16/95

Energy 2.0
Green energy policies to 2020

Green Party resolution of 19 June 2007

Uns geht's ums Ganze.
www.gruene-bundestag.de

BÜNDNIS 90
DIE GRÜNEN
Bundestagsfraktion

Imprint

Publisher	Bündnis 90/Die Grünen Bundestagsfraktion Platz der Republik 1 11011 Berlin, Germany www.gruene-bundestag.de
Reference	Bündnis 90/Die Grünen Bundestagsfraktion Info-Dienst (Information Service) Platz der Republik 1 11011 Berlin, Germany Fax: +49 30 227 56566 E-mail: versand@gruene-bundestag.de
Authors	Renate Künast MP, Bärbel Höhn MP, Hans-Josef Fell MP, Winfried Hermann MP, Peter Hettlich MP, Dr. Reinhard Loske MP, Jürgen Trittin MP
Press date	19 June 2007
Nominal charge	€ 1,50

Special thanks to: Eltje Aderhold, Christoph Benze, Marc Berthold, Felix Beutler, Claudia Brammer, Olaf Denter, Arnd Grewer, Arne Jungjohann, Katharina Fichtenau, Markus Meyer, Carsten Pfeiffer, Frank Steffe, Silvia Uplegger, Jakina Wesselmann

Energy 2.0

Green energy policies to 2020

Conservation, renewables, efficiency

Contents

I. Energy 2.0 – Green policies to 2020

The prime objective behind the energy policies outlined in this document is to limit global warming to a maximum of two degrees centigrade. The international scientific community has determined that this can only be achieved if CO_2 emission in industrialised countries is reduced by 80 percent by 2050. This will require a drastic restructuring of energy generation and supply methods by 2020. In Germany, robust energy policies are needed to ensure CO_2 levels are reduced by at least 40 percent between 1990 to 2020.

Climate change and how it can be controlled are currently hot topics. However, the debates and announcements are rarely followed by real action. Bündnis 90/Die Grünen is proposing an energy concept that contains specific and realistic measures to achieve a 40 percent reduction in CO_2 levels – without Germany having to construct any new coal-fired power plants or re-embrace nuclear energy. These measures will affect all levels of society: commerce and industry; the residential sector; trade and transport. All of us will have to fundamentally change the ways in which we produce and transport goods, travel and live. It is vital that we reconceptualise the workings of the economy and create a new level of energy awareness in the public mind. Germany is one of the world's major industrial powers but also one of its biggest energy-wasters. It is our responsibility to move forward and become a role model for climate-friendly approaches to living and to doing business.

One of the biggest ambitions of our energy concept is to provide clear guidelines for business. Both the creative and the technological focuses of trade and industry need to be aligned with the 2020 energy objectives. This will also help to secure future markets and create new employment.

Without a doubt, the rising costs of oil and natural gas will have a dramatic effect on both public and private finances. As has been widely discussed in the media (e.g. the 2006 report in *Stern* magazine), a passive wait-and-see approach will ultimately be much more costly for the national economy than one of decisive and pre-emptive action. If we fail to adequately address the energy issues at hand, the repercussions will certainly be felt by the wealthy, but even more so by the poor; public funds will be hard stretched to provide the increased financial support needed by the low-income segment to cover rising energy costs. The measures we propose will also, unavoidably, have financial repercussions for individual citizens. Where possible, the increased financial burden will be softened through support schemes and tax measures. The public authorities will also have to increase their expenditure. However, our action plan represents a vital investment in the future, and it proposes financially more viable alternatives to oil and gas – which are fast becoming unaffordable. Every kilowatt hour which is saved, however, is free of cost, as are the sun's rays and the wind. A stronger focus on technical innovation will reduce the implementation costs for renewable energies and energy conservation measures. Furthermore, our energy concept can also help solve the growing number of conflicts surrounding natural resources.

Our proposed energy concept encompasses all major energy-consuming sectors – electricity, heating and transportation. The future viability of these relies on the **"big three": efficiency, renewables, conservation**. Reform has already been introduced in the area of power generation; these policies now need to be extended to the heating and transportation sectors. In order to inspire the required innovations, we aim to launch a series of targeted research and information/education campaigns.

There are other areas where CO_2 emissions also need to be reduced and where CO_2 absorption needs to be improved. This is the case especially in agricultural production and forestry. We will propose a supplementary concept for these, entailing several additional climate protection measures.

The energy concept of Bündnis 90/Die Grünen integrates climate protection with energy supply security, and it provides feasible answers to the security-related questions that are raised at every energy policy summit. Instead of clinging to dwindling resources such as natural oil and gas, coal and uranium, our solutions are focused on renewable energies and energy conservation.

The measures described in this document are designed for swift conversion to the use of renewable energies. Some of the proposed measures will be more effective than we are currently predicting, while others may only come into full fruition after 2020. However, a 40 percent reduction in CO_2 levels is a realistic goal even without the electricity imports we are planning for. As a top priority, a political framework needs to be set up which can incorporate the proposed energy measures as quickly as possible. Climate protection needs to become an issue of concern for everyone, across all sectors, and it requires determined political leadership.

Our 2020 energy concept

The most important **measures in the electricity sector:**

- Electricity efficiency plan: making efficiency standards and certification more dynamic; introducing an electricity conservation fund

- More renewable energies through optimisation of the Renewable Energies Act (*Erneuerbare-Energien-Gesetz* / EEG); introduction of a law governing the inclusion in the supply network of biogas; market incentive schemes for the power sector

- In place of existing electricity imports from fossil-fuel and nuclear sources: approaching foreign providers with cooperation deals on the import of renewable energies, based on clearly defined sustainability criteria

Energy conservation and improved energy efficiency will achieve a reduction in CO_2 levels of at least 45 million tonnes; implementation of renewable energies is predicted to eliminate at least 70 million tonnes of CO_2 emission. This goal is fully achievable without electricity imports.

The most important **measures in the heating sector:**

- Building rehabilitation plan: tighter monitoring and enforcement of the Energy Conservation Ordinance (*Energieeinsparverordnung* / EnEV); revision of the KfW Building Rehabilitation Programme

- Improved promotion of combined heat and power generation (CHP)

- Introduction of a renewable-energy heating law

Energy conservation in the heating sector is predicted to achieve a reduction in CO_2 levels of at least 30 million tonnes; renewable energies and CHP are predicted to achieve reductions of at least 85 million tonnes.

The most important **measures in the transport sector:**

- Traffic reduction and modal shift: funding for public transport, foot and bicycle traffic; sustainable logistics concepts for the commercial sector

- Efficiency increases: CO_2 thresholds of 120g/km from 2012 onwards; remodelling of vehicle tax into CO_2 tax; expansion of highway tolls for trucks; more speed limits

- Prioritisation of environmentally friendly propulsion systems: one million electric vehicles (including plug-in hybrids); sustainability-tested biofuels; no more competitive advantages for transport methods that are not climate-friendly

Traffic reduction and modal shifts, coupled with efficiency increases, are predicted to achieve CO_2 reductions of at least 35 million tonnes in the transport sector; the introduction of renewable energies is predicted to achieve a reduction of at least 15 million tonnes.

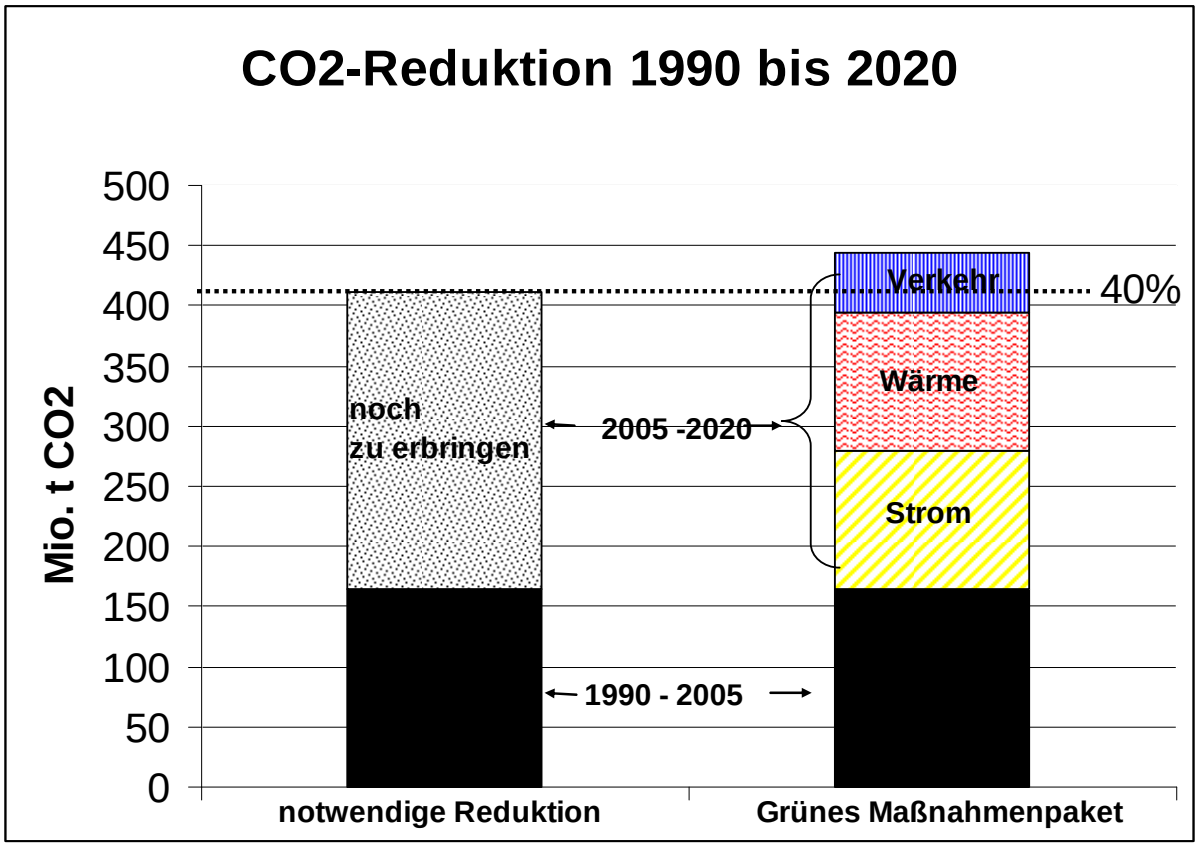

Fig. 1: Reduction in CO_2 levels by 2020 according to the Green action plan

With our proposed measures, it is realistic that Germany will achieve a 40 percent reduction in CO2 levels from 1990 to 2020 – without requiring nuclear energy or new coal-fired power plants.

If the energy concept is implemented with the tools and approaches we are proposing, an even higher reduction in CO_2 levels is possible. We will also see the advancement of sustainable developments such as large-scale geothermal power generation and the widespread launch of the electric car. While these measures will only have a significant effect after 2020, they will greatly speed up the creation of a CO_2-free economy.

In all of our calculations, we refer to **end-use energy**, as only this is indicative of consumer energy requirements and the supply share of individual energy carriers. The energy sector frequently publishes figures that describe primary energy production; in terms of usage analysis, these are only useful for measuring energy waste and CO_2 generation, not actual energy requirements. Nuclear power plants and most coal-fired power plants in fact only utilise about 30-40 percent of the produced energy (primary energy) for the generation of electricity – the remaining energy rises straight into the air. These conventional plants generate more clouds than they do power.

Climate-orientated **emissions trading** with no privileges for existing fossil-fuel-based power generation methods is vital for the propagation of energy conservation As is a revision of the **Ecological Finance Reform** to incorporate air travel, so that subsidies that are ecologically detrimental can be reduced.

With the Renewable Energies Act (EEG), the Eco Tax, the European Emissions Trading System and the phasing out of nuclear energy, Bündnis 90/Die Grünen has paved the way for the **solar energy age**. Within just a few years, Germany has become a pioneering force in the implementation of solar and wind energy, and world export champion for renewable energy technologies. The Renewable Energies Act has become an international model for the propagation and funding of renewable energies. The German labour market has also benefited greatly from the introduction of sustainable energy. Today, 215,000 people are employed in the renewable energies industry – six times as many as in the coal industry.

