy consumption at state level.

The identified development of consumption by energy source is very different. For the federal government it was established, both for the early action period and for 2007, that the percentage of the energy consumption of the properties accounted for by electricity is about a quarter (i. e. three-quarters heat). However, according to the estimates it is anticipated that the electricity component will increase further by 2016, which is due in particular to the sharp increase in the electricity consumption of information and communication technology (ICT). In the period from 1995 to 2015 we can assume an increase in ICT electricity consumption of 30 %. Significant additional electricity consumption is accounted for by air conditioning and other technical installations in buildings.

Electricity consumption in the state properties plays an even more important role. In 2007 electricity already accounted for more than 30 % of energy consumption, and in 2010 more than 35 %. Over 40 % is forecast for 2016. The main cause is ICT again and to a lesser extent heating and air conditioning in buildings, though both exhibit strong growth rates. With relatively constant usage of the end-user systems, usage of

Table 4.7.4. Summary of energy consumption in the public sector at conversion factor for electricity 1

		2007	2010	2013	2016
Total public sector	PJ/a	**212.4**	**208.2**	**202.0**	**197.8**
Energy consumption (federal government)	PJ/a	31.7	30.1	28.7	27.3
Energy consumption (federal states)	PJ/a	45.3	46.2	45.6	45.1
Energy consumption (municipalities)	PJ/a	135.4	131.9	127.7	125.4

the infrastructure in particular increases (servers, networks, telephone exchanges, etc.). The institutes of higher education in particular should be highlighted, as due to their high level of technological development they are responsible for a relevant share of the increases in electricity consumption.

In contrast to this trend no significant increase in the electricity component has so far been apparent at municipal level. According to the two studies for the Second NEEAP the latter's share of the energy consumption of properties in the period 2007–2016 is between 18 % and 19 %. The total electricity consumption of street lighting is falling somewhat.

4.7.5 Top-down: trend

Table 4.7.5. shows the energy savings made by the public sector calculated by means of the top-down methods. The top-down approach highlights the great importance of the municipalities in the rise in energy efficiency in the public sector: approximately 25 PJ of the total identified savings of just under 48 PJ can be attributed to the more than 13,000 municipalities and the more than 300 districts. The federal government contributes a total of approximately 19 PJ to energy savings. With a saving of just under 4 PJ the federal states make a further important contribution to the energy savings of the public sector.

A detailed analysis makes it clear that the energy savings at federal level are due in particular to reductions in built surface area. While the built surface area of the civil federal administration remains approximately constant at just under 27 million m² gross built surface area with a slight increase to 2016, the built surface area in non-civil usage falls by almost 50 % to 31 million m² gross built surface area in 2016. Nevertheless, the overall specific energy consumption values of the federal administration's real estate stock also fall to 2016. However, the savings thus achieved are partly offset by additional electricity consumption, in particular in the ICT sector. The federal government has already reacted to this rising electricity consumption in the ICT sector and has started a "Green IT Initiative" with the ambitious target of reducing the federal administration's electricity consumption in ICT by 40 % to just over 1 PJ/a by 2013. In addition, the introduction of energy efficiency standards in procurement of ICT should have a positive effect.

This trend towards falling heat consumption and rising electricity consumption can similarly be observed in the federal states. As the built surface area of the state properties barely changed in the period under review and no major changes are expected in future, the surface area effects here are negligible, so almost the entire change in consumption can be put down to changed specific consumption values. Thus by means of forward projection of the trend, in 2016 an energy saving of just under 5 PJ/a can be expected in the heating sector. By contrast, ICT-related additional consumption is forecast for the electricity sector in particular, and this would wipe out more than two-thirds of the energy savings achieved in the heating sector.

At municipal level energy savings were made in particular by means of a reduction in heat consumption and in electricity consumption for street lighting. The contribution of the heating sector is more than ten times

Table 4.7.5. Overview of the top-down savings in the public sector at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Top-down	vs. 1995	vs. 2007			vs. 1995
Total public sector	**31.7**	**5.4**	**11.7**	**15.9**	**47.6**
Federal government	14.7	1.5	3.0	4.4	19.1
States	2.4	0.4	0.9	1.4	3.8
Municipalities	14.6	3.5	7.8	10.1	24.7

that of street lighting. In contrast to the trend established in the federal government and states there is no significant increase in electricity consumption in municipal properties, nor is one to be expected in future.

4.7.6 Bottom-up: quantified measures

The analysis of the individual measures by means of bottom-up methods highlights the importance of the Future Investments Act (ZuInvG), which compared to the other instruments is responsible for more than 40% of the savings identified by means of bottom-up methods. The KfW programmes for the public sector are similarly of relatively great importance.

However, in principle, in evaluation of the energy savings of individual measures in the public sector calculated by means of bottom-up methods it must be taken into account that only part of the activities of the federal government, states and municipalities were recorded and that the latter still took and implemented significantly more measures than were listed in the Second NEEAP. This applies in particular to the activities of the approximately 13,000 municipalities. Due to their large number and comparatively limited scope of application, it was not possible to include any of the municipalities' independent programmes in the bottom-up analysis. However, the results of the top-down calculations indicate considerable activity and volume effects at municipal level and highlight the very great importance of municipalities for energy savings in the public sector.

At state level a large number of measures and programmes were identified that produce energy savings in the public sector, for example regulatory measures such as procurement guidelines, state economic pro-

Table 4.7.6 Overview of the bottom-up savings of selected measures in the public sector at conversion factor for electricity 1

Energy saving	2007	2010	2013	2016	Total
Unit	PJ/a (conversion factor for electricity 1)				
Bottom-up – quantified	1995–2007	2008–2010	2008–2013	2008–2016	1995–2016
Total public sector	**1.1**	**9.1**	**14.3**	**16.4**	**17.2**
Energy-efficient modernisation of the social infrastructure	–	1.3	1.3	1.3	1.3
Energy Savings Programme for Federal Government Properties (€120m Programme)	0.2	0.8	1.0	1.5	1.7
KfW Energy-efficient Redevelopment – Municipalities	–	0.5	1.1	1.8	1.8
KfW Municipal Loans – Energy-efficient Building Redevelopment	0.1	0.3	0.3	0.3	0.4
KfW Social Investment – Energy-efficient Building Redevelopment	0.0	0.2	0.3	0.5	0.5
Future Investments Act (ZuInvG)	–	4.5	7.7	7.7	7.7
Contracting for federal government properties	0.1	0.1	0.1	0.2	0.3
Green IT Initiative of the federal government	0.1	0.3	0.7	0.9	1.0
mission E	0.3	0.3	0.3	0.3	0.3
Activities of the federal states in the public sector	0.3	0.8	1.5	1.9	2.2

grammes, and programmes of lending to municipalities. In addition many federal states address energy-saving measures of private actors by means, for example, of programmes in the buildings sector or for companies. Overall it was only possible to quantitatively evaluate a small percentage of these measures, but in addition further important fundamental developments were identified, in particular in the organisation of property management into organisational forms intrinsically promoting energy saving, and these led in some cases to considerable energy savings and are likely to have formed the basis for increased and effective activity aimed at energy saving at federal state level. The most important trends include the following:

- → The bundling of areas of operation in independent state construction agencies since 2000.
- → The transition to an organisational structure based on the landlord-tenant model[26], which can lead to optimisation of space utilisation.
- → Transfer of responsibility for construction and cost to the user (owner model[27]), in particular with large properties such as institutes of higher education.
- → Increased use of contracting models.
- → Taking into account of life-cycle costs in invitations to tender for construction services.
- → Optimisation of operation by means of intensified energy controlling, more training courses, and network-building among the heating installation operators and operations supervisors.

At local level the municipalities similarly use a large number of different measures for increasing energy efficiency. In particular these include investment measures such as general property redevelopment, completion of contracting projects, expansion of local heating networks, redevelopment of street lighting including the installation of LED lamps, construction of central district heating plants at schools, optimisation of the existing control technology, use of biomass heating, and leasing of urban roof areas for the expansion of photovoltaic installations. To these can be added many activities to do with publicity and public relations work and the drawing up of conceptual foundations, carried out by municipalities. This applies for example to the introduction of municipal energy management, the execution of training courses or workshops on energy saving for facility managers, the carrying out of energy-saving projects in schools, or the holding of days of action with free energy counselling for private households. In addition, a large number of municipalities address energy-saving measures by private actors by means of funding programmes or information and counselling measures for private households or companies.
In general the debate on the subject of energy efficiency in the municipalities should also be seen in the context of municipal climate protection, which is pursued and dealt with there with great awareness. For execution of measures for increasing energy efficiency their sometimes greatly varying organisational, financial and political frameworks are also critical. This also means that corresponding activities cannot be pursued and carried out with the same intensity and degree of priority in all municipalities.

Thus the two studies carried out in the framework of the Second NEEAP demonstrate that there are significant differences between the size categories in terms of inhabitants depending whether or not there is a facility management function. In more than 90 % of the cities with more than 50,000 inhabitants personnel resources are tied up with facility management, while in the cities with less than 50,000 inhabitants the proportion falls sharply. Compared to major cities, smaller cities and municipalities have fewer properties of their own and therefore lower management and operating costs.

Even more pronounced differences between the cities and municipalities become apparent in respect of the number of inhabitants when it comes to distribution of municipal energy representatives. The great majority do not employ any energy representatives. Energy representatives mainly operate in cities: almost 65 % of the cities with more than 50,000 inhabitants and 96 % of the cities surveyed with more than 100,000 inhabitants employ one or more municipal energy representatives. Accordingly, municipal energy reports, the purpose of which also includes documentation of the activities of the energy representatives and which also fall within the latter's area of responsibility, are mainly submitted in larger cities. These figures allow the assumption that for

26 The landlord-tenant model involves conclusion by the state authorities or their agencies with the state of transfer/user agreements that are similar to a lease contract. This is intended to lead to additional cost transparency and improved use of resources.

27 With the owner model the user of the property assumes all the duties of the owner and principal.

small municipalities the cost of a separate municipal energy representative is not viable or that financing is difficult. A possible approach to finding a solution would be to start an intermunicipal cooperation venture to set up an authority to take care of the energy management of several small municipalities. This model has been discussed in expert groups, but has not yet been implemented in practice.

It is nevertheless clear overall that the question of the existence of municipal facility management, energy representatives, or the drawing up of corresponding reports and climate protection concepts allows inferences to be drawn in respect of the debate on issues such as energy-efficient building redevelopment and energy-efficient procurement in the municipalities. At the same time the collection and evaluation of data on energy consumption in municipal properties, for example, forms a necessary foundation for any consideration of the execution of energy-saving measures and can often only take place if personnel and time are available for these tasks. One can therefore conclude that data on energy consumption and energy savings is more likely to be available in municipalities which have facility management or an energy representative than in those which do not. Ultimately, though, and most importantly, municipal commitment in the area of energy efficiency also has a financial dimension. Although the debate about and the efforts towards execution of energy-saving measures have increased in the municipalities in recent years, beneficial investments and measures can be confronted with a series of obstacles. According to information supplied by the municipalities, situations like absence of capital for investment measures, competition with other investments with higher priorities in some cases, the length of the amortisation periods or lack of time, and the large workload of the municipal employees mean that energy-saving measures are not carried out on a greater scale in the municipalities (Prognos/DIFU 2011).

The quantified measures listed in the summary table are described individually below.

M 76: Future Investments Act (ZuInvG)		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding	Start: 2009	End: 2011	
Description	In the framework of the federal government's Second Economic Package of January 2009 the law on the execution of future investments of the municipalities and federal states (Future Investments Act [ZuInvG]) is making cash available to the municipalities and states to a total value of €10bn. The federal states and municipalities are taking on a co-financing share of 25 %, so that a total of at least €13.3bn is available for additional investments in the training and education infrastructure and for improvement of the remaining infrastructure. In addition numerous projects and measures for increasing energy efficiency are being carried out.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **7.7 PJ**	–	4.5 PJ	7.7 PJ
Reference	*Prognos/DIFU 2011*		

M 77: Energy Savings Programme for Federal Government Properties (€120m Programme)		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2006	End: 2010	Extension from 2011 budgetary year intended
Description		Under the so-called €120m Programme those energy-saving measures in respect of the federal government's real estate stock are being (partly) financed which clearly exceed the level of requirements of the prevailing EnEV. Every attempt is being made to divide resources equally between civil and non-civil properties.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**1.7 PJ**	0.2 PJ	0.8 PJ	1.5 PJ
Reference		*BBSR 2010; Prognos/DIFU 2011*		

M 78: Activities of the federal states in the public sector		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 1995	End:	
Description		→ progres.nrw, market launch, public sector (North-Rhine Westphalia); → Climate Protection Plus Programme, municipal (Baden-Württemberg); → Energy-efficient street lighting (Baden-Württemberg, Lower Saxony); → REN/RENplus Programme (Brandenburg); → Hesse's Special Investment Programme (Hesse); → KIF Municipal Investment Fund (Schleswig-Holstein); → Climate protection funding guideline, public sector (Mecklenburg-Western Pomerania); → Building Construction Investment Programme (Saarland); → Climate Protection Stimulus Programme 2008–2009 (Baden-Württemberg)		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**2.2 PJ**	0.3 PJ	0.8 PJ	1.9 PJ
Reference		*Prognos/DIFU 2011*		

M 79: Energy-efficient modernisation of the social infrastructure		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding	Start: 2008	End: 2009	
Description	The "Investment Pact 2008" of the federal government, states and municipalities for energy-efficient modernisation of the social infrastructure subsidised planning and construction projects for buildings in the social infrastructure in need of energy-related improvement. The allocation was made by way of a subsidy towards the investment costs. Energy savings in the redeveloped buildings are reported to a monitoring body at the BMVBS. Funding was allocated in particular to municipalities in a difficult budgetary situation which consequently had difficulty financing energy-saving measures. The latter received funding of up to 90 % (compared to 66 %) of the investment costs. The buildings had to be redeveloped at least to the level of a new building pursuant to EnEV DIN 18599. Verification of this was on the basis of an energy requirement certificate. The Investment Pact allowed the implementation of measures which would not otherwise have been possible due to existing financing constraints.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **1.3 PJ**	–	1.3 PJ	1.3 PJ
Reference	*BMVBS 2010; Prognos/DIFU 2011*		

M 80: KfW Energy-efficient Redevelopment – Municipalities		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Funding	Start: 2009	End: not determined	
Description	KfW banking group is providing direct loans to municipalities for energy-efficient redevelopment of schools, school sports halls, children's daytime facilities, and buildings used for work with children and young people. Funding is awarded for redevelopment to new construction level (programme component A) in conformity with KfW efficient building standards 100 and 85 as well as certain individual measures such as thermal insulation and heating or window replacement (programme component B). This programme is the successor to KfW Municipal Loans for Energy-efficient Building Redevelopment. Continuation of the KfW Municipal Loans for Energy-efficient Building Redevelopment Programme (see M 77).		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **1.8 PJ**	–	0.5 PJ	1.8 PJ
Reference	*KfW 2010; Prognos/DIFU 2011*		

M 81: KfW Municipal Loans – Energy-efficient Building Redevelopment		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2007	End: 2009	
Description		KfW banking group is providing direct loans to municipalities for energy-efficient redevelopment of schools, school sports halls, children's daytime facilities, and buildings used for work with children and young people. Funding is awarded for redevelopment to new construction level (programme component A) as well as certain individual measures such as thermal insulation and heating or window replacement (programme component B). Continuation from April 2009 as KfW Energy-efficient Redevelopment Programme – Municipalities (see M 76).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**0.4 PJ**	0.1 PJ	0.3 PJ	0.3 PJ
Reference		*KfW 2010; Prognos/DIFU 2011*		

M 82: KfW Social Investment – Energy-efficient Building Redevelopment (CO_2 Building Redevelopment Programme)		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive		
Funding		Start: 2007	End: not determined	
Description		KfW banking group is extending transmitted credits to municipalities for energy-efficient redevelopment of schools, school sports halls, children's daytime facilities, and buildings used for work with children and young people. Funding is awarded for redevelopment to new construction level (programme component A) in conformity with KfW efficient building standards 100 and 85 as well as certain individual measures such as thermal insulation and heating or window replacement (programme component B).		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**0.5 PJ**	0.0 PJ	0.2 PJ	0.5 PJ
Reference		*KfW 2010; Prognos/DIFU 2011*		

M 83: Green IT Initiative of the federal government				
Information, motivation, communication		Start: 2008	End: not determined	
Description		(1) Creation of a council of IT managers and IT control group members; (2) Objective: reduction by 40% of ICT-induced energy consumption in relation to base value of 650 GWh/A by 2013; (3) Drawing up of guidelines and best-practice examples; (4) Formulation of a continuous cross-departmental reporting system.		
Energy saving (total)		**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1	**1.0 PJ**	0.1 PJ	0.3 PJ	0.9 PJ
Reference		*BMI 2010; Prognos 2011*		

M 84: mission E			
Information, motivation, communication	Start: 2007	End: not determined	
Description	Campaign to change user behaviour in respect of energy consumption by the employees of the German armed forces. (1) Base module including introductory seminar, campaign compendium, consulting capacity at the North Rhine-Westphalia Energy Agency, internet forum, technical seminar, and (2) Individual supplementary modules in seven areas for action.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **0.3 PJ**	0.3 PJ	0.3 PJ	0.3 PJ
Reference	*EA.NRW 2010; Prognos 2011*		

M 85: Contracting for federal government properties		Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive	
Information, motivation, communication	Start: 2002	End: not determined	
Description	Counselling by the German Energy Agency on contracting projects is directed in particular at federal government properties with the help of guidelines, an internet portal, work aids, a contracting hotline, and support with project development. The objective of the counselling is to find energy supply and energy saving contracting services for federal government properties and to implement these with the help of third parties. The aim is also to exploit energy-saving potential in the public sector by means of financial and technical support from specialised companies. In addition to this contracting projects are leading to demand for particularly efficient technologies and products which is creating positive incentives for the market.		
Energy saving (total)	**Early action (1995–2007)**	**Current period (2008–2010)**	**Forecast (2008–2016)**
CF=1 **0.3 PJ**	0.1 PJ	0.1 PJ	0.2 PJ
Reference	*dena 2010a; Prognos/DIFU 2011*		

4.7.7 Further measures and projects

M 86: Federal ministry buildings	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: self-imposed commitment	Term: since 2000
In the National Climate Protection Programme of 13 July 2005 the federal government reaffirmed its self-imposed commitment of 18 October 2000 to reduce CO_2 emissions in its sector by an average of 30 % during the period 2008 to 2012 compared to 1990. Following the announcement on 18 October 2000 of its self-imposed commitment the federal government is striving to achieve the additional target of a reduction in CO_2 emissions for its sector of 50 % by 2020 compared to 1990. According to the data currently available the federal government assumes that the target stated in the self-imposed commitment for all the properties in its sector will at least be met, if not exceeded. Under the Energy Savings Programme for Federal Government Properties (€120m Programme) measures for structural thermal insulation and measures related to technical building equipment for savings in energy and reduction of emissions impacting on the climate are being subsidised. Examples of additional measures for fulfilment of the target are contracting projects in federal government properties.	
Further information: *www.bundesregierung.de*	

M 87: Climate protection projects in social, cultural and public institutions	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: 2008-2011
Various activities in the municipal sector are funded through the funding programme, among other things climate protection concepts and part concepts, advisory assistance in the implementation of existing concepts by a climate protection manager, deployment of energy-efficient technologies in electricity usage, and pilot projects with the CO_2 neutrality model. The municipal climate protection projects are intended to allow municipalities to identify and exploit potential savings in the public sector. The projects are thus initially aimed at public administration departments and sponsors of social and cultural institutions. However, as a result of the public relations work in the projects and of demonstration effects the users of these institutions and thus also the population at large will be addressed. As at 31.12.2009 a total of 688 projects with a total volume of €101m and subsidies of about €52m have been approved, in some cases to be executed over several years.	
Further information: *www.bmu-klimaschutzinitiative.de*	

M 88: Fifty/fifty – incentive schemes for schools to save energy	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: continuous
In order to promote energy-conscious day-to-day behaviour, some German federal states, cities and municipalities have implemented special incentive programmes such as “Fifty/fifty” in schools. The incentive of Fifty/fifty is that each participant school receives 50 % of the energy costs saved by means of conscious user behaviour for its own free use. The aim is to save electricity and heat by means of simple and practicable energy-saving measures.	
Further information: *www.fiftyfiftyplus.de*, *www.ufu.de*	

M 89: Guide to Sustainable Construction	Measure within the meaning of Art. 10, Para. 2 of the Buildings Directive
Type of measure: information, motivation, communication	Term: since 2001
The Guide to Sustainable Construction is a decision-making and work aid for the design, maintenance, operation and utilisation of properties. The current guide describes methods and procedures for the implementation of sustainability measures in construction and contains recommendations for structural and architectural building quality, technical building equipment, and energy supply. In addition the guide formulates targets to be complied with for the design of new building projects and building extensions. With its requirement of compliance with sustainable construction rules in all federal government properties the government is pursuing the objective of fulfilment of its exemplary role in improvement of energy efficiency as well as encouraging imitation in the properties of the federal states and municipalities.	
Further information: *www.nachhaltigesbauen.de*, *www.bmvbs.de*	

5. The market for energy-related services in Germany

Already today Germany has the largest and one of the most developed markets for energy services[28] in the EU (European Commission 2010a). A wide variety of energy services are supplied by a multitude of providers in the Federal Republic of Germany. The latter vary greatly in respect of size and specialisation and compete hard with each other.