In the larger scale of progress, however, these are just initial steps. If Germany's emissions are to be reduced by 40 percent by 2020, **all sectors must be incorporated into a general climate protection strategy**. We have to affix an unwavering, climate-orientated price to CO_2, one that persuades the economy and consumers to embrace alternatives. Now is the time to dissolve the traditionalistic structures of the conventional energy sector and unravel the rigid networks. All the major energy producers are aiming to continue with dependence on fossil and nuclear fuels. However, a regenerative and efficient energy concept should incorporate decentralised structures, where small and medium-scale companies also contribute to energy generation.

Today, most electricity is produced in large-scale power plants, from where it is distributed directly to the customers – with enormous energy losses en route. The centralised model of electricity generation will still be relevant in the future, but it is neither the only nor the most sensible approach to providing energy. **Energy supply methods have to be decentralised**. An ideal energy network consists of a large number of small supply stations that generate and distribute electricity close to where the consumers are. These small-scale power plants can all feed into the same power network and group together to provide stable, regulated electricity. Renewable energies can be eas-

ily integrated, and transmission losses are kept to a minimum. A decentralised energy system will create new jobs and combine income and added-value potential, benefiting especially rural communities and medium-sized businesses across both Eastern and Western Germany.

A restructuring of the energy sector also entails the creation of an open and competitive energy market. Innovation and consumer-oriented price structures are only possible if new providers can participate in the energy market in **fair competition** and without discrimination. The existing deregulation of the energy sector in the areas of network operation, power generation and gas provision has led to a high level of market concentration. The lack of competition is detrimental to consumers as well as to the environment. Compared to other European countries, German customers pay the highest prices for electricity and gas. Through added market transparency, greater unbundling and deconcentration of the energy market, we want to achieve increased competition, an ongoing reform of the energy sector, and a stronger orientation towards **consumer interests**. When there is a financial surplus, this either needs to be passed on to the consumers in the shape of discounts or invested in the development of sustainable energy supply methods. This is the only viable model for the future.

Over the next three decades, Germany's energy supply networks will require extensive **modernisation**. At least 50,000 megawatts of output will need to be renewed by 2030. Many power plants are being shut down anyway as result of the nuclear power phase-out but approximately 45 percent of lignite-fired power plants, 40 percent of gas plants and more than a third of anthracite-fired power plants will reach the end of their operational lifespan during this time. If these power plants were to be replaced by new plants based on the same fossil-fuel concepts, the energy sector's excessive CO_2 levels would be fixed for a period extending well beyond 2050 – even if the new plants operated much more efficiently. During the transition period towards a sustainable energy system, we will, however, still need to build new gas power plants. But these must be designed as combined heat and power generation plants. The current need for new power plants represents a historic opportunity to reform the energy sector and introduce new power generation technologies based on renewable energies.

Coal-fired power plants without CO_2 sequestration are incompatible with today's climate protection needs and should no longer be built. However, the technologies and processes needed for CO_2 capture and storage (CCS) are still in development and will not be industrially available by 2020. The energy sector must be stopped from building further conventionally designed coal-fired plants, as this would only exacerbate the existing climate problems. We would like to take the energy providers propagating CCS at their word and propose a coal moratorium: Do not build any new coal-fired power plants until you can prove your proposed CO_2-free plants are technologically feasible, ecologically sound and economically viable. A range of pilot and demonstration projects are currently in planning or under construction. Only once these become commercially viable should any further coal-fired power plants be built. Power plants without CCS are not compatible with ambitious climate protection goals and fitting existing plants with CCS technology is financially prohibitive and technologically inefficient.

Nuclear energy does not constitute a solution to our energy woes. Supplies of uranium are limited, and the issue of radioactive waste storage has not been satisfactorily ad-

dressed anywhere over the past 50 years. Germany's existing repositories have not solved any problems; they have merely created new ones. In addition, there is a latent risk of accidents, which has further intensified through the threat of international terrorism. None of these risks are acceptable. In addition, nuclear energy is simply too expensive. In Germany alone, nuclear power plants are absorbing more than €100 billion of government funding. What's more, nuclear energy cannot contribute to climate protection because of its low generating efficiency. Fifty new nuclear power plants would have to be built in Germany before there would be a noticeable benefit to climate control – an absurd scenario. Prolonging the lifespan of existing nuclear power plants would only benefit corporate energy providers, allowing them to expand their profit margins using old technology, while slowing down the pace of progress in the field of renewable energies and decentralised solutions. Efficient and economically viable climate protection can only be achieved without nuclear energy.

The heating and cooling market is a major part of Germany's energy sector. Almost 60 percent of end-use energy is used for the provision of space and process heat. Unfortunately, renewable energies are largely absent from this market, even though there is vast potential. We aim to introduce a **heating law** to encourage the adoption of renewable energies, building on the progress made in the area of power generation. Another big concern is that we are still throwing our heating energy out the window – quite literally. **Building rehabilitation** to improve energy efficiency is a top priority and long overdue. Heat is also being wasted on an industrial scale in conventional power generation. We are calling for combined heat and power generation plants in place of steam-electric power plants, as CHP is a far more efficient approach.

The **transport sector** is most dependent on crude oil resources (95 percent of the sector's fuel needs are covered by crude oil). In contrast to the other sectors, CO_2 emissions in transport have not fallen but risen since 1990. Effective climate protection measures are clearly long overdue. Germany simply has to get in line with the rest of the world and introduce a motorway speed limit; this would have a bigger single environmental benefit than any of the government's CO_2 measures currently planned for the transport sector. The time to shape the future of transport is now. We are demanding better economic conditions for the railways (e.g. by removing air traffic subsidies), an investment campaign, and a more competitive railways market, as trains are clearly the most climate-friendly form of transport. Car manufacturers need to be subjected to stricter regulations in order to encourage the introduction of fuel-efficient vehicles, which have long been technologically feasible, and consumers need to be offered incentives to purchase climate-friendly cars. We aim to provide consistent support to innovative solutions such as electric cars (hybrid and plug-in) and will strive to have at least one million of these vehicles on Germany's roads by 2020.

An energy generation method can only be considered sustainable if it maintains both its economic and ecological basis. For the **green energies** that will inevitably have to be introduced to meet the 2020 goals, internationally binding standards and certifications must be implemented to ensure acceptable production methods, from both an ecological and a societal point of view. Because this will be a gradual process, we have been careful not to rely too heavily on future biofuel potential in our energy concept. It is important that the implementation of green energies does not result in decreased biodiversity. We also advocate cascade utilisation of materials so that plants and by-products are exploited in their entirety.

Sustainable energy policies rely on **research** investments and incentives to modernise the generation, efficiency and utilisation of energy. It will remain a central task of politics to develop concepts and tools that foster promising **innovations** until these are ready for marketing. This equally applies to issues still awaiting satisfactory solutions such as electricity storage and distribution, the utilisation of heat energy and mobility as well as to new developments such as the sustainable exploitation of ocean energy.

Green energy policy is not restricted by our national borders. The impending climate catastrophe can only be averted if the world clubs together. Developing countries are being hit especially hard by the consequences of climate change and shortsighted international energy policies. Oil and gas dependency is an all-pervading power factor in world politics; it leads to conflict and war and thwarts multilateral peace plans. The goal of a green **energy foreign policy** is to find a way to decrease our dependency on oil and to focus more on renewables, energy efficiency and energy conservation – advocating a 2°C cap on global warming, demonstrations of international solidarity to people suffering from the consequences of climate change, fair energy utilisation around the world, and peaceful global development.

Green energy foreign policy is not limited to securing energy supplies. Our comprehensive strategy systematically places the energy concept in all areas of foreign policy. We are advocating **worldwide access to sustainable, climate and socially responsible energy**.

Green energy foreign policy demands **multilateral solutions**. The key to a global shift in energy utilisation is a climate control agreement based on international law. "**Kyoto Plus**" will combine enforceable emission quotas with technological collaborations. However, these goals can only be fulfilled if all industrialised countries – including the US – commit to a significant reduction in greenhouse gases. This degree of multilateral action is necessary if emerging markets such as India and China are to seriously enter climate negotiations and agree to CO_2 reductions. For international climate goals to be implemented effectively, more multilateral institutions will need to be established and boosted.

Green energy foreign policy focuses on the **millennium goals**. Innovative energy policies for poorer countries support progress, improve access to electricity and water, and combat poverty. If the "resource curse" is to be overcome, industrialised countries must refrain from applying double standards to developing countries that are rich in natural resources, and not allow them to get away with human rights abuses.

Green energy foreign policy is a strategic **policy of peace**. Global access to renewable energies prevents the conflicts and struggles surrounding fossil fuels.

The 2020 green energy concept is a comprehensive action plan for effective climate protection. In the coming months, we will discuss our concept with Germany's citizens, scientific and business communities, and local and state government. We will update the concept to reflect this dialogue and further specify the details of implementation.

The green energy concept – TABLES:

Table I: CO_2 emissions – reductions proposed by the Green energy concept

	Emissions, mill. tonnes	**in percent**
Total CO_2 emissions in 1990 (Kyoto reference year)	1,030	100%
40 percent CO_2 reduction by 2020	- 412	-40%
CO_2 reduction already achieved by 2005	-164	-16%
CO_2 reduction still needed before 2020	-248	-24%
CO_2 reduction in 2005-2020, as proposed by the Green action plan (Energy)	-280	-27%
CO_2 reduction proposed by green action plan, plus 1990-2005 reduction	-444	43%

Table II: Measures and projected outcomes

Reference year: 2005

a) Strombereich

Measures	CO_2 reduction target
Electricity efficiency plan • Electricity conservation fund • Dynamic efficiency standard ("top runner") • Improved certification • Energy conservation bonds • Industry energy auditing • Greater efficiency in the power plant fleet	**45-65 mill. tonnes**
Renewables in power generation • Optimisation of the Renewable Energies Act (EEG) • Introduction of law to include biogas in the supply network • Europe-wide biogas strategy • Geothermal deep drilling programme which covers for the risk of low recoverability • Electricity imports based on renewable energies • Research campaign • Loosening of bureaucracy	**70-85 mill. tonnes**
Emissions trading	
Ecological financial reform	
Research campaign (efficiency, renewables, storage…)	

b) Heating sector

Measures	CO_2 reduction target
Building Rehabilitation Plan • Tighter enforcement of the Energy Conservation Ordinance (EnEV) • Energy efficiency certification for buildings • Improved financing of the KfW Building Rehabilitation Programme • Support scheme for technical retrofitting of buildings • Tax rebates for rehabilitation measures	**30-35 mill. tonnes**
Renewables and CHP in the heating sector • Introduction of a heating law • Combined heat and power generation • Market incentive scheme	**85-95 mill. tonnes**
Emissions trading	
Ecological financial reform	
Research campaign (including building research)	

c) Transport sector

Measures	CO_2 reduction target
Energy conservation and efficiency in transport	**35 – 40 mill. tonnes**
Action plan for traffic avoidance • Redeployment of road construction funds • Reform of the property tax system • Lowering of the commuter allowance	
Action plan for modal shifts in transport • Advocacy of foot and bicycle traffic • Increased funding for public transport	

• (Doubling of bicycle traffic and shift of short-distance trips to public transport) • Creation of guidelines for tolls in cities • Reform of the railways: Public financing of the railway infrastructure • Introduction of a kerosene tax	
Action plan for climate-friendly traffic planning • Reduced speed limits (120/80/30 kmph) • CO_2 thresholds of 120 g/km by 2012, 80 g/km by 2020 • Company vehicle taxation according to CO_2 usage	
Action plan for commercial transport • Increase and expansion of truck tolls • Improvement of truck efficiency through better engines and lighter materials • Funding for commercial rail transport	
Renewable energies in the transport sector • 15-20 percent of fuel needs in transport to be provided by alternative fuels • 1 million electric cars (incl. plug-in hybrids) • Renewable energies used for rail transport	**15-20 mill. tonnes**
Ecological financial reform	
Research campaign (incl. zero-emission drive systems)	

Note: Further development of the ecological financial reform will lead to a reduction in energy consumption and CO_2 emissions in all three sectors. Emissions trading will steer investment decisions towards renewable energies, combined heat and power generation, and efficiency increases in the electricity and heating sectors.

Table III: Energy consumption by 2020

End-use energy	Current status (2005)		2020 Green energy concept		
	Energy consumption, absolute (PJ)	Percentage of renewables	Energy consumption, absolute (PJ)	Reduction on figure for 2005	Percentage of renewables in 2020
Heating	5,359	5.4%	≈ 4,200	22%	28%
Transport	2,635	5.6%	≈ 2,200	17%	20%
Electricity	1,876	10.1%	≈ 1,550	16%	43%
Total	9,869	6.3%	≈ 7,950	19%	29%

II. Action plan for faster energy reform

1. Electricity – energy conservation, efficiency and renewables

In Germany, the ever-rising level of electricity usage accounts for 20 percent of the country's total energy consumption. Half of the electricity generated is used by industry; the two remaining quarters are shared between the residential sector and small businesses. Currently, 12 percent of Germany's electricity is already being generated from renewable energies. In spite of this positive development, electricity consumption is still causing more than 40 percent of CO_2 emissions, which is why the bulk of CO_2 reductions must come in this area. From a technological point of view, this is entirely feasible.

Over the coming years, many power plants will be shut down as they reach the end of their useful lives or as a result of the nuclear power phase-out plan. If new coal-fired power plants were to be built to replace the old capacities, this would have disastrous consequences for the climate. From an economic as well as an ecological perspective, the most sensible solution is to replace the decommissioned power plants with "virtual plants" and renewable energies, i.e. to utilise and conserve our electricity resources more intelligently.

1.1 Basic premises of the electricity action plan

Nuclear energy: The agreement to phase out nuclear energy will continue to be implemented. By 2020, the power supply grid will include very few nuclear power plants. According to Germany's nuclear power phase-out law, the last nuclear power plant will be decommissioned in 2023, from which point no more power will be produced using nuclear energy in this country. For 2020, the Federal Environment Ministry is predicting 31 TWh or 338 PJ of nuclear energy production.

Lignite and anthracite: ISUSI's energy study presents a forecast scenario where the decommissioned old lignite and anthracite-fired power plants are not replaced by further lignite/anthracite-fired plants. This matches our energy concept. An energy study by Greenpeace/Eutech predicts slightly larger capacities from coal-fired power plants for 2020, based on the existing power plants. Because it is difficult to predict exactly when the old power plants will be decommissioned, we are basing our approach on the more conservative capacity figures suggested by Greenpeace/Eutech. Based on the power plants' actual full-load hours and assuming slight efficiency increases due to modernisation, our prediction for 2020 is 85 TWh from lignite-based power generation and 70 TWh from anthracite-based power generation.

Discussions on energy policy have long addressed the viability of coal-fired power plants with low CO_2 emissions, although this idea throws up a large number of technical and economic question marks. Now, the concept is little more than a research topic. Even assuming all the technical and financial issues pertaining to the capture and storage of CO_2 can be resolved, CSS-fitted power plants would not be able to make a significant contribution to the energy supply network by 2020 – the technology simply would not be commercially viable by then. At the moment, a mere few hundred MW are

being planned for research purposes and these are predicted to be fed into the supply grid primarily after 2015.

Energy efficiency: Although Germany has successfully decoupled economic growth from electricity consumption, electricity demand is still rising by more than 0.5 percent each year. Annual electricity consumption has increased from 472 billion kilowatt hours (kWh) in 1995 to 540 billion kWh. There is plenty of scope for efficiency improvements, although little progress has been made in this area.

Natural gas: Among the fossil fuels, natural gas causes the lowest CO_2 emissions. Today, natural gas is used to generate 15 percent of our power supply. Investments in natural gas technologies and infrastructures also represent potential investments in the biogas sector.

As a result of efficiency increases, an additional 10-12 percent of energy will be generated from the same amount of natural gas by 2020.

Figures concerning the availability of natural gas reserves vary widely. Such figures are of little use in predicting the effects of future shortages; as soon as there is more demand than there is supply, consumer prices skyrocket.

Regarding the future contribution of natural gas to Germany's power generation network, the available studies show differing forecasts. The Federal Environmental Ministry predicts that the share of natural gas will rise to 17 percent. A study by Prognos assumes that the level of natural gas usage will remain constant. Greenpeace predicts that the share of natural gas in primary energy consumption will have doubled by 2020. Based on high conservation and efficiency forecasts, its study predicts an absolute increase in natural gas's share of the network of 7.5 percent.

We assume that natural gas consumption will remain largely constant until 2020. There will be less demand for the resource in the heating sector, whereas the power network will require a lot more gas, particularly biogas. With biogas production and imported biogas, natural gas usage in Germany could in fact be reduced by approximately 15 percent. However, this prediction heavily relies on gas conservation and substitution through renewables in the heating sector. Our gas usage forecast also considers the supply gap that has been predicted by E.OM Ruhrgas and LBST for the EU's natural gas supply network by 2020.

Crude oil: In the field of power generation, crude oil has largely been phased out as a resource. The only plants still feeding the network are small-scale combined heat and power generation plants, and plants that provide peak-load energy.

Renewable energies: Power generation from renewable resources within Germany can be supplemented by imported renewables. There are two types of importing – electricity importing and biomass (resource) importing. The latter should be treated in the same way as other resources imported for energy generation, such as crude oil, natural gas, anthracite and uranium.

Biomass: Aside from the rapid growth potential of this relatively new fuel resource, the main factors to consider are ecological risks and resource restrictions. Global food crop availability and sustainability regulations need to be considered whenever biomass is used for energy generation. This applies to national biomass production as well as to biomass imports. Imports may take the shape of solid, liquid or gaseous biomass, but are only permissible if the exporting country can prove it complies with the relevant social and ecological standards.

1.2 Electricity conservation plan

Plenty of opportunities for electricity conservation are yet to be embraced. Among all the discussions on green energy, it pays to remember that the most climate-friendly kilowatt hours is still a non-existent one.

In the residential and industrial sectors, the potential for energy conservation is enormous. The Wuppertal Institute for Climate, Environment and Energy has predicted that home electricity usage can feasibly be reduced by 20 percent over the next decade, the equivalent of 25 million tonnes of CO_2 – a considerable contribution to climate protection. However, this relies on comprehensive consumer education and willingness to participate. Our goal is to affect the required changes in consumer behaviour in a socially acceptable fashion.

Bündnis 90/Die Grünen want Germany to become the world's most energy-efficient economy. For this to happen, our electricity consumption must be halved between 2000 and 2050, which means a reduction to 250 billion kilowatt hours (TWh) per year. This can only be achieved if we instate an annual reduction target of at least 5 TWh, i.e. one percent. From 2005 to 2020, we need to achieve a 16 percent reduction, i.e. a target consumption level of 410 TWh. This could be achieved with a package of measures and tools.

Measures and cross-sectional tools:

- **Electricity conservation fund:** Our goal is to establish an annual fund of €1 billion for additional investments into electricity conservation. This fund is to be co-financed from the profits of emission credits auctions. The fund is to support a range of electricity conservation activities, including the "Green Light" campaign for energy-saving lamps; energy rewards for purchases of energy-efficient appliances (e.g., refrigerators, freezers, washing machines); replacement of inefficient night-storage heaters. If properly implemented, this fund can achieve a reduction of 32 TWh, i.e. 17 million tonnes of CO_2.

- **Energy testing as part of Stiftung Warentest** (Germany's consumer goods testing association): An adequately equipped, qualified and independent institution needs to be established to inform citizens, trade and commerce about the responsible and efficient usage of energy and natural resources.

- **Energy efficiency action plan:** If we want to rescue energy conservation from its backbench position in energy politics, we need to provide a systematic conservation concept. Such a concept is also stipulated by the EU Directive on Energy End-Use Efficiency. According to this, all 27 EU member states were required to submit a national Energy Efficiency Action Plan (EEAP) no later than 30 June

2007. We want Germany's plan to stipulate ambitious goals for energy saving in the sectors of primary energy, electricity, heating/cooling and fuel, as well as proposing specific measures and ongoing monitoring. The plan also needs to include a feasible forecast of how to achieve the directive's energy target – which is to increase energy efficiency by nine percent over the next nine years.

- **High efficiency standards for electrical appliances:** According to the EU Directive on Ecodesign of Energy-using Products, all common electrical appliances (televisions, computers, photocopiers, lamps, motors, etc.) will soon have to comply with Europe-wide minimum efficiency standards. Products that do not meet the energy ratings will not be granted a certificate of compliance. This will also apply to conventional lightbulbs, as they use five times as much electricity as comparable energy-saving lightbulbs, fluorescent lamps or LEDs. We propose that the minimum efficiency standards not only specify ambitious energy ratings but are also periodically updated in a three-year cycle. A "top runner" approach needs to be adopted so that modern, energy-efficient appliances can quickly gain widespread market acceptance.

- **Standby mode:** The Ecodesign Directive also states that more attention needs to be paid to energy losses caused by appliances in standby mode. Our goal is a Europe-wide ban on devices with inefficient standby modes. An appliance's standby electricity consumption must be as low as possible and not exceed one watt. It should be mandatory for all devices to feature a manual "off" switch.

- **Improved identification:** We need informative and dynamic energy consumption IDs for all common electrical appliances across Europe. The indicated efficiency classes should be updated once every three years at least. Class A should be reserved for the most efficient 10-20 percent of each appliance range. A categorisation using four efficiency classes (A, B, C, D) will be sufficient to provide an adequate indication of energy ratings. Energy rating labels are to be fitted not only to refrigerators and washing machines but to all electrical devices encompassed by the Ecodesign Directive.

- **Reduced tax rates to reward energy audits:** In industry, there is massive potential for energy conservation, which has remained largely untapped. We propose that electricity-consuming industries only be allowed exemptions from electricity tax, or from the compulsory implementation of CHP systems and the Renewable Energies Act (EEG), if they conduct energy audits and/or introduce energy management systems. If a company fails to demonstrate that it has made any efforts to improve energy efficiency, it should have to pay the full tax rate, i.e., pay the full implementation costs. Certification with different categories needs to be designed for the verification of industrial energy efficiency.

- **Installation of intelligent electricity meters:** At the moment, German households receive an electricity bill only once per year. This gives them no indication of their daily usage patterns or of seasonal fluctuations. We propose that intelligent electricity meters (smart meters) are made compulsory for all households. Consumers will be able to access up-to-date information on energy usage and costs directly from their smart meter via the Internet. As a result, they will be able to modify their usage patterns and learn how to take advantage of the dif-

ferent electricity rates offered throughout the day. This benefits not only household expenditure but also reduces electricity usage during peak times – which in turn reduces the need for costly peak-load energy. Intelligent metering technology is also designed to allow consumers to form local electricity purchasing cooperatives. Furthermore, intelligent meters are the basis for efficient building automation systems; if properly implemented, these again increase energy efficiency for consumers and enable the introduction of flexible electricity rates.

- **Government-funded debt guarantees for energy conservation contracts:** Energy conservation measures often require a high level of initial investment, which can only be written off over an extended period of time. For many companies, this kind of investment is unaffordable. There are some energy service providers which address this shortfall and specialise in energy conservation contracts, financing their services from customers' monthly savings. Unfortunately, most of these providers only offer a limited range of energy conservation options, as large-scale investment in long-term contracts represents an unacceptable financial risk (customer insolvency, etc.). To alleviate this situation, the government should offer debt guarantees to such providers.

- **Ecological public procurement:** Public authorities should act as role models for society. By awarding energy conservation contracts for public and government facilities on a large scale, the state can significantly bolster the market for energy-efficient products, making them more affordable and gaining widespread consumer acceptance. We want public procurement to be consistently orientated towards the most energy-efficient devices, systems and building technologies. All federal authorities and offices should, for example, be covering their electricity needs through green energy.

1.3 Renewable energies in electricity production

The proliferation of renewable energies in the electricity sector has been a big success. The implementation goals set for 2010 were already reached by 2007, and the high growth rates of the last few years have meant a significant upswing for the entire sector. Germany's wind and solar industry leads the world, and the export of renewable energy technologies has become a lucrative business. Today, well over half of the wind turbines manufactured in Germany are destined for foreign use. The Renewable Energies Act (EEG) has turned out to be a vital economic boost for this sector. However, the possibilities are far from exhausted; the contribution of renewable energies to electricity production can, and will, increase even further.