Below we outline the main features of this market. It is difficult to offer coherent observation and description of the total energy services market and all its sub-sectors due to the heterogeneity of its participants and above all its products. Information about market size is based on different studies, which in turn are based on surveys and on evaluations of existing statistical data such as figures from the associations or the state funding programmes. The various service industries have been examined with varying levels of thoroughness in these studies. For the very important contracting market, for example, there is a large number of studies which analyse the supply side and the demand side individually. It is possible to make sufficiently precise statements on the size of the total market. Assessment of the market for energy audits and for other energy efficiency measures is more difficult. Studies and data do exist for certain sub-markets, e. g. energy consultations for residential buildings, but they are not sufficient to give a general overview. In particular for the other energy services and energy efficiency measures sector, simply due to the multitude of relevant technologies, possible uses and innovation potential in the market underlying these services it is currently only possible to a limited extent to obtain an overview of the market as a whole.

In respect of the total volume of the energy services market and its future development various studies anticipate significant short- and medium-term annual growth. Nevertheless, there are no reliable quantitative estimates for this. With the forecast growth in the energy services market coupled with its growing importance, an increased requirement for more detailed market data and information can be expected. Against this backdrop the BfEE has been entrusted by the EDL-G with the task of monitoring and analysing the energy services market and submitting proposals for its further development to the federal government. In addition it will among other things contract out market monitoring studies and use the supplier list administered pursuant to the EDL-G.

5.1 "Contracting" energy service

Contracting, in particular energy-saving contracting, is one of the most effective instruments for increasing energy efficiency and can at the same time facilitate the financing of energy-efficient and therefore cost-saving technologies.

The term *contracting* is defined by DIN 8930 – Part 5: Energy contracting is an integrated energy services product, designed to bring about long-term improvement in the energy and cost efficiency of buildings or production operations. An external energy utility (contractor) carries out a modular package of measures (from the components design, construction, operation and restoration, optimisation, fuel procurement, (co-) financing, and user motivation). The contractor assumes technical and economic risks and issues guarantees for the cost and results of the energy service over the total contract term. Characteristic features of contracting as opposed to other energy services are the assumption of warranties over an extended contract term and the making of investments in energy efficiency measures at the contractor's own risk.

Forms of contracting

A distinction can be made in the market for energy contracting between four essential products or contracting models with varying degrees of intervention in the installations and buildings of the contractee as well as differing levels of assumption of risk by the contractor:

- Energy-savings performance contracting: The contractor takes care of the financing, planning, execution and management of energy-saving measures. The subject matter of the contract is guaranteed energy cost-cutting by the contractor for the client. The contractor therefore carries out

28 In this section use of the term "energy services market" also includes the market for energy audits and other energy efficiency measures, unless explicitly stated otherwise.

energy-saving measures which are mainly concerned with reducing the energy requirement, thus supply of energy (e.g. optimisation of the heating system) and energy consumption (e.g. installation of energy-efficient equipment, optimisation of heat distribution, etc.). The contractor receives a pro rata share of the energy costs saved as remuneration.

- → Energy supply contracting: The contractor designs, builds, finances and maintains an installation for the supply of energy. The client receives the energy on fixed conditions. The subject matter of the contract is the supply of energy. The efficiency-boosting measures of the contractor are therefore aimed at optimisation of the installation itself (e. g. optimisation of the heating system, production of electricity from a combined heat and power generation facility).
- → Operational management contracting: This differs from energy supply contracting merely in that the contractor takes over and optimises an existing installation.
- → Financing contracting: The contractor designs, finances and sets up an installation for the supply of energy. The client operates, monitors and repairs it. Repayment of the installation costs takes place over the contract term. Here the emphasis is on the financial service in combination with professional selection of the energy installation.

The contracting market is currently dominated by the energy supply contracting model. In energy supply contracting the scope of action of the contractor in respect of increasing energy efficiency is narrower, as in the framework of this model it is geared to efficient provision of energy. With energy-saving contracting, moreover, greater energy efficiency potential can be realised on the demand side, as besides efficient provision of energy use of the energy is also optimised. However, this leads to significantly deeper interventions into the structures and processes of the property in question and thus to more demanding requirements in terms of the establishment of areas of responsibility and the definition of interfaces between contractor and client. Operational management contracting is a comparatively simple contracting model, as it is not associated with any ownership or economic delimitation of the power engineering installations. However, from an energy efficiency point of view the importance should not be ignored, as here, too, an inherent incentive for the energy-efficient operation of installations is created.

Market volume

Current studies assume total annual sales for the total contracting market of approximately €1.8-2.4bn (Prognos 2010; Wuppertal Institut/ASEW 2010). This corresponds to approximately 40,000 to 50,000 ongoing agreements (Prognos 2010). Robust annual growth rates of approximately 10 % are estimated for the past few years, and these are expected to continue over the next few years (Prognos 2010). By far the highest sales volume in the contracting market is generated by energy supply contracting. In a survey carried out in 2008, of the companies active in the contracting market significantly more than half stated that they achieved more than 80 % of their sales in the contracting business with energy supply contracting (BMVBS/BBSR 2009). Due to the high market shares generated in this sector, the savings made from energy supply contracting are certainly considerable. A current study estimates an annual market volume of approximately €250-350m and thus calculates that approximately 10–15 % of the total contracting market is accounted for by the energy-saving contracting sector (European Commission 2010a).

Contracting providers

The total number of companies active in the German contracting market is estimated at approximately 250 to 500, of which about 250 are classed as being active. Within this group of active contracting companies there are large differences between estimates of the number of ongoing contracts. The range is from less than five contracts up to several hundred per company. Besides this it can be assumed that the number of suppliers in the submarket for energy-saving contracting is much smaller than in the market for energy supply contracting. This is presumably also likely to be connected with the fact that energy-saving contracting requires a higher level of knowledge as well as the assumption of comparatively greater risk on the part of the contractor.

In the framework of the above company survey executed in 2008, by their own admission the suppliers of contracting products are for the most part original

energy service contractors (approximately 36 %), municipal utilities[29] (25 %), and energy utilities (approximately 17 %), while just a small percentage of the suppliers are engineering firms, designers or workshops (together approximately 5 %).[30] Among the energy utilities contracting is for the most part carried out by subsidiaries, while the companies calling themselves original energy service contractors are independent companies or subsidiaries of building and metering service providers or of suppliers in the technical building equipment (TBE) business. According to the same study these suppliers differ not only in respect of their business background and resulting area of specialisation and expertise, but in particular also in respect of their size. While the majority are small and medium-sized companies, about 10 % reported total annual sales of over €200m. More than half have annual sales under €10m and in terms of sales are therefore small companies under the EU Block Exemption Rule (BEI et al. 2009a). Overall, therefore, the German contracting market contains a multitude of diverse suppliers with different competencies and consequently varying operational focal points.

Client segments

The most important client segments for the contracting companies are trade and industry on the one hand and the residential property market on the other, in particular the rental sector. According to rough expert estimates and surveys made by contracting companies an approximate respective annual market volume of €1bn can be assumed for both sectors (Prognos 2010). Due to the increasing cost pressure on companies and the assumption of rising energy prices in trade and industry, particularly great growth potential is expected in future. From the point of view of the companies the main potential in the residential property rental sector is in properties with a minimum size of approximately ten residential units. There is similarly still considerable untapped potential here in some cases (BEI et al. 2009a). In addition the contracting sub-market for public-sector properties, which according to current studies is estimated at approximately 10 % of the total contracting market, plays an important role (Prognos 2010). Despite this comparatively small market share considerable growth potential and corresponding opportunities for contracting suppliers are expected over the next few years for this sector too, due among other things to a rising level of awareness of contracting among decision-makers in the municipalities.[31]

Appraisal

The positive development of the contracting market over the past few years, the existing growth potential, the forecast further growth, a growing level of awareness of contracting among decision-makers on the client's side, together with increasing involvement of larger companies with high yield expectations show that contracting represents an important instrument for economic development of existing energy efficiency potential through market mechanisms. From an energy and climate-policy point of view the strengthening of energy efficiency-boosting forms of contracting is desirable. The expansion of the opportunities offered by energy contracting announced against this background in the federal government's energy concept should further support and strengthen the forecast positive development. In this connection the federal government will present a bill proposing a harmonised framework for heat supply contracting, in particular for the residential property rental sector. Overall, however, the suppliers are themselves also required to develop the more complex energy-saving contracting products in additional segments or in some cases to standardise the energy supply contracting services to the extent that the large market segments with smaller properties can also be developed, for example by means of bundling several smaller properties.

Examples of successfully executed contracting projects in the market:

Numerous companies and public institutions have already recognised the great potential of contracting for energy- and cost-cutting and as a financing instrument; for example a small municipality in Baden-

29 According to a membership survey carried out from December 2010 to January 2011 by the Working Group on Economical Energy and Water Usage (ASEW) and the Association of Municipal Companies (VKU), in which a total of 120 municipal utilities participated, 53% of the municipal utilities offer contracting in the area of heating systems alone. According to the survey the services of three-quarters of these companies are also targeted at private clients (VKU/ASEW 2011).

30 The remaining approximately 18% of the companies surveyed provided no data on this (BEI et al. 2009).

31 The level of awareness of contracting should increase further, also among decision-makers in the residential property market as well as in trade and industry (Prognos 2010).

Württemberg. For the primary school there the municipality agreed with an energy utility an energy-saving contracting plan under which the contractor guaranteed the education authority a pre-established maximum energy consumption volume over a defined contract term. In order to achieve the latter, following analysis of the potential savings of various possible solutions, the contractor carried out partial modernisation of the building by means of roof renovation, fitting of new windows and new heat insulation, installation of a modern wood-pellet boiler, and the use of energy-saving pumps. As a result of these measures the school was able to reduce its energy consumption by more than 40 %.