Our goal for 2020 is for 43 percent of all electricity to be produced from renewable energies.

Tools and outcomes

a) **Stabilisation and optimisation of the Renewable Energies Act (EEG)** – to ensure the best possible investment conditions for all renewables (solar, wind, small-scale hydroelectric, sustainable energy crops, geothermal and ocean energy), especially for new medium-sized enterprises. Medium-sized entrants to the market need to be provided with startup incentives, such as remuneration guarantees for feeding the supply network or contractually guaranteed supply periods. A degressive remuneration scale over time will

encourage innovation and technical progress. We also need quality assurances for supplied biogas and for sustainable energy crops. Whenever bioenergies are being provided, climate efficiency, ecological sustainability and global food crop availability must be ensured.

b) The **market incentive scheme** will foster innovations in renewable energies in the electricity sector, too, supplementing the EEG as an innovation tool.

c) **Research campaign** for renewable energies and energy conservation technologies: Renewable energies research funds to double by 2010 (ForschungsVerbund Sonnenenergie / FVS, Association for Electrical, Electronic & Information Technologies – VDE) and increase tenfold by 2020 (German Advisory Council on Global Change / WBGU); interdisciplinary research strategies for renewable energies in other research areas, such as materials research, microsystems technology, or biotechnology (not including agricultural genetic engineering). Increased research into renewable energies will lead to faster cost reductions in production.

d) **Education campaign for renewable energies:** Integration of renewable energies teaching into the curriculum of all areas of education and all major disciplines, including economics; public information campaigns; financing of teaching positions and professorships in energy efficiency and renewable energies.

e) Support of the REnKNOW.net Internet platform in aid of establishing an international Open University for Renewable Energies (OPURE).

f) **Reduction of bureaucratic obstructions** to the implementation of renewable energies, without infringing on existing environmental protection and food availability regulations.

g) Incentives for underground cable networks to encourage proliferation of the supply network – underground cabling encounters much less resistance than overhead powerlines. Network expansion could progress considerably faster in many regions if underground cabling were used.

h) Creation of a **biogas feed-in law** to prioritise biogas in the natural gas network.

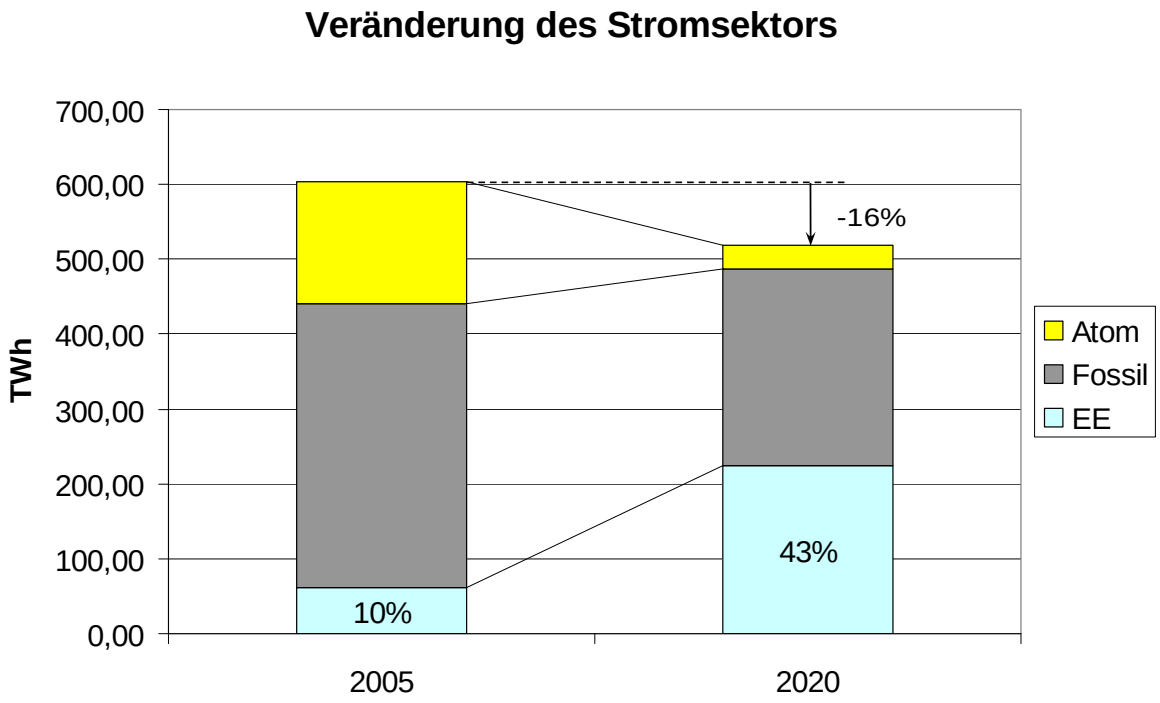

Fig. 2: Energy supply shares as proposed by the 2020 Green action plan

Specific technological measures:

a) Wind energy

Wind energy has experienced very strong growth over the past 17 years. Before the Electricity Feed Law was introduced in Germany, there were only a few isolated generation systems being operated by hobbyists. Today there are multi-MW systems.

Still, there is a lot of room for improvement for wind energy in Germany. Wind energy will continue to expand, onshore as well as offshore. Older small-scale systems will be replaced by bigger, more efficient systems (the "Repowering" concept). The availability of higher masts has opened up opportunities for many new wind farming areas, including in Southern Germany. The fixed yield threshold that was previously instated as a prerequisite for feed remuneration has in fact led to increased processing costs, as well as obstructing the proliferation of wind energy in a number of regions.

Offshore expansion will begin in earnest around 2010; commercial exploitation of offshore wind energy will be well underway by 2020. The BEE (German Renewable Energy Federation) is predicting 70 TWh of onshore wind power generation for 2020, while Greenpeace is predicting 45 TWh of offshore wind power. The total wind energy contribution predicted by these studies is 115 TWh. For the forecast scenario of our energy concept, we are predicting 94 TWh.

This goal will require the following measures::

- Implementation of the Repowering concept by replacing existing distance regulations with the federal regulations on immission control (sound, shading).

- Removal of height restrictions, but also restriction of light pollution emanating from wind energy systems; development of alternative lighting methods for wind farms.
- Prioritised implementation of the Repowering concept in network regions experiencing problems with voltage drops.
- Adaptive and degressive remuneration for onshore wind-based networking feeding.
- Elimination of network bottlenecks and faster network expansion through an improved legal framework for expansion of the electricity supply grid (including allocation options for cost overruns).
- Improvement of the Renewable Energies Act's (EEG) remuneration regulations for offshore wind energy as a startup incentive; broadening of the stipulated time restrictions of the EEG to allow extraction of wind power during peak load times (thereby improving remuneration from wind power used as peak-load energy or during peak load times).
- The disproportionate dip in the remuneration scale for offshore wind energy that is currently in place should be replaced by steeper degression rates. Degression should commence one year after a figure of 3,000 MW of offshore wind capacity is reached.
- Faster creation of the infrastructure required for proliferation of offshore wind energy projects (e.g. ports, as well as network connections), without infringing on environmental and species protection.
- Streamlined, location-independent remuneration rate for small-scale wind energy systems.

Additional requirements are better network control and coordination within the European power supply grid. The grid requires an increased number of cross-border transfer points; international cooperation on prognosis and data exchange; and standardisation of network conditions across Europe. Existing networks can be optimised through measures such as temperature monitoring and through the recabling of existing overhead powerlines. A quicker approval procedure for new cable technologies is also required.

b) Biomass

Since the introduction of the Renewable Energies Act (EEG) in 2000, there have been substantial developments in the field of bioenergy. Before the 2004 amendment, a number of wood-fired power plants were constructed and there was also a strong push towards biogas. As a result of several new incentive schemes, particularly the NaWaRo (sustainable resources) bonus, there has been rapid growth in biogas production since 2004. Bonus programmes have encouraged the use of vegetable oils in district heating plants; today's biomass for electricity generation can be solid, liquid or gaseous. Because of the unprecedented boom experienced by biomass technologies, increased monitoring is needed to control the sustainability of energy crop production, processing and exploitation.

Alongside the introduction and proliferation of new technologies for the exploitation of biomass – such as biorefineries – biogas production in Germany will continue to expand. Other countries will also focus more strongly on biogas production. Some of the produced gas will be sold in the European market through the existing pipeline network. This could also enable Germany to, for example, cover part of its gas requirements through biomethane from other countries. Over the next decade, wood-based biomethane production will become a standard technology. Again, the sustainability of this process must be monitored, particularly in regard to forest regeneration. Biomethane will supplement and also replace natural gas in the heating sector, the electricity sector and the transport sector.

The potential for utilisation has to be calculated in reference to ecological factors and environmental protection issues. By 2020, we envision that nine billion m^3 of natural gas will have been replaced by locally produced biomethane, and another nine billion by imported biomethane. This level of importing would only take up around two percent of Europe's biogas capacity (disregarding Germany). If 35 percent of this was used for power generation, the electricity sector could output a total of 30 TWh from biogas alone.

Outlook: By 2030, biogas imports could feasibly rise to 27 billion m^3 to supplement the local production of biomethane, which by then will have reached at least 13 billion m^3; the total amount of biomethane usage will be 40 billion m^3. Our biogas import figures represent a very modest chunk of Europe's future biogas capacities (as predicted in the IE study of the Bündnis 90/Die Grünen parliamentary group).

The following measures will be required:

- Increased CHP bonus in the Renewable Energies Act, reduction of the NaWaRo premium.
- Higher incentives for the exploitation of biogenic waste products in biogas systems.
- Bonuses for the supply of peak load energy.
- Inclusion of new technologies in the innovations bonus, e.g. thermoelectrics.
- Financial support for the development of highly efficient biomass CHP technologies to achieve electricity production capacities comparable to fossil fuel plants in the medium or long-term; increased control of field sizes and monoculture usage in energy crop farming
- Orientation of the Renewable Energies Act (EEG) towards the planned sustainability directive
- Creation of a **biogas feed law**: This law would enforce the prioritised position of biogas in the natural gas network, with added privileges for decentrally and sustainably produced biogas (supply as well as third party access). To ensure the commercial viability of biogas plants and network feeding, fixed remuneration rates and periods are required. As in the EEG, remuneration rates should be scaled according to plant size, and remuneration is to be degressive over time.

c) Photovoltaics

There have been enormous advances in photovoltaics over the last few years, and the number of new PV systems has increased dramatically. The established solar power companies have experienced excellent growth and have been joined by a number of new providers. There is healthy competition between the different solar technologies, which will ensure further cost decreases. Germany has the highest number of new solar installations, and also the most solar power plants. As the world champion in solar energy, Germany is taking full advantage of its leading position in the market.

Past forecasts for the photovoltaics sector have never been able to keep pace with actual growth. Our forecast is based on the BEE's calculations of 20 TWh, which should be regarded as a conservative estimate. Should the costs of photovoltaics drop further than predicted, this forecast may well fall short of reality, too.

The following measures are required:

Degression in the remuneration of supplied solar energy should be scaled in a way that creates incentives for further cost reductions, and ensures the commercial viability of operating solar power systems. Through economies of scale and the introduction of new technologies, an increased proliferation of photovoltaics will lead to further cost reductions. These can be passed on to the market, decreasing the cost for each generated kilowatt hour of solar power.

Once the costs of photovoltaics have decreased to a degree where they are lower than residential power supply costs – which is predicted to happen within the coming decade – the installation of photovoltaic systems should be made mandatory for all new buildings.

d) Hydroelectrics

Currently, hydroelectrics are contributing approx. 3.5 percent to Germany's power generation network, just above 20 TWh. The energy stores provided by hydroelectrics are very useful for compensating the supply fluctuations of photovoltaics and wind energy.

Operators of small-scale hydroelectrics station are predicting that an additional capacity of 20-24 TWh will be available in the future. The exploitation of this potential will have to take into account all relevant ecological criteria. Modernisation of existing hydroelectrics systems is not predicted to achieve a significantly higher power output.

For 2020, we are adopting the conservative forecast of the Environment Ministry's scenario, which predicts 25 TWh, i.e. an increase of 5 TWh.

This will require the following measures:

- Increase of the bonus for ecological measures.
- Removal of bureaucratic obstacles, without infringing on environmental protection.

e) Geothermal energy

The potential for power generation from geothermal energy is huge. As the geothermal study of the Bundestag's Office for Technology Assessment has shown, geothermal energy alone could replace all the power currently generated by Germany's lignite and nuclear-based power plants. However, in May 2007 Germany still had only one operational geothermal power plant, located in Neustadt-Glewe, and this plant is comparatively small, producing less than 1 MW. A number of projects are currently in planning and several new plants are already under construction. Once the testing stage is over, large-scale commercial exploitation of geothermal energy is likely to proceed very quickly. The predictions for 2020 vary considerably, from 3.6 TWh (Environment Ministry scenario) to 127 TWh (ISUSI). Our own forecast is based on the figures calculated by Greenpeace, which predict 11.6 TWh.

This requires the following measures:

- The federal government should cover the risk of low recoverability for the first 100 geothermal energy plants; alternatively, provision of an insurance to the same effect (the "100 Geothermal Energy Plants Programme").
- Setting up and quickly implementing a deep drilling programme and a seismic programme with the aim of gaining comprehensive geothermal data through a range of projects, to be made available to the entire geothermal energy community.
- Improving the legal framework for the construction of geothermal energy plants. While retaining the current level of public dialogue, the permission procedure for test drillings needs to be much faster. Introducing a CHP bonus as part of the Renewable Energies Act (EEG). In addition, findings from previous drillings should be made available to new geothermal projects more quickly.

f) Ocean energy

There is some potential for the utilisation of ocean energy in Germany, particularly from wave energy, but this is completely untapped. Even the capacity estimates have been merely perfunctory. Technologies for generating power from wave energy and tidal energy are still in their pilot stages. Osmotic power plants are no more than a research topic, and tidal power plants are unsuitable for the German coastline's low tidal range.

Because of the accelerating technological advances in ocean energy, particularly wave energy power generation, there should be initial viable results by 2020. A strategic combination with offshore wind parks is highly recommended – for example, the shared use of cable networks. There could also be joint maintenance.

The first systems will need to be tested over the next few years and then gradually introduced. By 2020, ocean power generation in Germany could feasibly reach an output level of 0.5 to two TWh. Our forecast assumes the bottom end of the scale, i.e. 0.5 TWh.

This will require the following measures:

- Bonuses for the construction of ocean power plants.

- Equal conditions as for offshore wind energy in regard to network costs and connection conditions.
- Supplementary infrastructure schemes.
- Support for pilot projects.
- Research into the effects of ocean power exploitation on oceanic biodiversity.

Electricity imports based on renewable energies

Studies conducted by the German Aerospace Center (DLR) and ISET (Institute for Solar Energy Supply Technology) have shown that there is great market potential for power generated in sunny and windy regions and cheaply transported to central Europe. Potential capacities from the southern Mediterranean region and the Middle East alone would be more than sufficient to cover European power requirements. In terms of supply security, however, it would be imprudent to rely on large-scale electricity importing. Decentralised, local power generation is undeniably a preferable option. Nevertheless, a certain degree of electricity importing could be very useful – especially when it is spread across multiple export and import countries. Currently, there are no countries outside the EU with wind farms or solar power plants that are generating electricity for EU member states. Given the right political initiatives and economic conditions, this could change very quickly, especially considering that the necessary technologies are already very advanced.

Energy partnerships could help establish a broad supply infrastructure across the power-generating countries of North Africa. The electricity surplus from these countries would then be available for export to the EU. This would have several advantages: large-scale reductions in CO_2 levels; a comprehensive transfer of technology; green energy supplies gradually replacing crude oil and natural gas imports. We would thus see climate protection taking place in both the importing countries and the countries of origin, as well as in the trade activities between them. Additional jobs would be created with our systems manufacturers and in the exporting countries.

Our 2020 forecast predicts that five percent of our gross power generation requirements can be covered by imports from Northern Europe – particularly through hydroelectrics and wind farming – and from the MENA region (Middle East, North Africa). Assuming a gross power generation of 520 TWh in 2020, this would mean 26 TWh would come from imported electricity based on renewable energies. Even if delays in network or plant construction were to affect the predicted import levels, the goal of our energy concept – a 40 percent reduction of CO_2 emissions by 2020 – could be achieved regardless.

The following measures are required for fostering electricity imports based on renewable energies:

- A trans-European strategy for MENA countries (Middle East, North Africa) to generate electricity from renewable energies and export their surplus to Europe.
- EU **directive for electricity network feeding** from renewable energies, based on Germany's Renewable Energies Act (EEG).

Electricity generated from waste heat

Outside the field of renewable energies, there is essentially no electricity being generated from waste heat in Germany. However, the technology bonus provided to renewable energy systems as part of the Renewable Energies Act (EEG) has encouraged several biogas plants to exploit waste heat for electricity, predominantly through ORC processes. The same progress should be made for waste heat from other areas, particularly industrial waste heat. New technologies such as thermoelectrics may well gain significance in this respect. As there is no comprehensive potential analysis for this approach to power generation, we are predicting only five TWh as part of our forecast. The ideal future scenario is that the potential is activated to a degree where electricity can be obtained without additional energy expenditure.

This will require the following measure:

The CHP law should include a bonus for electricity generation from waste heat.

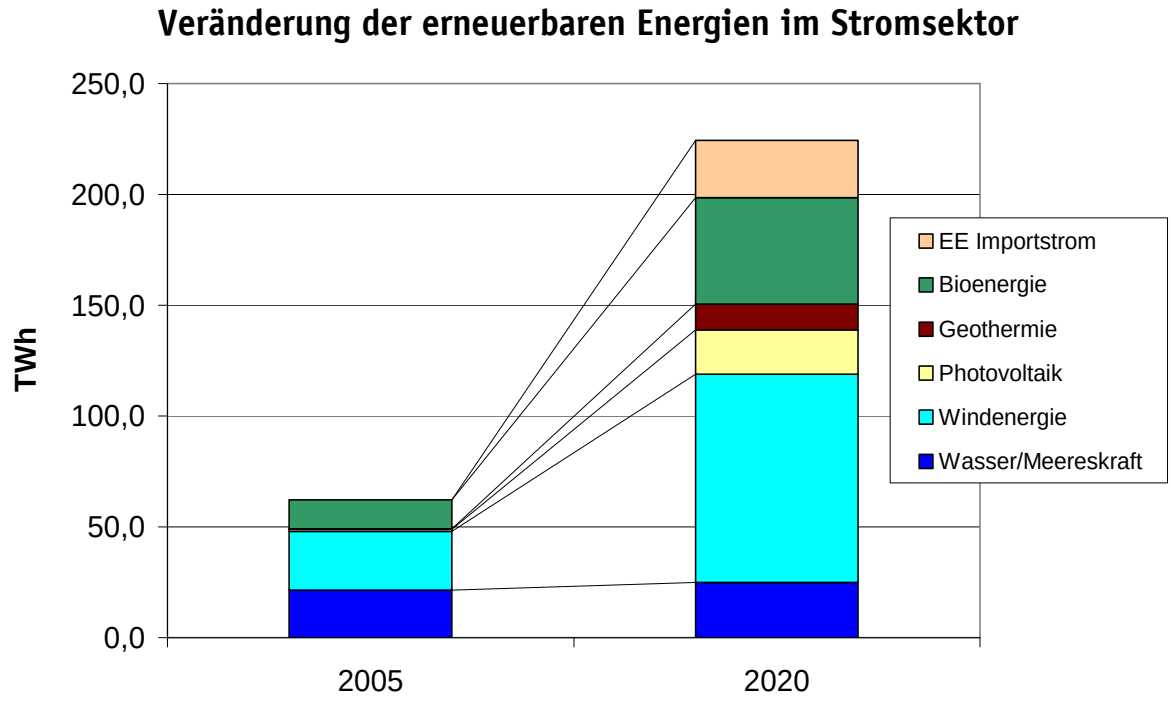

Fig. 3: Green action plan: Renewable energies in power generation

CO_2 reductions in the electricity sector since 1990

The gross power output of 549.9 TWh in 1990 and 618 TWh in 2005 can feasibly be reduced to 502 TWh by 2020 if the cited conservation measures are instated. This target figure does not include the electricity needed for electromobility (rail and road) in the transport sector and electrical heat pumps in the heating sector, which is predicted to be 16 TWh.

Between 1990 to 2020, power generation processes involving fossil fuels will become more efficient.

The decisive factor lies in the contribution of renewable energies to power generation, which has already increased from four percent in 1990 (mainly hydroelectrics) to 11 percent in 2005; for 2020, we are predicting a figure of 38 percent within German sources and 43 percent overall.

By 2020, most nuclear power plants will have been decommissioned, which means that nuclear energy will have been replaced by other energy carriers. To fulfil the given climate goals, these must be CO_2-free or CO_2-neutral.

The cited forecast figures will result in a total reduction of CO_2 emissions of 44 percent for the electricity sector from 1990 to 2020, i.e. a total of 143 million tonnes.

2. Heating and cooling – energy conservation, efficiency and renewables

Almost 60 percent of our total energy consumption is used for the generation of heat. In the residential sector, it accounts for more than 90 percent (if we discount transport). Households primarily use this energy to heat rooms (75 percent) and water (12 percent). To a lesser degree, the same applies to the commercial sector (trade, services and small-scale production). In the industrial sector, more than 80 percent of the total energy consumed is used for heat generation. Production heat takes up almost two thirds of the energy budget – which represents a 25 percent share of the total CO_2 emissions in Germany.

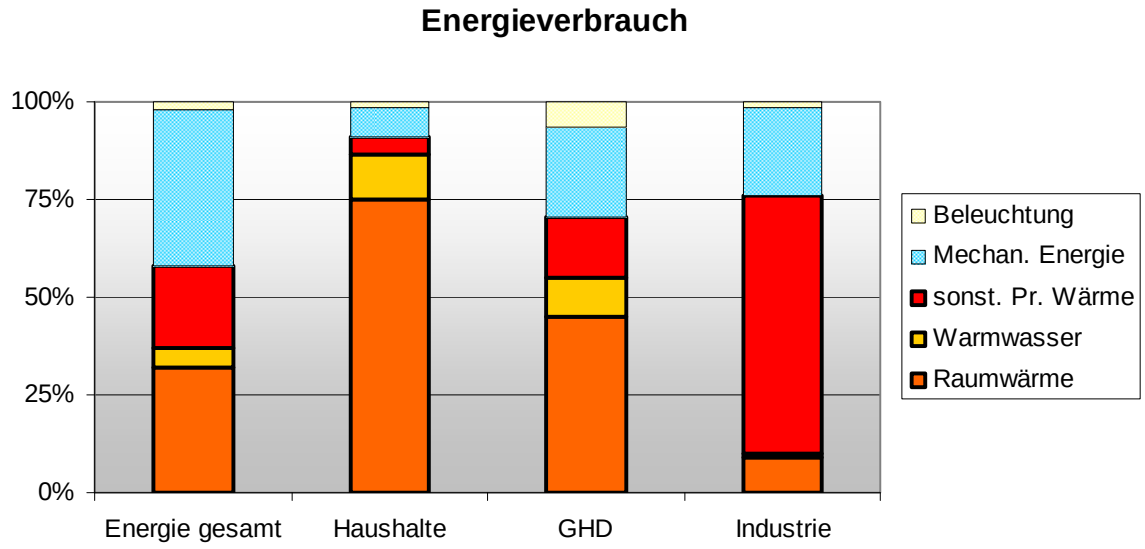

Fig. 4: End-use energy analysis 2005 (source: Energie Spezial, April 2006, VDEW)

Unsurprisingly, energy conservation is a key issue in heat supply. Improved insulation can significantly reduce energy consumption in buildings. However, the methods of heat generation also need to be optimised. On the one hand, heat generation is still largely based on the burning of fossil fuels. On the other, there is an astonishing amount of heat wastage: In electricity production, two thirds of the primary energy used dissipates as waste heat.