Energy-saving contracting has also proved its value with hospitals. For example an energy-saving contract for heat and electricity with a 12-year contract term was concluded between a large hospital and its energy utility. The hospital is already sharing the savings during the term of the contract, and thereafter it receives the full annual saving. The hospital started to benefit from contracting at just the right moment, as no funds for energy modernisation measures were available at this point in time. The package of measures, which was financed by the contractor, included modernisation of the technical equipment for lighting, air-conditioning/heating/ventilation, pumps, drive units and ICT as well as optimal control of the latter, and besides this active inclusion of the hospital staff by means of information measures. So far the measures have cut energy costs by 37%, which corresponds to €200,000 annually. In addition water consumption was cut by a massive 45 %, among other things by equipping the steam sterilizers with water-saving switches.

A growing number of municipalities are also using contracting solutions, for example a medium-sized city in North-Rhine Westphalia. Due to a lack of financial resources this municipality issued its first ever public invitation to tender for an energy-saving contract for the redevelopment of its street lighting. The energy service contractor that was awarded the contract invested extensively in the infrastructure. Almost 5,000 old lamps, a large number of which were high-pressure mercury vapour lamps, were exchanged for energy-efficient high-pressure sodium vapour lamps; the same process was used for obsolete ballasts and lateral luminaires. The installation of autotransformers for new, energy-efficient lighting management for gradual voltage reduction during the evening and night hours completed the schedule of measures. Even after the first year of the contract out of a total of more than five years, it was clear that the contractually guaranteed 44 % electricity saving had been achieved.

All three measures received the “Energy Efficiency Good Practice” label of the German Energy Agency.

5.2 Energy audits

An energy audit within the meaning of the EDL-G is a systematic method for obtaining sufficient information about the existing energy consumption profile of a building or group of buildings, of an operational procedure in the manufacturing sector, or of an industrial plant or of private or public-sector services in order to determine and quantify the opportunities for energy savings and record the results in a report.

Taking into account this definition, the energy audit services offered make this a very heterogeneous market. The products on offer in the market range from the ubiquitous and comparatively inexpensive issuing of energy performance certificates to the detailed, one-day or longer on-site energy consultation, for example in respect of buildings and/or production plants in companies. On the basis of various data from scientific studies, from associations and from other institutions such as the German Energy Agency, as well as from the government funding programmes in the area of energy counselling, statements about the energy audit market can be made in respect of some of these segments.

Energy performance certificate sub-market

For the market segment concerned with the issuing of energy performance certificates projections based on random sample surveys made in the framework of a current scientific study (BMVBS 2010a) have shown that a total of just under 1.9 million energy performance certificates for residential buildings were issued up to May 2009. Of these approximately 1.2 million were consumption certificates and about 700,000 requirement certificates. Consequently even before the performance certificate requirement had fully come into effect just over 10% of the residential building stock in Germany had energy certificates,

though there was still market potential for additional certificates to be issued. By contrast the market for residential buildings owned by housing associations is saturated. In that market 87 % of the housing associations have themselves issued certificates for 90 – 100 % of their residential property units. In addition to this the survey revealed that a large share of the energy certificates are issued by very well qualified specialists. 62 % of all issuers surveyed are architects or engineers (a total of 71 % of the surveyed issuers have a higher education qualification), and the latter issued 67 % of all the certificates issued by the surveyed issuers.

No reliable data are available in respect of the total number of issuers in Germany. However, there are several publicly accessible databases in which issuers of energy performance certificates can register. Thus a total of about 11,000 issuers are currently listed in the database of the German Energy Agency. Of these about 1,000 issuers of energy certificates have the quality seal of the German Energy Agency. Energy certificates issued with this quality seal must comply with certain quality requirements in respect of the reliability of assessment of the energy building quality and can only be issued for residential buildings on the basis of the energy requirement. So far about 1,200 energy certificates have been issued with the quality seal of the German Energy Agency.

Energy consultation sub-market

In the energy audit market, market data can similarly be provided relatively easily for parts of the market segments for energy consultations for residential buildings, energy consultations for non-residential buildings, and optimisation of processes in SMEs. The basis for this is provided by data from the state funding programmes of the federal government which exist in this sector. For the energy counselling in residential buildings market segment this is on the one hand the “on-site-energy consultation in residential buildings” administered by BAFA and on the other hand the centre-based energy counselling of the consumer advice centres. The on-site counselling requires visual inspection of the residential building, explanation of the findings and the creation of a written report by a qualified energy advisor, and funds this by means of corresponding subsidies. The energy consultations at the consumer advice centres are initial consultations held at the consumer advice centres themselves in return for a contribution to costs of five euros and carried out by qualified energy advisors; for the interested consumers this represents an initial orientation session designed to determine and exploit their own potential for energy savings. The energy counselling of SMEs related to non-residential buildings and optimisation of processes is funded by the federal government by means of the KfW’s “Special Fund for Energy Efficiency in SMEs”. In the framework of this programme initial and detailed consultations with SMEs using qualified energy advisors are funded by means of investment subsidies.

Based on the structure of the qualified energy advisors in these funding programmes the competition on the supply side in both sub-markets (consultations for residential and non-residential buildings as well as for process optimisation in SMEs) is very heavily dominated by a large number of small and medium-sized energy consulting companies, in particular firms of architects and consulting engineers as well as engineers. It should be noted, however, that the funding programmes of the federal government do not account for the total market for energy consultations on the supply side. The energy consultations of the energy utilities are not included in the funding programmes. This applies in any case to the large supra-regional energy utilities as well as a multitude of municipal utilities, which offer energy consultations for residential buildings either themselves (for example in service centres) or through co-operation partners (for example firms of engineers or architects or workshops) (VKU/ASEW 2011). To these can also be added numerous workshops, which similarly offer their customers energy consultations which they provide independently.

A total of well over 10,000 energy advisors are currently registered in the “On-site Consultation” funding programme, and of these just under 4,000 advisors actually carried out energy consultations in 2010. For independent energy counselling for non-residential buildings and process optimisation of SMEs data can be derived from the KfW’s “Special Fund for Energy Efficiency in SMEs” funding programme. Approximately 2,000 advisors are registered in the KfW’s advisor exchange for execution of these energy efficiency measures. However, the latter appear to be building energy advisors for the most part. There are clearly far

fewer energy advisors in the process technology or green IT sectors so far. This at least is the conclusion of a survey by the regional partners which brokered the funding in the framework of the evaluation of the funding programme (IREES/Fraunhofer ISI 2010).

In respect of the market volume for energy consultations within the funding programmes referred to the following statements can be made: In the course of the on-site programme, in 2009 more than 35,000 energy consultations were carried out that were eligible for assistance. These led to total sales of over €25m, and in 2010 the number of consultations was 18,000 with total sales of over €15m.[32] As far as the consumer advice centres were concerned, 90,000 private consumers received individual energy counselling in 2010. In the framework of the "Special Fund for Energy Efficiency in SMEs" funding programme for power engineering process optimisation about 4,000 projects related to this are currently in progress. Moreover, with an improved information base for the recipients of counselling in respect of the opportunities for implementation of energy-saving measures the energy consultations carried out in the framework of the funding programmes create incentives for appropriate investments.

For other market segments, such as services for process optimisation in large companies, for rental of electricity meters, or for energy consultations outside of the federal government funding programmes which can similarly be allocated to the energy audit market sector, no adequate data is currently available. However, in future additional information on market events can be expected through the supplier list operated by the BfEE since April 2011.

5.3 Other energy services and energy efficiency measures

According to the definition of the EDL-G and the ESD the term "energy efficiency measure" is extremely broadly formulated. According to this energy efficiency measures are any measures which as a rule lead to verifiable and measurable or estimable energy efficiency improvements (cf. Art. 3, Letter h of the ESD; Section 2, No. 8 of the EDL-G). This openness is most certainly intentional, to ensure flexible understanding of the term allowing for future development. This nevertheless means that merely due to the diversity of possible technologies and innovations it is very difficult to obtain and project a general overview of the resulting measures when describing this market.

Accordingly, in the following representation only a small number of selected market segments can be described among the other energy services and energy efficiency measures. They are described briefly and, where possible, estimates of their market volume are given.

5.3.1 Energy-efficient building redevelopment and energy efficiency measures in SMEs

In respect of the market for energy-efficient building redevelopment the following general key data can be cited in order to provide a rough impression of the existing market potential: The total building stock in Germany comprises approximately 17.3 million residential buildings with about 39 million residential units, of which about 75 % were built before 1978 and thus before the first Thermal Insulation Ordinance came into effect. To this can be added approximately 1.5 million non-residential buildings, of which in the public sector alone there are approximately 40,000 schools, about 48,000 kindergartens, nurseries and crèches, and several tens of thousands of school sport halls. More than half of these approximately 150,000 public-sector buildings are in need of energy redevelopment, in particular schools built in the 1960s and 1970s. In the buildings sector as a whole there continues to be great energy saving potential and thus also market potential in respect of thermal heat (heating of buildings and water heating).

In view of this considerable efforts are now already being made to modernise Germany's building stock by means of energy-efficiency redevelopment of buildings. Lack of information about potential savings as well as the financing constraints of private and public-sector building owners in addition to relatively long amortisation periods of up to twenty years and longer in some cases are nevertheless leading to a frequent need for additional incentives to exploit the available

32 The number of consultations carried out is calculated on the basis of the number of consultations for which financial assistance was paid in the years in question.

potential savings. Correspondingly, for many years there have been various opportunities to take advantage of funding through a series of funding programmes, provided by the federal government in particular. According to a report by the International Energy Agency, Germany continues to be the leader in energy efficiency measures in the buildings sector (IEA EE Working Party 2010). The following presentation of the effects of selected funding programmes gives an initial impression of the size and potential of this market. First, however, it should be mentioned that a large number of the more than 1,000 energy utilities (supra-regional utilities and municipal utilities) – for the purpose of customer allegiance or for other reasons – offer funding programmes for building insulation, exchange of heating systems, installation of heat recovery systems, etc.

For the residential buildings sector a large number of funding instruments are available through corresponding programmes of the municipalities, states and federal government. At federal level – in addition to programmes for funding energy-efficient new buildings – besides the energy efficiency components of the market incentive programme for promotion of renewable energies and several programmes of the KfW, the KfW CO_2 Building Redevelopment Programme is the largest funding instrument for the building stock. In the framework of the CO_2 Building Redevelopment Programme loans or subsidies are awarded by the state-run KfW development bank for energy-related modernisation or construction of residential buildings. Investment in energy efficiency measures in residential buildings carried out on the basis of loans and subsidies under the CO_2 Building Redevelopment Programme amounted to more than €21bn in 2010.