2.1 Building economy

Approximately one third of all our energy is consumed indoors. This means that 20 percent of our CO_2 emissions come from buildings.

CO_2 emissions from buildings strongly depend on the climatic characteristics of the seasons and differ from year to year. This of course affects the number of days per year when heating is required, the temperatures produced on these heating days, and average annual temperatures. For the period between 1990 and 2006, we have a reliable set of heat usage statistics for many regions in Germany.

The Hanover region, for example, shows two clearly discernible trends during this period:

1. Average annual temperatures in the region have risen from approx. 9.5°C to approx. 10.1°C.

2. The number of heating days per year in the region has decreased from approx. 220 to approx. 200.

One reason for the reduction in CO_2 levels is thus lower demand for heating, which is a direct repercussion of climate change. Improved efficiency is another reason, achieved through higher energy prices, support schemes and regulatory standards.

This tendency has been significantly reinforced by the heat conservation measures instated in the past few decades (WSVO/Heat Conservation Regulations from 1977, 1984, 1995, EnEV [Energy Conservation Ordinance] 2002, 2008). Federal and state support schemes have also greatly improved heat conservation, for example through large-scale building rehabilitation programmes and market incentive programmes. Over the last four to five years, there has also been a dramatic rise in heating costs, which, coupled with the country's weak economy, has led to a more cautious consumer attitude towards heating, and ultimately produced lower CO_2 levels.

Increases in heat consumption since 1990 have mostly been caused by the significant growth in heated residential areas, despite unchanging, and in some regions even sinking, population numbers.

The number of dwellings in Germany increased from 34 million in 1990 to 39.5 million in 2005, and the total residential floor space increased from 2.8 billion m^2 to 3.4 billion m^2 in the same period. Although this tendency slowed somewhat after the boom years of the early 1990s, it is widely predicted to continue (e.g. by BBR, IÖR, Difu). In 2005, there was a net increase of 30 million m^2/a for residential floor space. Considering the economic upswing of recent years, it should be assumed that without countermeasures, this figure will not be decreasing in the near future.

The positive and negative tendencies in heat usage are difficult to reconcile; at best the level of CO_2 emissions from buildings can be assumed to remain constant. According to the available forecasts, the CO_2 reductions achieved through efficiency im-

provements are offset by the increased emissions coming from expanding residential areas. It should therefore be assumed that the positive development noted for CO_2 emissions in the past, from residential and non-residential buildings alike, was primarily caused by climate change.

While CO_2 emissions between 1990 and 2005 reduced by ten percent, the number of heating days also decreased by ten percent during this time – a very telling comparison.

The current situation

Approximately one third of our total energy (around 4,000 PJ of 14,000 PJ) is used by the residential sector, causing around 20 percent of our CO_2 emissions (200 million tonnes of CO_2).

CO_2 emissions from residential buildings can primarily be attributed to room and water heating. After continual increases since 1990, emissions reached a level of 120 million tonnes of CO_2 by 2005. In non-residential buildings, there are significant additional CO_2 emissions caused by air conditioning systems; this adds another 45 million tonnes of CO_2.

On 31 December 2005 there were estimated to be a total of 39.5 million dwellings in Germany. Of these, at least 75 percent were built before 1984 (i.e. before the second WSVO/Heat Conservation Regulation). In terms of energy efficiency, many of the older buildings need to be rehabilitated to meet the requirements of the current Energy Conservation Regulation (EnEV).

All residential buildings erected after 1984 are required to comply with the second or third WSVO or the 2002 EnEV. For our 2020 forecast scenario we are disregarding these newer buildings, as they will not be due for standard rehabilitation during this time.

The standard rehabilitation period for construction elements (roof, cladding, windows) is usually 50 years; for building technology (heating, etc.) it is 20-25 years. The rate of rehabilitation is therefore approx. two percent per year for construction elements, and four to five percent per year for building components.

However, as only about a third of the standard rehabilitation measures on older buildings have thus far included energy rehabilitation, the actual rehabilitation rate for making buildings more energy efficient is currently only 0.6 to 0.7 percent.

Tools and outcomes

A The Energy Conservation Ordinance and rehabilitation rates

a Emission reductions

1. It is essential to implement energy measures for old buildings more quickly – and to ensure a higher annual rehabilitation rate. The tools we can use to promote these measures are a new Energy Conservation Ordinance (new EnEV) and the Building Rehabilitation Programme of the KfW Förderbank (state-owned development bank). **Our goal is to increase the rehabilitation rate for residential buildings from 0.6 percent to two percent.** With such an increase, a quarter of all outstanding building rehabilitation would be completed by 2020. This would achieve an annual emissions reduction of 20 million tonnes of CO_2. However, this goal can only be achieved if the 2008 EnEV – which has just been agreed – is further tightened, and if implementation of the regulation is closely monitored. The end-use energy consumption of older buildings has to come down from the current average value of 250 kWh/ m^2a to less than 100 kWh/ m^2a.

2. We aim to increase the rehabilitation rate for older non-residential buildings to four percent. This would mean half of the outstanding rehabilitation measures completed by 2020, achieving an annual emissions reduction of six million tonnes of CO_2 by 2020. A much tighter Energy Conservation Ordinance is needed (new EnEV). This must enforce a reduction of end-use energy consumption by non-residential buildings from the current level of 300 kWh/ m^2a to less than 200 kWh/ m^2a.

b Additional emissions

3. CO_2 emissions from new residential buildings must also be significantly reduced. For new buildings, we propose the level of end-use energy be reduced from the current average value of 100 kWh/ m^2a to no more than 60 kWh/ m^2a (i.e. "low-energy house standard 60"). Although an additional 5.5 million tonnes of CO_2 emission will be created through new residential construction by 2020, our scenario would nevertheless achieve a 40 percent reduction (3.5 million tonnes of CO_2) compared to the levels specified by the EnEV 2002 regulation.

4. We also aim to significantly reduce CO_2 emissions from all new non-residential buildings. In these, the level of end-use energy has to be reduced from the current average value of 200 kWh/ m^2a to no more than 100 kWh/ m^2a. Although an additional approx. three million tonnes of CO_2 will be created through new non-residential construction by 2020, our proposed scenario would nevertheless achieve a 50 percent reduction (1.5 million tonnes of CO_2) compared to the levels specified by the EnEV 2002 regulation.

Conclusion A: By reducing the maximum permitted end-use energy consumption levels, as regulated by "new EnEV", and instating a significantly higher building rehabilitation rate of two/four percent , a total reduction of 19 million tonnes of CO_2 emissions can be achieved for residential and non-residential buildings. This figure also takes into account emissions from new buildings.

B Technical measures

There is enormous potential for energy conservation in the area of building technology. Efficiency can be vastly improved by renewing heating systems (usually every 20-25 years), optimising circulation pumps (size upgrades, electronic control), optimising and calibrating the heating networks (hydraulic balancing), and installing electronically controlled thermostats.

For this energy-saving potential, we are conservatively predicting a reduction of ten million tonnes of CO_2 for residential buildings and two million tonnes for non-residential buildings by 2020.

Conclusion B: Technical optimisation can achieve a reduction of around 12 million tonnes of CO_2 by 2020. The total possible reduction potential is actually 25-30 million tonnes of CO_2, but this cannot realistically be achieved within the next 15 years.

C Advice services, energy pass, rent index

5. Targeted on-site advice to building owners and tenants is an effective measure for achieving energy savings outside of rehabilitation, e.g. improved individual heat usage patterns. Taking into account the additional funds needed to provide such advice services, an estimated reduction of 400,000 tonnes of CO_2 could be achieved for residential and non-residential buildings. As well as being provided independently, the envisioned advice services should be taught as part of job training in the relevant professions.

6. The main goal of introducing an "energy pass" is to achieve the rehabilitation measures described in points 1-4 above. According to a study by Jülich Research Centre, the energy pass could also be used to achieve additional reductions; a conservative estimate would be another 600,000 tonnes of CO_2 from residential and non-residential buildings. This also needs to be taken into consideration when calculating the total emission reductions.

7. The "Mietspiegel", Germany's rent index, should include an indication of dwellings' energy consumption and also reflect investments in energy efficiency. No extra costs will be created by this measure if it is instated together with the energy pass.

8. Energy standards need to be specified as part of tenancy law; the owner/tenant dilemma frequently slows down investment in building insulation and energy conservation in rented dwellings. To resolve this impasse, tenants should be granted a better legal position for enforcing energy standards in their homes.

Conclusion C: Advisory and tenancy law-related measures can achieve a total emissions reduction of one million tonnes of CO_2 by 2020. The theoretical reduction potential is significantly higher, but this cannot be accurately predicted.

D Additional benefits through support schemes

9. Through the KfW Building Rehabilitation Programme, the government is providing attractive low-interest loans for rehabilitation. €1.5 billion were spent last year on

the energy rehabilitation of 265,000 dwellings, i.e. 0.7 percent of homes. Again, most of the achieved emission reductions are already included in points 1-4 above. However, the KfW programme is likely to trigger a series of additional conservation measures, which it has been estimated will translate into a further emission reduction of 700,000 tonnes of CO_2 for residential and non-residential buildings by 2020.

10. The KfW Building Rehabilitation Programme is a vital tool and should continue to be applied. However, before the programme is expanded any further, it should be discussed what legal control functions are to be introduced by the envisioned new Energy Conservation Ordinance. A quantitative overload of funding and control is not necessarily the best approach, and the KfW support scheme should be primarily conceived as a supplementary measure.

11. Experience in 2006 showed that the increased demand for building insulation materials (including insulating glass) caused by rehabilitation funding schemes has led to price hikes in materials and installation, as well as windfall gains for manufacturers. A sustainable and sensible market expansion will only take place once there is a solid political framework for energy-efficient building rehabilitation.

12. According to the Federal Ministry of Transport, Building and Urban Affairs, the KfW Building Rehabilitation Programme has achieved a theoretical emissions reduction of 900,000 tonnes of CO_2 per year. However, to assess the actual level of reduction we need tighter quality monitoring of the measures instated by KfW and its agents. The granting of low-interest loans by the KfW Bank must be accompanied by independently-conducted efficiency inspections of the actual building modifications.

13. Ecological building materials not only require less energy to manufacture, they are also more CO_2-neutral, renewable and recyclable. Timber production, for example, requires 8-30 kWh to produce $1m^3$ of building parts, whereas concrete production would require 200 kWh for an equivalent output, steel production 500-600 kWh, and aluminium production 800 kWh. One cubic metre of spruce timber used in construction captures 0.7 tonnes of CO_2, and at the same time saves one tonne of CO_2 through of its substitution for less ecological materials. The use of sustainable building materials needs to be fostered through a market incentive scheme.

Conclusion D: In total, the rehabilitation funding schemes outlined above are predicted to reduce emissions by an additional 700,000 tonnes of CO_2 by 2020. However, the issues addressed in points 8-10 will probably be more significant in the long term than the schemes' direct contributions to emission reductions.

The KfW programme only accommodates a limited range of all the possible energy rehabilitation measures; some of the investments required for large-scale rehabilitation are well beyond the programme's financial scope. To encourage large-scale improvements, better tax deduction options for energy rehabilitation are required. Like the KfW programme, however, such tax bonuses will need to be directly linked to minimum reduction targets (e.g. the "low-energy house" concept for the rehabilitation of old buildings), and monitored by independent energy inspectors.

2.2 The renewable energies success story – to be continued in the heating sector

In the heating sector, there is virtually no utilisation of renewable energies – not in residential buildings, not in commercial buildings, and least of all in industrial buildings. The contribution of renewables to the heating sector's energy requirements is a mere 5.4 percent. According to the BDH (Association of the German Building, Energy and Environmental Technology Industry), only ten percent of 17 million installed heating systems comply with the current technological standards, i.e. only ten percent integrate renewable energies.

In contrast, solar thermal energy, geothermal energy and biomass technologies offer plenty of scope for higher energy efficiency in the heating and cooling sector:

- Solar thermal panels: standalone systems, local heating.
- Geothermal energy: standalone systems (e.g. heat pumps), local heating.
- Biomass: standalone systems (pellets, split logs, biogas), CHP, local heating.
- Supplementary technology: small-scale wind energy systems, small-scale hydroelectrics, improved storage technology (including seasonal storage), utilisation of industrial waste heat, utilisation of waste water heat, etc.

In the cooling sector, solar thermal cooling is particularly efficient, but there are also cooling units based on green energy, biogas and geothermal heat.

Measures are urgently needed to speed up technological development and foster market acceptance. In the biomass area, internationally binding certification criteria are long overdue.

If all the necessary measures are taken immediately and effective tools are established, 28 percent of our heating requirements can be covered through renewable energies by 2020.

- We estimate 144 PJ could be achieved through solar thermal energy alone. This requires the utilisation of ten percent of all roof areas suitable for solar technology across Germany by 2020.
- In geothermal energy, strong growth is to be expected in the exploitation of shallow geothermal energy. Heat pump numbers could be increased from approx. 100,000 (presently) to one million by 2020. This corresponds to 78 PJ of heating.
- In the area of deep geothermal energy, accurate predictions are difficult. For our forecast, we are assuming the same values as Greenpeace, which is predicting a heat energy level of 48 PJ from deep geothermal energy by 2020.
- In the generation of effective heat energy, solid biomass remains the most efficient option. Central heating systems can be fired with wood pellets, wood

chips and split logs. Wood chips and hay bails can also be used for the generation of local and district heating. Presently, approximately 273 PJ of heat are produced from direct firing systems. However, the potential of solid biomass for generating effective heat energy in the home is a lot higher; a feasible target figure would be 453 PJ (cf. NatPlus II).

- Biogas is predicted to contribute 190 PJ to heat generation through gas heating systems.

- All of the cited predictions are based on improved and expanded storage technologies. For example, seasonal storage systems holding heat surplus from the summer can provide this as useful heat in the winter.

- When biomass is integrated into combined heat and power generation (CHP), an additional 166 PJ of heat will be produced from biomass and another 96 PJ from geothermal energy.

As our predictions show, renewable energies can provide approximately 22 percent of the energy needed for heat generation, i.e. 914 PJ. This figure does not include the additional capacities of CHP generation; with biomass and geothermal energy integrated via CHP, the contribution of renewable energies rises to 28 percent. In total, the contribution from renewables to the heating sector can feasibly be predicted to reach 1177 PJ by 2020. However, a large part of this potential will have to be implemented within the existing heating supply network, which urgently needs expanding and upgrading.

Tools and outcomes

a) We urgently need a **Renewable Energies Heat Law** (EEW) that is widely applicable and based on regulatory standards.

   A renewable energies quota for heat generation needs to be imposed on operators of new heat generation systems and operators who are replacing or upgrading existing systems. The quota should also encompass operators of heating networks. Operators who cannot or will not comply with this quota should pay a compensation tax, based on the output of the installed fossil fuel heating system. Such taxes can be used to fund renewable heat generation systems, heat storage systems, energy conservation programmes and heating networks.

   The renewable energies quota must be supplemented by:

   - improved building planning regulations;
   - tighter integration with the EnEV regulations;
   - compulsory replacement of outdated heating systems.

b) Currently, the ***Marktanreizprogramm*** **(Market Incentive Scheme or MAP)** is the government's only tool for promoting the introduction of renewable energies in the heating sector. The total level of funding for renewables in heating is €213 million per year; considering the vast challenges posed by climate protection, this is not

nearly enough. The MAP is not designed to steer the necessary energy developments in the heating sector, and the potential remains largely untapped.

The MAP needs to be restructured into a powerful innovations scheme that helps next-generation technologies to reach widespread market acceptance. The scheme should not be restricted to the heating sector but also accommodate renewable energy concepts in the electricity and transport sectors. Bündnis 90/Die Grünen are calling for a significant boost and redesign of the MAP market incentive scheme.

If the described measures are instated, the following CO_2 reductions can be achieved:

A reduction in heating requirements of approximately 1,174 PJ and an increase of renewables' share in heat generation from 5.4 percent to 28 percent by 2020 will achieve an **emissions reduction of 130 million tonnes of CO_2** compared to 2005.

This goal should be further supplemented by municipal measures. It would require an urban planning concept to include, for example, maximum sunlight exploitation, strict insulation guidelines and mandatory inclusion of renewables. Local funding can also be a vital contribution in this regard.

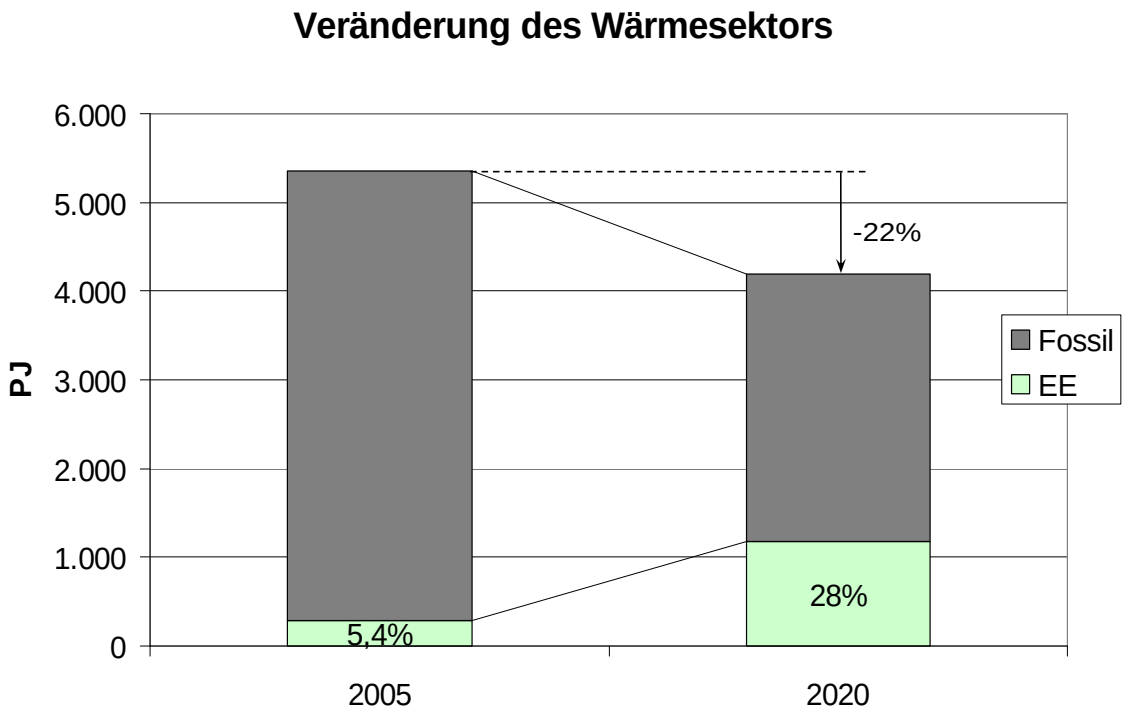

Fig. 5: Green action plan: Energy consumption in the heating sector

2.3 Dual-functioning power plants instead of cloud generators

The combined heat and power generation concept (CHP) is neither new nor hi-tech. In fact, this very simple and efficient idea of synchronously generated heat and power has been around for a long time. Conventional steam-electric power plants, by comparison, act more like cloud generators; half of the energy they create is dissipated as waste heat.

The proliferation of CHP technology and infrastructure is vital to a sustainable and efficient energy supply grid. In some European countries, "dual-functioning power plants" have already enjoyed a high level of success: In Denmark, CHP is used for over 50 percent of electricity production; in the Netherlands and Finland, it is used for over 35 percent. In Germany, however, CHP is employed sporadically, contributing only 11 percent to the supply grid. Assessing the contribution of current CHP plants to the heating network is problematic; a rough estimate would be a nine percent contribution to room and process heat.

Since 2002, the expansion of CHP generation in Germany has been propelled by two government initiatives:

- The CHP law of 2002 fosters the construction of CHP plants up to 2 MW. Until 2005, this also included the upgrading of major older plants. The CHP law is the result of an agreement between the German government and German industry, which had voluntarily committed to increasing the usage of CHP. To date, the outcomes of this agreement have been quite underwhelming. The CHP amendment did trigger some investment but this was mainly focused on upgrading existing power plants and constructing small-scale district heating plants. The German industry's declared commitment to expand into CHP for its own usage has largely gone unfulfilled. In the meantime, other CHP development opportunities have been neglected. The CHP-based reductions did not come anywhere close to the target of 43 million tonnes of CO_2 per year that the government and industry had agreed on.

- The CHP law is supplemented by another law which fosters the use of renewable energies in combined heat and power generation: The Renewable Energies Act (EEG) includes a special CHP bonus to encourage renewables-based CHP plants. This has already led to significant progress over the last years.

However, the potential for CHP generation in Germany is significantly higher than present contributions would suggest. In fact, more than half of our energy could be produced using this efficient technology. A study by the German Aerospace Center ("Analysis of the National Potential for the Implementation of Highly Efficient Co-Generation") from December 2005 predicts an electricity potential of up to 357 TWh and a heating potential of 351 TWh. Greenpeace predicts that by 2020, 170 TWh of electricity and 267 TWh of heating can be commercially produced. Our forecast predicts a feasible contribution from CHP to power generation of 154 TWh – which is 30 percent of the total amount of the total electricity to be produced. For heating, we are predicting a CHP-based annual output of 164 TWh, i.e. a contribution of 14 percent. However, these goals can only be achieved if a permanent framework is established immediately to

attract further investment in the construction of power plants and heat supply networks.

Gas power plants are particularly important in this respect. Not only are they significantly more efficient than coal-based power plants, they are also fully compatible with biogas, which makes them a sound investment in the future. The increased demand for natural gas is insignificant within the total resource allocation of our energy concept as natural gas demand in the residential sector is predicted to drop strongly as a result of improved insulation and the introduction of renewable energies.

Even today, CHP is an important feature in many biogas plants. We are predicting the energy potential from renewables (primarily geothermal heat and biomass) in CHP generation to be in excess of 262 PJ.

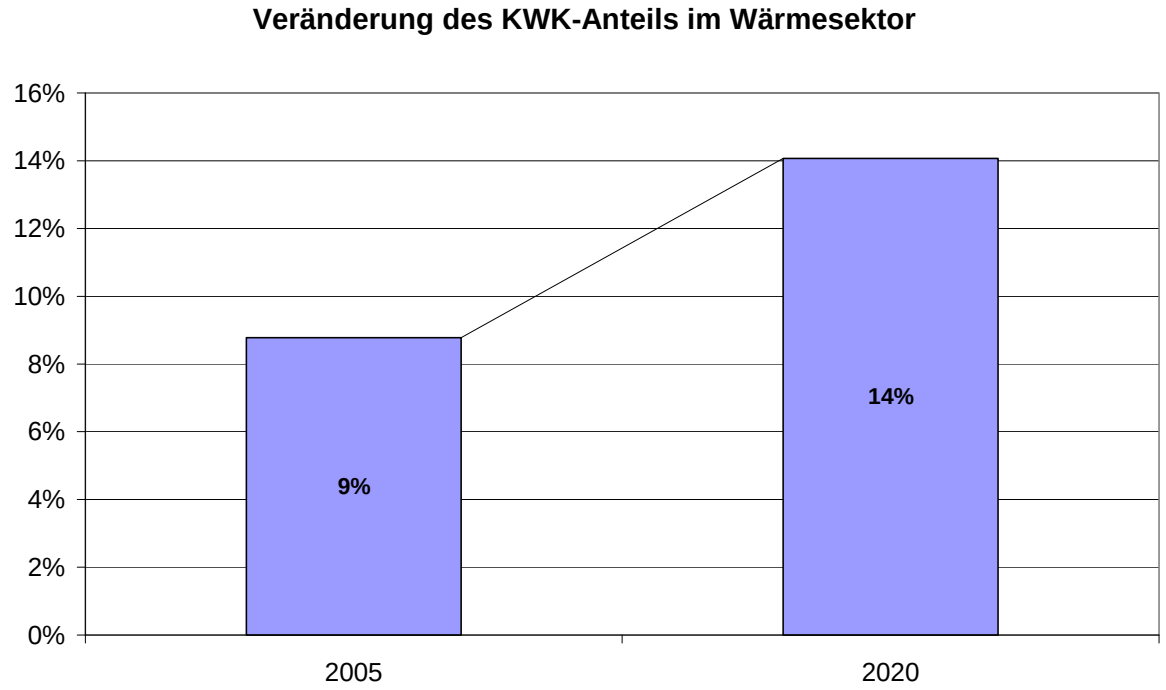

Fig. 6: Green action plan: Increase of the CHP share in heat generation

a) CHP amendment

The 2002 CHP law is in urgent need of amendment. The law's bonus scheme has essentially been successful. However, the excessive restrictions – such as the tight deadlines or the limitation of only replacing existing CHP plants – have to be removed, as does the distinction between supplied electricity and electricity consumed by the supplier. Only once the funding environment is shown to have a long-term outlook, i.e. a reliable and comprehensive framework, will combined heat and power come to full fruition in Germany.