For the public buildings sector, funds totalling €10bn have been made available through the federal government's current Second Economic Package running from 2009 to 2011 for additional investment in infrastructure measures, including for educational institutions such as schools and universities. The federal states and municipalities take on a cofinancing share of 25 %, so a total of at least €13.3bn is available for investment. These funds are also used to finance numerous projects for energy-related redevelopment of buildings. With the KfW programmes for the redevelopment of buildings in the municipal and social infrastructure financed by the CO_2 Building Redevelopment Programme, since 2007 more than 950 buildings have undergone energy-efficient redevelopment. Another instrument is the investment pact adopted in 2008 for the energy-related redevelopment of schools, kindergartens, sports facilities, and other social infrastructure in the municipalities. Through the investment pact investment subsidies are awarded to municipalities with budgetary difficulties, some of which cannot participate, or cannot participate to a sufficient extent, in similar credit programmes and which do not have the resources to reduce the investment backlog that has accumulated over the past few years. Investments worth up to €900m were initiated in these municipalities through the investment pact in 2009. These measures also made an important contribution to securing and creating jobs in the SME and trades sector.

Besides efficiency-boosting measures in residential and public buildings, exploitation of the existing potential for increasing energy efficiency of SMEs by means of energy-efficiency redevelopment of buildings and optimisation of processes is similarly of great importance. Here, too, now as previously there are still considerable opportunities for market participants. A current scientific study examined by means of a representative random sample in the framework of a survey of SMEs the role and importance of energy efficiency in SMEs (Prognos 2010a). About 50 % of all companies surveyed said that the subject of energy efficiency is important or very important to them, while about two-thirds see opportunities in their companies for reduction of energy consumption. The percentage of companies that have implemented energy efficiency measures in the last three years has doubled compared to a previous survey carried out in 2005 to just over 60 %. Moreover, just under 50 % of the companies said that they use or have used energy services and gave as justification in particular value-added and quality features such as gains in know-how, price maintenance or price guarantees, and an increase in the likelihood of success of the measures. Overall, larger and energy-intensive companies comparatively frequently belong to the group of SMEs active in the area of energy efficiency and using energy services. At the same time, however, there are various obstacles preventing implementation of energy efficiency measures by smaller and medium-sized companies. In particular these include a lack of financing options, absence of knowledge of

potential and opportunities for increasing energy efficiency, a lack of personnel resources, and over-long amortisation periods.

Not least in view of this, the implementation of energy-saving measures in SMEs is supported by various funding instruments at state and federal level. At federal level the ERP Environmental Protection and Energy Efficiency Programme (part B) existing and implemented by the KfW since 2008 is worthy of mention; under this programme low-interest loans are awarded to SMEs for the implementation of energy efficiency measures for buildings or process optimisation. In 2010 loans totalling €675m were awarded under the programme. Of this just over half was invested in construction of new buildings and about a third in energy efficiency measures in the machinery stock including cross-sectional technologies.

Examples of successfully executed energy efficiency measures in building redevelopment
Examples of restructuring measures in public-sector buildings have already been listed under "Contracting". However, impressive savings in respect of energy use and energy costs in buildings are also achieved by industrial companies, especially if the planning concepts are already focused on energy efficiency criteria.

For example, in construction of his new plant a manufacturer of high-efficiency engines and fans pursued the objective of meeting the total heating requirement of the industrial building by means of optimal utilisation of any waste heat created in the production process. By means of regulated displacement ventilation such a high temperature is created under the ceiling that the air under the ceiling can be used directly for heating the adjoining parts of the building. Surplus heat is stored in a sprinkler tank, which in turn serves as a heat sink for a heat pump. By means of such intelligent utilisation of waste heat and optimised heat distribution the company makes total annual energy savings of 91 %. The energy savings in just the first year were higher than the additional cost of the efficiency-boosting measures in construction of the new plant. Thus the investment was amortised after just a few months.

A large supplier of automation technology achieved similarly high energy and cost savings in the course of expanding a location in Saarland. The objective was also minimisation of future energy consumption, and for this reason energy efficiency was taken into account as a planning parameter here, too. Sophisticated, innovative solutions were developed for air-conditioning and generation of compressed air and electricity. The installation of energy-efficient displacement ventilation and intelligent control technology together with the use of renewable energies and of a central district heating plant resulted in an energy saving of 38 %.

For their exemplary energy efficiency measures both companies received the Energy Efficiency Award of the German Energy Agency.

Examples of successfully implemented energy efficiency measures in industrial processes
Not only optimisation of installations and building redevelopment result in potential energy and cost savings for trade and industry enterprises. A frequently very powerful lever for improving energy efficiency which is similarly already recognised and used by a large number of companies is optimisation of industrial processes.

For example, with the help of innovative technology based on basic research, a small brewery managed to reconfigure the process of wort boiling and the evaporation of unwanted flavourings so that it reduced energy usage by a total of 80 %. The key component of the beer brewing process, and also responsible for a large part of the energy usage in beer brewing, is wort boiling in the wort kettle. During the brewing process hops are added to the beer wort, as a result of which the beer gets its characteristic taste. Unwanted flavourings escape with the steam. In order to achieve good total evaporation and to remove the required amount of unwanted flavourings, in the existing practice the wort kettle is heated with high energy usage. The brewery is now switching to a method based on the principle of multistage distillation. Using the counterflow principle the wort is fed through the steam allowing it to absorb additional flavourings and greatly reducing total evaporation as well as the corresponding energy usage.

In a small to medium-sized biotech company producing processed beer yeast products, modification of the production wastewater treatment process reduced electricity consumption by over 70 % and in addition cut usage of chemicals and the resulting waste volume. In its plans for extension of the wastewater plant the company systematically sought a holistic solution with the aim of optimised chemicals and energy usage, reduction of waste, and lower investment. In the treatment process used to date pollutants are eliminated by means of aerobic bacteria. However, the required injection of oxygen into the wastewater treatment plant meant that this was a very energy-intensive method. In addition this process produced a considerable amount of sludge, which in turn had to be drained using chemicals and then disposed of. In the course of extending the wastewater plant the company instead introduced an anaerobic procedure, as a result of which electricity consumption was considerably reduced and the entire chain of unwanted consequences (sludge formation, use of chemicals) was prevented. In addition the company uses the biogas arising in the water treatment process in a central district heating plant and can even feed surplus electricity into the power grid.

Both of the measures referred to above similarly received the German Energy Agency's Energy Efficiency Award.

5.3.2 Energy Management

Energy management comprises the sum of all the measures planned and executed in order to ensure minimum energy usage for the required performance. With the introduction of an energy management system influence is brought to bear on organisational and technical processes as well as on behaviour in order to reduce the total energy consumption of a company or organisation and to sustainably improve energy efficiency through a systematic approach. An energy management system comprises the organisation and execution of energy policy, the planning, implementation and operation, monitoring and measurement, inspection and correction, internal auditing, and regular reviewing by the management. Energy management systems are thus an instrument for consistent and systematic exploitation of potential for energy savings. Their use is suitable both for the public sector and for companies, and in particular for sectors using energy-intensive production processes. Thanks to achievable and in some cases very considerable energy savings and the accompanying cost reductions they strengthen the competitiveness of companies (BMU/UBA 2010). The essential difference between energy management and energy counselling is the requirement for continuous implementation of the former after introduction of an appropriate system, while the latter only involves a once-off situation analysis and recommendations for action based on this.

Since 2009 there has been a European standard for energy management systems, EN16001, and Germany participated directly in drawing it up through the corresponding DIN committee. The standard was also implemented in Germany by means of DIN EN16001: 2009. It can be used in companies and organisations of all sizes and from all sectors and was designed to allow it to be combined with other management systems. Thus in Germany, for example, about 45,000 companies and organisations have introduced the DIN EN ISO 9001 quality management standard and about 5,000 companies and organisations have met the environmental management requirements pursuant to DIN EN ISO 14001 (EMAS) (BMU/UBA 2010).

Notwithstanding these harmonised criteria, which can be applied to energy management systems by means of the standard, the concrete requirements made by companies of an energy management system vary according to the size, structure and energy intensity of the respective companies. The range of energy services offered is correspondingly broad. It extends from planning of an energy management system through consultation and implementation of individual components (e.g. energy management software[33] and measurement and control technology) to complete acceptance of energy management by a company. In addition, in the course of implementation of the measures identified by means of energy management additional services can be offered or demanded that are not directly connected

33 In general terms it is true that in carrying out operational energy management the number of different software-based energy management systems and their utilisation is increasing constantly (Prognos 2010).

with energy consumption, e.g. in tendering and award management (Prognos 2010). In the real estate sector energy management is frequently taken care of by providers of facility management services. To date there are no reliable market surveys on energy management, not even for definable subsectors (Prognos 2010). Notwithstanding this there are already innumerable cases of successful introduction of energy management systems in Germany, of which we briefly present some examples below.

Examples of energy management projects successfully implemented in the market

The implementation of an energy management system in one of the plants of a major automotive manufacturer was worthwhile in many respects. The investment required for the energy management system and the energy efficiency measures it involved were exceeded twice over by the energy costs saved in the first year. This corresponds to a return on capital of over 200%. A total energy saving of 11% was achieved. The core of the energy management concept applied here under the guiding principle "only use energy if necessary" was continuous notification and involvement of the plant employees, as a result of which important behavioural changes were achieved among the latter. A high level of commitment among the management and systematic measurement of results were further success factors. The most important technical measures were the optimisation of cooling, heat recovery and air installations.

In addition, by means of systematic implementation of an energy management system a large company in special chemicals production has been able to save large volumes of energy and therefore also cut its energy costs considerably. By means of the energy management system that has been implemented throughout the group the interdisciplinary teams of experts have worked with the employees at the locations to draw up 250 optimisation measures to date, of which 90 have been implemented. The key to efficient energy management is that the experiences of individual divisions and locations are transferred to the entire company. The objective is for each production location to use energy according to the "state of technology". An initial assessment of the potential savings is achieved with a questionnaire, which builds on the company's existing experiences. On this basis the teams analyse all energy-using processes and develop proposals. An example of the success of this method is the optimisation of an afterburning plant at one of the company's production facilities. Based on the energy management system the optimisation potential was identified and appropriate measures were implemented, which in this concrete case led to a reduction in natural gas consumption by 72.5% and a corresponding return on capital of 136% per annum.

Both of the measures described above similarly received the German Energy Agency's Energy Efficiency Award.

Energy management systems are not only found in major groups. Many small and medium-sized companies have also recognised the advantages. In a small to medium-sized sheet metal production company an employee was trained to Chamber of Industry-qualified energy manager level and energy management was introduced. In the first energy audit the company's most important energy aspects were identified. There followed a breakdown into operational areas and processes and determination of the accompanying activities to which the energy aspects were allocated. Specialist companies analysed the efficiency of the heating system and compressed air system, and the collected data were brought together centrally in an energy report and appropriate savings measures were planned. The findings were incorporated into the strategic and operating objectives. To maintain the effectiveness of the system internal audits are now regularly carried out and where appropriate adjustments are made to achieve further improvement. Besides making large savings, by means of internal and external communication about the energy management system the company also sensitised the employees to the issue of energy efficiency.

The measure was recognised with the "Energy Efficiency Good Practice" label of the German Energy Agency.

5.3.3 Measurement and metering services

There are about 48 million electricity meters and around 12.5 million gas meters in Germany. Until liberalisation of the measurement and metering sector, annual electricity consumption metering had to be carried out by

the network operator. With the opening of the measurement and metering sector to competition[34] the federal government has created the prerequisites for proliferation of new technologies, allowing precisely-timed analysis of consumption and therefore improved individual consumption management and optimisation to be achieved by a contractor.

In concrete terms the Energy Industry Act (EnWG) now gives connection users the option of having operation of the metering point (installation, operation and maintenance of the metering equipment) and the metering (reading) taken care of by an expert third party. Moreover, since January 2010, pursuant to Section 21b of the Energy Industry Act (EnWG), in new buildings and large building renovation projects metering equipment must be installed by the metering point operators which reflects actual energy consumption and the actual period of use. A conscious decision was made not to define a technical standard or set minimum technical requirements or specify details of the features of the required electronic meters.

In addition, with the liberalisation of the measurement and metering sector the requirements of Art. 13 of the ESD were met in Germany. Under this Directive the Member States ensure that all consumers in the electricity, natural gas, district heating and/or air-conditioning and water heating sectors receive individual meters at competitive prices which reflect consumers' actual energy consumption and the actual period of use.

This initiative of the ESD was continued at European level taking into account further developments in measurement and metering technology. Thus in the Third Single European Energy Market Package the Member States are given guidelines in respect of facilitating widespread installation of intelligent metering systems whose technical requirements go well beyond the requirements of the ESD but are already available today. By way of implementation of these guidelines the federal government will take the following measures, making use of its freedom of implementation as foreseen by the Third Single European Energy Market Package: Firstly it will stipulate minimum technical requirements for intelligent metering systems which guarantee their use in socalled smart grids and fulfil the requirements in respect of protection and security of data. Secondly, the efficiency appraisal stipulated in the Third Single European Energy Market Package will be implemented by 3 September 2012, and thirdly a strategy for the roll-out of the intelligent metering systems in the period from 2013 to 2022 will be established.

A diverse services market has already come into being in the measurement and metering sector. For example it includes reading on site, remote reading, inspection and changing of metering devices, though potentially also additional services such as receivables management, energy data management and energy controlling for larger clients, such as hospitals, and home automation for private households. The competitive structure thus also varies from one subsegment of the market for measurement and metering services to another. For example, for reading many larger energy utilities use external contractors or subsidiaries, while most small energy utilities do it themselves. External contractors for dedicated on-site reading are frequently small, locally based companies, whereas services related to heating cost allocation and billing are often contracted out to large heating cost service providers with nationwide coverage.

In particular, the market segment for intelligent metering systems (socalled smart meters), which represent the interface between energy network and consumer, should offer many additional development opportunities in future. Intelligent metering systems facilitate the transfer of (real time) information in both directions and are thus likely to hasten the advent of time- and load-based rates and the associated management of energy demand (to a certain extent) together with optimisation of the grids, among other things by means of reduction of peak loads and easier integration of renewable energies. At the same time, by means of improved information about energy consumption and the associated costs they can to a certain extent form the basis for behaviour-based energy savings by the consumer. In the evaluation of existing studies and smart metering projects in Germany and Europe in the framework of a project (KEMA 2009) it has been demonstrated that the amount of achievable energy

34 The measurement and metering sector was opened up to competition with the Law on the liberalisation of metering in the electricity and gas sectors of 29.8.2008 and the Ordinance on the enactment of regulations on metering equipment in the electricity and gas sectors of 17.10.2008.

savings varies enormously due to differing regulatory and business environments and statements in respect of across-the-board estimates can hardly be viewed as reliable.

Even though there are no reliable data currently on the volume and growth of this part of the energy services market, given the next stages of development that have been described one can assume further positive development in future.

5.3.4 Energy-efficient procurement

The consideration of energy efficiency as a criterion in the procurement of products and services and in particular through attention to the life-cycle cost principle in appropriate cases offers additional opportunities for energy savings and also cost-cutting both for the public sector and for companies. Particularly in the area of energy-efficient procurement, Art. 5 of the ESD highlights the importance of the exemplary role of the public sector. Each year public authorities in Europe spend approximately 16 % of the gross domestic product of the EU on procurement of goods (e. g. office equipment, components and transport equipment) and services (e. g. building maintenance, transport, cleaning and catering services, and public works) (European Commission 2008). In Germany the federal government, federal states and municipalities have enormous market power, with annual spending on procurement of products and services to a total value of approximately €250bn, which through demand can create important stimuli for increased supply and stronger market penetration of energy-efficient products and services as well as for additional market-driven technological innovations.

A study (McKinsey 2008) has stated the procurement volume of the public sector – merely for the sectors that are especially relevant from the point of view of energy consumption, being buildings, appliances and IT, mobility and transport routes, utilities and waste management, and energy production – at more than €51bn. Of this approximately €32bn, or 62 %, is accounted for by the municipalities including municipal utilities, approximately €13bn by the federal government, and approximately €6bn by the federal states. Nevertheless, the challenge of integrating energy efficiency as a criterion throughout the public-sector procurement process, in particular in the municipalities in view of their enormous number and the very heterogeneous requirements and available resources, is especially large.

Notwithstanding this, the market dominance of the public sector is especially pronounced in certain areas, for example in transport infrastructure and the utilities and waste management sector, each with more than 40 % market share, or in the server market, which accounts for approximately 20 % of demand (McKinsey 2008). The market dominance of the public sector in this segment is of particular significance for energy efficiency, as electricity consumption of the ICT sector, in particular the computer centres with their servers, is very high. In 2007 electricity consumption by ICT in Germany accounted for 10.5 % of total electricity consumption. Much is already being done in this sector, in particular by the universities with their mainframe computers and correspondingly high energy costs; thus among the top ten of the 500 most energy-efficient supercomputers in the world, four are located in German research institutions (as at November 2010: www.green500.org). Not to be under-estimated, moreover, is the signal effect on private households and companies of the consideration of energy efficiency criteria in the procurement activities of the public sector. In the transport sector, in IT equipment, or in building redevelopment, for example of schools, the public sector can fulfil a visible exemplary role and is indeed already taking on this role to a large extent.

With this in mind, in June 2011 the federal government changed the Ordinance on the awarding of public-sector contracts (Awarding of Contracts Ordinance – VgV) such that in implementation of directives 2006/32/EC and 2010/30/EU in the procurement of goods relevant to energy consumption, technical plant or equipment (supply of goods or prerequisite for the provision of a service) the highest level of energy efficiency or – where available – the highest level of energy efficiency within the meaning of the EnVKV is to be required in the performance specification. Besides this bidders must provide concrete information on energy consumption and – in appropriate cases – on the life-cycle costs. The awarding authority must take into account this information from the bidder as a highly weighted award criterion in the process of determining the most economic bid.

Moreover, both the federal government and some of the federal states and municipalities have enacted internal administrative regulations, according to which energy efficiency criteria must form the basis of all procurement activities in terms of performance specification and evaluation of bids. The growing importance and consideration of energy efficiency in the procurement process is also highlighted by a multitude of public-sector tender platforms at EU, federal government and state level as well as by a series of private platforms, on which services and products are increasingly supplied and demanded taking into account energy efficiency criteria. According to an assessment by the German Energy Agency made for the BfEE of public invitations to tender related to energy efficiency, from 2004 to the beginning of 2011 a total of 554 contracting services were put out to tender on the supra-regional tender platforms Tenders Electronic Daily (TED) and Vergabe24/Deutsches Ausschreibungsblatt (German public contract awards journal). Of these 115 were accounted for by energy saving contracting, 418 by energy supply contracting, and 21 by lighting contracting. The average guaranteed annual energy cost saving in the framework of the energy-saving contracting amounted to about €270,000 (net) for the known cases. Besides contracting services further classical invitations to tender related to energy efficiency can be found, especially in construction services, such as modernisation of heating systems and window replacement, and in the supply of goods, for example in ICT and procurement of hybrid vehicles.

Examples of successfully implemented procurement procedures taking into account energy efficiency criteria

A good example of the inclusion of energy efficiency criteria in the procurement process is provided by a city in Baden-Württemberg. In the framework of the local environmental conservation agenda the municipal council adopted a resolution that environmentally-friendly equipment would be used in all administrative sectors in replacement of old equipment. Since then all EDP equipment (PCs, monitors, and printers), as well as photocopiers and fax machines have been procured by a central department in accordance with the central procurement guidelines and also taking into account the energy efficiency of the equipment. EDP appliances are now generally leased, as are photocopiers, and TFT screens and fax machines are bought. The award criteria for all invitations to tender for computers, photocopiers, printers and fax machines are based on the performance requirements of the Energy Star, TCO (EDP hardware), Blue Angel and Nordic Swan (photocopiers) labels. By using energy-efficient new equipment the city makes annual savings estimated at 5,000 to 8,000 kWh of electricity and thus cuts costs accordingly, which takes the pressure off the municipal coffers.

However, energy-efficient procurement is not only an issue in the public sector, but also in companies. The reason for this, besides the somewhat "soft" factors of original environmental commitment or the positive image of a modern sustainably managed company, is also "hard" cost calculation taking into account total life-cycle costs. For example similar procurement principles as in the example referred to above have already applied since 1995 in a company manufacturing baby food. Here, too, a central department organised procurement for several locations in Germany and Austria. Procurement of environmentally-friendly office equipment alone means an annual saving of approximately 15,000 kWh, which corresponds to an annual cost saving of about €4,000. Half of the savings are achieved simply due to the decision in favour of flat screens.

Environment and energy efficiency criteria also form a component of the procurement principles in the municipal transport companies of a major city. Since as long ago as 1999 the company has been reducing pollutant levels in buses by procuring and using state-of-the-art buses with particle filters or buses with hydrogen propulsion. First of all a quality and environmental management system was integrated within the structure of the company. In addition to that, at regular intervals the environmental conservation measures are documented and evaluated. Responsibility for the environment is part of the entire process chain, from procurement of products through their utilisation to final disposal. These requirements also apply to suppliers of and contractors to the transport company. The environmental requirements are defined in the tender process and are subsequently contractually agreed. Within six years the pollutant levels of the total bus fleet had been reduced by more than 80 %.

In a north German city replacement of the lighting in all the major municipal administration departments and all the schools was put out to tender throughout Europe. The background to this was that the city's environmental authority regularly looks for beneficial climate protection measures and implements them with funds from a separate budget. The environmental authority identified the city's lighting as being a potential area for action and given that similar lighting technology was used throughout all the administration departments it seemed like a good plan to issue a single invitation to tender for all the administration departments and schools. In the course of the optimisation measures in each light two inefficient fluorescent lamps were replaced by one modern, efficient lamp with electronic ballast. Energy consumption was reduced by half. No additional money was required. The loan required for the investment is being financed by the costs saved each year.

The initiatives in the municipalities and companies described above were assessed as being good examples in the framework of the EU-funded "Buy Smart" project.

5.4 Energy and climate protection agencies

With the German Energy Agency (dena) at federal level together with a large number of other energy and climate protection agencies at regional and local level a network of important institutional promoters has grown up in Germany over the course of many years, and these make a significant contribution to increasing energy efficiency, among other things, and they also cooperate with stakeholders from the political community, industry and society. The German Federation of Energy Conservation and Climate Protection Agencies (eaD) currently includes 32 energy and climate protection agencies.

Through their activities energy and climate protection agencies make an important contribution to furthering development of the markets for energy services and energy efficiency measures. The main areas of activity are energy-efficient buildings, energy saving in electricity and transport, efficient energy production, networking and storage, and innovative energy services. In all these areas they initiate exemplary projects, champion pioneers, advise politicians, manufacturers and service providers, qualify disseminators, inform consumers and provide them with energy counselling, mediate in the marketplace between supply and demand, construct networks, evaluate technologies, analyse market segments and foreign markets, and develop future scenarios.

In addition to this the German Energy Agency also directly supports implementation of the ESD in Germany through an EDL information and communication platform. The core of this project is an online information and communication portal at www.energy efficiency-online.info, which provides information among other things on the implementation status of the ESD in Germany, on good practice projects in the framework of energy services in companies or in the public sector, and on public-sector invitations to tender taking into account the energy efficiency criterion. Besides the online portal, in the framework of the project the "Good Practice" label among other things is awarded to projects in the energy services market whose implementation has led in exemplary manner to energy savings. In addition current market developments are publicised and market participants are supported in their activities. Besides this, each year a competition called "Energy Efficiency and the Public Sector – Good Examples" is held. Furthermore the German Energy Agency regularly stages workshops on current issues with direct relevance to the ESD and to the energy services market and thus contributes to the cross-linking of relevant stakeholders.

5.5 Market constraints and future challenges

Energy services, energy audits and other energy efficiency measures represent a large, multi-facetted and growing market which can make a relevant contribution to increasing energy efficiency and to achievement of the energy efficiency targets of the EU and the Federal Republic of Germany. Nevertheless, like every other market, this market is subject to various constraints, the overcoming of which represents a future challenge for stakeholders in industry, the political community, and administration.

Lack of information

As various studies have established, there continues to be a lack of information among consumers about the

potential (economic) energy savings, about possible improvements to the procedures and processes, and about the multitude of resources and options available for their exploitation.
Due to a lack of information about energy consumption it is difficult for energy consumers to identify opportunities for making savings or recognise the need to increase energy efficiency at all. Of help in this respect are, among other things, measurement and metering facilities for energy consumption and also specialists, e. g. energy managers, who take care of energy saving in companies or public institutions. Once fundamental awareness of this has been created, targeted information about possible energy efficiency measures is necessary. In this case qualified energy counselling can provide an insight. Subsequently concrete instructions on implementation of the measures are necessary. This requires information about qualified providers of energy efficiency measures. In addition information should also be available on a problem-specific basis, in other words a decision-maker must be able to use the information for his own purposes. In complex industrial systems technical efficiency depends not only on the individual system sections, but also to a great extent on the overall process. The absence of standards can prove to be a constraint here.

Furthermore, for energy counselling and energy services a growing number of well-trained specialists is necessary in order to develop commercially viable and technically developed projects and services. This is the concern of various qualification programmes of the chambers of industry and commerce and of the programme sponsors (KfW Akademie).

Absence of incentives or a lack of prioritisation
Besides a lack of information, there is frequently no incentive to make investments in energy efficiency measures. A reason for this can be that the energy costs in the company or in the private household only constitute a small share of the total costs. In companies energy costs are budgeted through overhead cost centres, so in investment decisions energy consumption factors are viewed as being secondary. The implementation of efficiency-boosting measures, especially in companies or in the public sector, is similarly obstructed by the fact that no responsibility for energy issues is defined.

In the residential property market the so-called "landlord-tenant dilemma" prevents implementation of a significantly larger number of redevelopment measures in rental housing construction. The landlord, who takes decisions about redevelopment measures, for the most part shows little interest in getting to grips with questions of energy consumption, as the energy costs are borne by the tenants. The current legal situation offers the landlord the opportunity to raise the rent by 11 % of the modernisation costs, which is sufficient scope of action to make appropriate investments, though depending on the situation in the respective residential property market the rent increase cannot be implemented everywhere and thus the investment cannot always be refinanced in the market. Legal questions come to the fore in the changeover to contracting in the occupied rental housing stock unless allocation of the contracting costs has been agreed between the parties to the lease contract. A legal basis is required for allocation of the costs.

A similar problem crops up not only in rental housing construction, but appears as the "user-investor dilemma" anywhere that investments and the costs of operation of the installations are borne by different actors. For example, this is similarly often the case in the framework of cameralistic budget management in the public sector. Savings through energy-saving measures lead in the subsequent years to a reduction of the corresponding budget item in the administrative budget, while the investments must in addition be dealt with on a once-off basis out of the capital budget. In these scenarios the implementing authorities have no incentive to make investments or engage in energy-saving behaviour. It should be pointed out in this context that in the framework of the federal and state budget regulatory systems growing flexibility for (efficient) energy-saving investments has been created over the past few years, though this is not yet adequately reflected in current administrative practice.

Financing risks
In addition the realisation of measures is frequently prevented by a lack of financing options or (from the point of view of the agents) over-long amortisation periods. Capital constraints can arise due to a number of sets of circumstances: for example, investors do not have sufficient capital and would have to make use of credit lines in order to make investments in energy

efficiency measures. In some cases this is only possible at a comparatively high cost of capital. In addition internal guidelines and international financing rules restrict the flexible use of equity capital and external capital. With limited availability of capital and a possible lack of prioritisation of energy efficiency measures companies tend to use cash resources for other investments, in particular related to the company's core competencies.

In procurement, efficiency technologies tend to lead to additional investment, which is refinanced in the course of operation by energy cost savings. Focusing purely on total investment in efficiency-boosting measures therefore frequently leads to suboptimal decisions. Where an extended appraisal is carried out, instead of recourse to the internal rate of return, in practice the amortisation period is frequently used as the decision-making criterion. It offers a simple performance figure, but is often not suitable as the sole basis for decision-making for investments. However, in entrepreneurial practice more complex efficiency appraisals are only carried out for investments in core processes.

Long contract terms are a particular constraint in contracting. Contract terms frequently as long as five to seven years and a resulting commitment to the contractor with corresponding risks can scare off potential customers. For the contractor himself, the long terms mean a possible default risk on the part of the contractee during the term. Given that in the worst case total loss of revenues and the investments already carried out may result, the energy utilities factor suitable risk premiums into their projects. Frequently potential contractees neglect to consider that the financing package represents just one performance component among many other different services provided by a contractor and can most certainly also be provided by the contractee's bank.

Transaction costs
Many energy services involve very complex packages. This applies in particular to the contracting sector – and especially to energy-saving contracting. This results in relatively high transaction costs for information procurement and processing as well as for the search for technical, economically viable and contractually attractive solutions. Further transaction costs are incurred in the preparation of projects with the preparation of the financing, invitation to tender, and execution of the measure as well as due to drawing up of the contract. Contracting is therefore frequently only seen as an option for relatively large projects. Reduction of the transaction costs could lead to the development of further market potential. Essentially the same constraint applies as with other energy services: with many energy-saving programmes, energy management systems and efficiency services specialised third parties (advisors, utilities, and contractors) can be of great advantage and can realise a great deal of energy-saving potential in the course of their market activities. However, involvement of such experts generates transaction costs which with small properties cannot be refinanced out of the savings.

General uncertainties
Uncertainties about future developments can also be an obstacle to the implementation of energy efficiency measures. Volatile energy prices and resulting price expectations can influence the use of energy efficiency measures to a considerable degree: With low price expectations the time taken until the differential investments in the efficiency technologies compared to the comparative technologies are recouped is extended. Besides this there are technical risks, in particular with complex technical solutions, as well as operating risks, for example interference in the process cycle or changes to the product features. In addition hidden costs may arise, for example due to an unexpected maintenance or training requirement, which reduce the savings from efficiency-boosting measures.

Legal constraints
Besides the aspects already mentioned the generation and distribution of energy is affected by legal factors, such as the complexity of tenancy law already referred to, construction law, and the energy-related regulatory environment.

A special problem is the unequal treatment of contracting and autonomous execution of measures. Unlike self-generated electricity, electricity from contracting projects is included in the Renewable Energies Act reallocation charge. This is an obstacle to the expansion of combined heat and power generation using innovative services such as contracting.

In summary it is clear that Germany currently already has the largest and one of the most developed markets for energy services, energy audits, and other energy efficiency measures in the EU. With its multitude of actors and market segments it is an extremely vibrant and competitive market. In future it will be important to eliminate the remaining obstacles and further improve the general environment for positive market growth. The objective will be to develop a considerable proportion of the economically viable energy saving potential by means of market-oriented energy services.

6. Outlook – planned measures

As already pointed out in detail, as things stand at present Germany exceeds the requirements in respect of the indicative energy savings target prescribed by the ESD. However, this will by no means slow down the country's efforts at increasing energy efficiency. Thus the result is to a certain extent due to methodology. Moreover, the much more exacting requirements of the EU Council Resolution of March 2007 and implementation of the energy concept necessitate considerable additional efforts.

The faster phase-out of nuclear energy initiated by the federal government with its resolutions of 6 June 2011 requires in addition that the fundamental reorganisation of energy supply and the increasing of energy efficiency in Germany already set out in the energy concept need to be accelerated and intensified once more. Therefore the federal government will continue its activities aimed at cost-effective exploitation of the now as previously enormous energy saving potential present in all end-user sectors and – where necessary – will increase them.

The observations made on the market constraints reflect the challenges for the future development of the energy services market that need to be overcome.

With this in mind, in the energy concept and in the energy package adopted for the latter's accelerated implementation a series of concrete additional measures is being established for each of the various areas for action, and these have in some cases already been implemented or else they are being implemented.

6.1 Increasing energy efficiency in private households, in trade and industry, and in the public sector

It is the intention that in exploiting the economic potential for increasing energy efficiency in companies and private households economic incentives together with improved information and counselling in particular will contribute to making it easier for companies and private consumers to independently develop previously unused energy efficiency potential and in so doing to save on energy costs and reduce damage to the environment. To promote this the federal government will carry out the following important measures:

- For public-sector procurement tough energy efficiency criteria will be legally anchored in the process for awarding public-sector contracts and will be an important criterion. As a further measure, with its resolutions of 6 June the federal government has adapted the Awarding of Contracts Ordinance accordingly. In principle products and services are to be procured which have the highest possible level of performance in respect of their energy efficiency and belong to the highest efficiency category.
- The federal government will continue to systematically develop and promote the market for energy services. In order to give consumers an improved market overview the BfEE, which was set up in the BAFA in 2009, will observe the market for energy services and submit proposals for its further development. For this purpose, since April 2011 a publicly administered supplier list has been available to the suppliers and consumers of energy services.
- In order to strengthen the role of consumers the federal government will in addition drive forward a system for transparent identification of energy consumption, for example of passenger vehicles and other products. This applies in equal measure to energy performance certificates against the backdrop of the amended European Buildings Directive.
- Taking into account the results of an ongoing research plan the federal government wants to cooperate with the energy industry associations to carry out a pilot project entitled "White Certificates" taking into account the experience of other EU Member States in order to investigate whether such an instrument could be used in the same way as emissions trading to tap cost-effective savings and efficiency potential and to find out what synergy effects are possible with instruments already known to be effective.
- It is planned to support industry in increasing its exploitation of the potential for energy savings estimated by scientific studies at €10bn per annum. In addition the federal government will support industry's own initiatives, for example through the Partnership for Climate Protection, Energy Efficiency and Innovation of the Association of German Chambers of Industry and Commerce (DIHK).

- In order to create a further strong incentive for increasing energy efficiency in the manufacturing sector, from 2013 onwards the federal government will only grant top rate energy and electricity tax relief where a company's operations make a contribution to energy savings. Verification of the savings can take place by means of a certified record in energy management systems or equivalent measures.
- By way of an additional element in this sector the federal government will offer small and medium-sized companies appropriate funding programmes. In addition the successful programmes for promotion of qualified and independent energy counselling of consumers and counselling of small and medium-sized companies will be expanded and developed as required to meet needs. Funding of low-interest loans and subsidies for energy efficiency measures carried out by small and medium-sized companies is also to be further improved in a focused manner.
- Using the separate assets of the energy and climate fund, on 1 January 2011 the federal government launched an energy efficiency fund at the BMWi. The plan is to use this to fund a large number of different measures for increasing energy efficiency in small and medium-sized enterprises and industry, among private consumers, and in municipalities, for example improved consumer information, product innovations, market launch of energy-efficient products, and innovative municipal energy efficiency measures. As at 2011 the energy efficiency fund has assets of approximately €90m.
- From 2011 the National Climate Protection Initiative of the BMU will be given additional financial resources out of the separate assets of the energy and climate fund.

6.2 Energy-related building redevelopment and energy-efficient construction

The main objective in the buildings sector is to reduce the heating requirement of the building stock in the long term with the aim of achieving an almost climate-neutral building stock by 2050, that is to say that the buildings would only have a very small energy requirement and the remaining energy requirement would predominantly be met with renewable energies. The following mid- and long-term targets have been set:

- doubling of the energy modernisation rate from 1% to 2%,
- 20% reduction in the heating requirement by 2020,
- from 2020 all new buildings are to be "climate-neutral" based on primary-energy specific values,
- 80% reduction in the primary energy requirement in the buildings sector by 2050.

Achievement of these targets requires an appropriate and reliable legal environment, time, and considerable investment in the realisation of long-term cost savings.

The existing instruments alone will not be enough to achieve these ambitious targets. Consequently the EnEV and the Renewable Energies Heating Act (EEWärmeG) will be developed further within the bounds of economic tenability.

Nevertheless, experience to date also shows that there are limits to the application of regulatory law, in particular in the building stock, in respect of the economic burdens on tenants and owners. In order to make use of the technical and economic opportunities for energy-efficient redevelopment of the building stock, a new strategic approach is necessary. In future it is important that in the interests of the owners the redevelopment requirement is defined in the long term in order that it can be taken into account in investment plans. Incentives should be created, but there should be no cases of compulsory redevelopment.

With the energy concept the federal government approved the framework for a comprehensive modernisation offensive which was further confirmed by the Cabinet resolutions of 6 June 2011. The core elements of this "modernisation offensive for buildings" are as follows:

- The amendment of the EnEV represents an ambitious increase in the efficiency standards for buildings insofar as this is economically viable in the framework of a macroeconomic appraisal taking into account the burdens of owners and tenants. Economic viability is assessed in particular under consideration of energy price and interest rate expectations, assumptions about rises or falls in construction costs, and the economic lifetime of the buildings or parts of buildings.
- Owners continue to have freedom of choice in respect of the measures to be carried out for ener-

gy-efficient redevelopment of the buildings (cladding, systems engineering, and use of renewable energies) and in respect of the execution of individual measures (in any time sequence) or alternatively once-off full redevelopment.

- Requirements made of new buildings will be increased on a step-by-step basis up to 2020 to meet the pan-European ultralow energy standard insofar as this is economically viable taking into account the burdens on owners and tenants. The requirements made of building stock units will be adjusted in the framework of economic viability as previously.
- The federal government will draw up a concept for a long-term redevelopment schedule. The schedule of redevelopment of buildings in the building stock begins in 2012 and targets a continuous reduction in the primary energy requirement of 80 % by 2050. It serves as a guide for owners and investors to achieving the ultralow energy standard with the redevelopment measures planned up to 2050. Implementation of the redevelopment schedule is based on voluntary participation. The exceptional circumstances of monuments and other structures worthy of protection for cultural reasons are being taken into account. ([35]*)
- The economic incentives for energy-efficient building redevelopment are to be in line with the redevelopment schedule. It is intended that the funding will be in proportion to how early and how far-reaching the energy-related modernisation measures are. With these targeted economic incentives among other things owners will in any case be motivated to combine planned modernisation projects with exacting energy-efficient redevelopment.
- With this in mind the proven CO_2 Building Redevelopment Programme (KfW funding programmes for energy-efficient construction and redevelopment) is also being continued and its content improved as far as financial constraints allow. The cash resources in the CO_2 Building Redevelopment Programme are being increased to €1.5bn per annum for the period from 2012 to 2014. In addition the federal government will investigate the possibility of basing fund-ing in the heating sector on a market-based and extra-budgetary solution from 2015 onwards. (*)
- Besides this fiscal promotion of energy-efficient redevelopment of rented and owner-occupied residential buildings is being examined. Taxpayers will be able to deduct investment costs as increased write-downs or as exceptional costs. (*)
- Following the resolutions of 6 June 2011 the federal government will proceed by setting a good example and from 2012 onwards will only erect new buildings in conformity with the ultra-low energy standard. (*)
- At the KfW a new funding programme called "Energy-efficient Urban Redevelopment" is to be started. Thus extensive measures in the energy efficiency of buildings and infrastructure are to be initiated in the district, among other things to give renewable energies wider possible use in innercity areas containing older buildings and to include additional investor groups in the redevelopment process. Funds totalling €100m are allocated to the programme for 2012. (*)
- The landlord and tenant legislation is being amended whilst safeguarding social protection of tenants with the aim of increasing exploitation of energy efficiency potential in the buildings sector and of making the landlord and tenant legislation more investment-friendly for energy-efficient redevelop-ment measures. The municipalities are being supported in the framework of pilot projects in the creation of energy-related rents indices. (*)
- The contracting opportunities are being extended. In this connection the federal government will present a bill for a harmonised framework for heat supply contracting, in particular for the residential property rental sector. (*)
- In view of the steadily increasing requirements being made in terms of the energy standards of buildings the federal government will call upon industry to commit to regular and improved continuing training of craftsmen and – where necessary – it will adjust the training regulations. (*)

35 The core elements of the modernisation offensive for buildings marked in this section with an asterisk are planned optional measures within the meaning of Art. 10, Para. 2, Subpar. 1 of the Buildings Directive.

6.3 Energy efficiency in the mobility sector

In order to increase energy efficiency in the mobility sector the timely setting of concrete efficiency targets for new vehicles, including for the period after 2020, is a key driver behind accelerated market penetration of CO_2-efficient vehicles. At the same time planning security for the industry is ensured. Ambitious thresholds are necessary for all vehicle classes – from two-wheeled vehicles to heavy commercial vehicles. With this in mind the federal government will argue at European level in favour of setting exacting CO_2 thresholds for new vehicles.

In addition, the federal government will investigate how future structuring and development of the heavy goods vehicle toll and the emissions-based motor vehicle tax can increase incentives for efficient and environmentally compatible freight transport and road traffic.

Overall the mobility sector must also make a contribution to limiting greenhouse gas emissions. In addition the electric mobility strategy based on the government programme of 18 May 2011 and the joint declaration of industry and the federal government of 3 May 2010 is being systematically pursued with the target of putting a million electric vehicles on the road by 2020 and six million by 2030. Development of the National Hydrogen and Fuel Cell Technology Innovation Programme is being continued as agreed and the foundation for further increases in the proportion of biocomponents in fuels is being laid by the federal government.

All the additionally planned measures just described are in principle subject to a legal and financing proviso. Nevertheless, a series of these measures has already been or is currently being implemented by the federal government. For its implementation, with effect from 1 January 2011 a separate “energy and climate fund” trust asset was set up for the additional funds required with an economic plan to be drawn up on an annual basis. It is intended that from 2012 the fund will be supplied from the federal government’s income from the auction of rights to emit greenhouse gases. In addition, on reversal of any provisions for defaults on repayment liabilities under KfW funding programmes, such provisions also flow into the fund. In addition the respective budget estimates apply.

No ex ante estimates in respect of the quantifiable energy-saving effects resulting from these additional measures can be made in the framework of the Second NEEAP. It can nevertheless be assumed that the measures will lead to considerable additional energy savings. As far as possible the federal government will report on this in the framework of future NEEAPs.

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