Because the consumption of heating energy is heavily influenced by seasonal fluctuations, CHP should also be approved for cooling.

b) Higher CHP bonus in the Renewable Energies Act (EEG)

The climatic benefits of CHP will increase considerably with the growing use of biomass as an energy resource. A study by ISUSI ("Renewable Energies and Combined Heat and Power Generation to Replace Outdated Power Plants in Germany", 2004) predicts that by 2020, more than 90 percent of CHP plants could be fired with biomass. The latest amendment to the EEG has already significantly boosted construction of biogas plants, something which can be directly traced to the introduction of the NaWaRo bonus. Many of these plants are small-scale or medium-size farm systems that are largely unable to exploit their heat potential in a commercially viable fashion. The EEG's own CHP bonus is insufficient to adequately foster the construction of biogas plants near places where the warmth could be effectively utilised on a large scale. This shortcoming could be addressed through a restructuring of the EEG bonuses in favour of CHP implementation. The objective of such an amendment would be to optimise the utilisation of available primary energy.

c) Biogas feed-in law

Many of today's biogas plants are being built near farms. This is generally also where the biogas is used to generate electricity. A more efficient exploitation of the accompanying waste heat should be fostered through CHP and through piping the heat to glasshouses and rural residential areas. A biogas feed-in law would enable farmers to refine the biogas they have produced and feed it into the public gas supply grid. This would represent a much better utilisation of renewable energies than the recent trend towards gigantic corn crops that cover thousands of hectares of land and are ecologically unsound.

d) Electricity generated from waste heat

This is a relatively new approach with plenty of scope for development. A number of methods are currently being tested and applied to increase efficiency, particularly in conjunction with renewable energies. However, there is also huge potential for these methods to be applied in conventional power plants. The CHP law needs to be amended to include feasible market incentives for electricity generation based on waste heat.

e) Expansion of local and district heating networks

The proliferation of CHP systems is usually hindered by a lack of adequate infrastructure for the commercial exploitation of the generated heat. Local and district heating networks and buffer storage need to be expanded concurrently with the construction of CHP plants. The first step is to establish supply clusters that can later be interlinked.

Local authorities need to be involved more closely in on-site potential analyses, detailed infrastructural planning and the actual construction of CHP plants. An important step towards this is to conduct a nationwide potential analysis of local/district heat provided by municipalities; in the long term, they represent a vital element in the nationwide energy supply concept.

Another crucial step is to provide fair and indiscriminate network access to all suppliers. Like electricity and gas, heat networks are grid or pipeline-bound infrastructures. Each heat supplier should be given the same transparent and unbureaucratic feed-in conditions. As has already been established in the electricity supply grid, the use of renewable energies should be prioritised.

To aid the introduction of local heating in residential buildings, a stronger structural perspective on housing areas is required. Wherever possible, there should be local government regulations to instate compulsory network access. Building design already has to comply with numerous regulations (ranging from building height to roof colour) so there is no reason why there should not be binding regulations in aid of climate protection. Additionally, public buildings should always be connected to heating networks as a first option. This way, public authorities would not only fulfil their role model function but also guarantee a reliable market for suppliers.

As well as significantly reducing the exploitation of primary energy, CHP greatly reduces CO_2 emissions. A study conducted by the Bremen Energy Institute and the German Aerospace Center has determined that if heat output from the district heating network were expanded to 140 TWh, this alone would achieve an emissions reduction of over 50 million tonnes of CO_2 per year. The proliferation of CHP technology should therefore be a central component of our climate strategy.

3. Transport – conservation, efficiency and renewables

The share of CO_2 emissions caused by transport is 18 percent – and increasing. According to the National Allocation Plan, in 2005 transport was the only sector in Germany where emissions rose in comparison to 1990. The increase was from 158 to 167 tonnes, i.e. around six percent. Given the vast increase in the number of people purchasing cars in East Germany after 1990 and the general European rise in transport CO_2 emissions of 25 percent, this may be seen as a relatively low increase. But it also means we have not reached (or exceeded) the reduction goals set by the Kyoto Protocol, but are simply moving towards the levels of 1990.

In the area of transport we have basically lost 15 years with regard to achieving our climate goals. Transport is the most neglected area of emissions reduction, and for this reason, efforts to reduce CO_2 emissions must be massively increased here. We need to establish a framework and structures which can lead to a real reduction in emissions.

No other sector is as dependent on oil as transport. Around 95 percent of our energy consumption in the area of transport is based on crude oil and 70 percent of our entire oil consumption is covered by transport. The predicted doubling in the numbers of cars in the world between 2000 and 2030 – from 700 million in 2000 to 1.4 billion in 2030 and then to two billion in 2050 – is already being overtaken by reality. In China the number of private cars is currently increasing annually by 20 percent! It is glaringly obvious that we need to get away from our dependence on oil if we want to stay mobile in the future.

As a country with expertise in transport technology, and particularly car manufacturing, Germany has the opportunity – and the duty – to develop much more efficient vehicles. It is not enough in the medium term to merely exploit the existing potential of the internal combustion engine. The hybrid technology launched successfully onto the market by Honda and Toyota, which makes use of braking energy, is a sign of the coming revolution in propulsion technology. The comparatively inefficient combustion engine will be gradually replaced by electric motors and greatly improved batteries. However, the internal combustion engine still has much potential. Considerable improvements in efficiency could be achieved in the coming years if the conventional engine is combined with mild or full hybrid concepts.

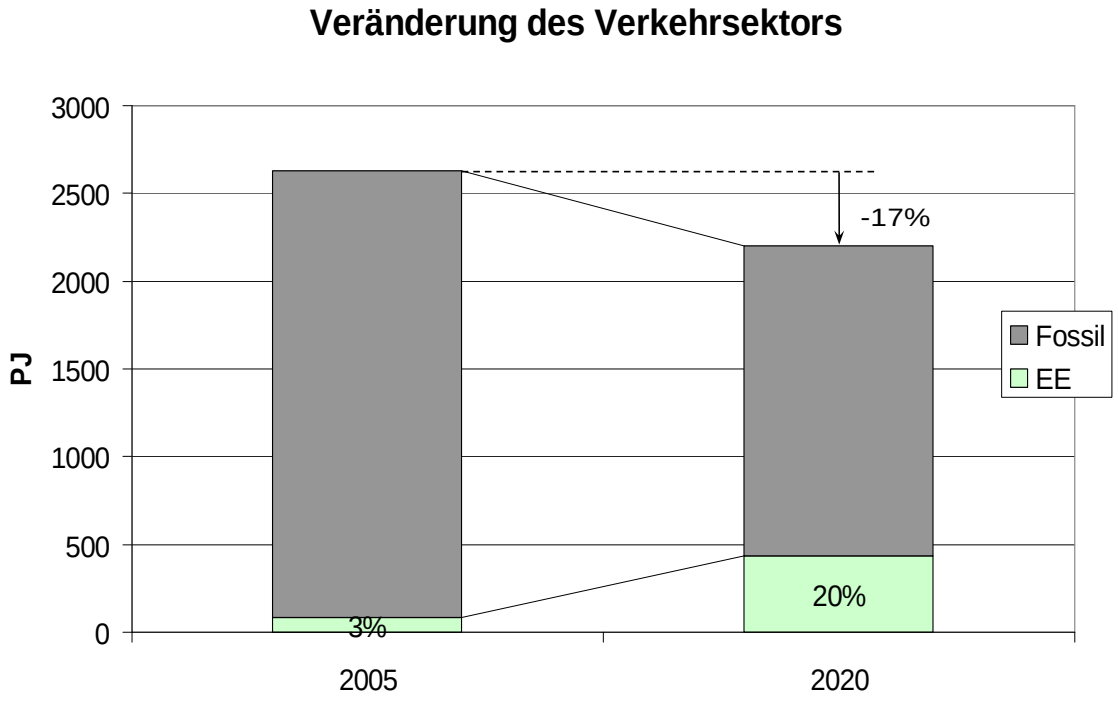

Fig. 7: Green action plan: changes in energy provision in the transport sector

3.1 Passenger transport dominated by the car

Statistically speaking, there is space for the entire population of Germany in the front seats of our cars. The country had 46 million licensed vehicles in 2006, making the car the dominant means of transport. In 2005 the share of traffic of motorised private transport (cars and motorbikes) was 80 percent. The railways had seven percent and remaining public modes of transport around eight percent. Air traffic has doubled since 1990 from 2.5 to five percent. Bicycles and pedestrians play a minor role if we only consider kilometres travelled per person.

Things looks quite different if we look at the number of trips. Trips on foot have a share of 23 percent and those by bicycle nine percent, while the entire public transport system, including the railway, only accounts for nine percent of trips.

CO_2 emissions from motorised private transport rose sharply until 1999. They have sunk since, but in 2005 were still above the level of 1990. The reason for the reduction is a combination of increased efficiency, higher fuel prices – partly through the Eco Tax introduced in 1999, the general switch to diesel, "fuel tourism" (driving over national borders to fill up more cheaply) and a reduction in the numbers of journeys because of the shape of the economy in general.

Basic assumptions and goals

A projection of the status quo indicates slightly reduced CO_2 emissions up to 2020. However, the positive effects of more efficient new vehicles will be almost completely absorbed by a further rise in the number of cars and the trend towards larger vehicles.

The car is likely to retain its current position as the leading form of transport; continued dynamic growth of air traffic is projected, while the remaining means of public transport will largely stagnate. Official predictions have largely ignored bicycle and pedestrian traffic, yet it offers great potential for climate protection.

The greatest potential for saving energy lies in greater transport efficiency, in relation to both specific use of modes of transport and to fuel efficiency, e.g. through the increased use of public transport or by encouraging drivers to drive in a more fuel-efficient manner (e.g. introducing speed limits on motorways).

In comparison to this crucial factor, renewable energy in the form of biofuels or renewably-sourced electricity) still plays a subordinate role. Biofuels will play an important role once electric propulsion makes its breakthrough in Germany. They will increase the distances hybrid, plug-in vehicles can travel. In the long term, green electricity will supersede biofuels as the most important renewable in the fuel sector.

To steer this trend in the direction of an environment-friendly transport system with lower energy consumption, we are pursuing the following aims:

- Massive increase in the efficiency of cars, trucks and other commercial vehicles, motorbikes, buses, aeroplanes, ships and trains.
- Wide market launch of alternative drives for cars, buses and motorbikes, e.g. we are aiming to put a million electric cars on the roads by 2020.
- More efficient and cleaner propulsion for aeroplanes, ships and trains.
- Promoting fuel-efficient driving for all forms of motorised transport.
- Reduction of motorised travel, especially for local trips.
- Doubling eco-mobility – pedestrian traffic, bicycles and public transport (also car sharing).

We envisage a transition from oil-dependent to renewables-based transport. The internal combustion engine still has enormous potential for the coming years but the long term future of the car lies in electric propulsion. The initially insufficient range provided by the battery can be compensated by highly efficient combustion engines which charge up the battery while the car is in motion.

We believe that a reduction in transport-sector CO_2 emissions of around 50-60 million tonnes can be achieved through the following action plan. This would be equivalent to a decrease of 30 percent in CO_2 emissions from traffic, despite the continued increase in emissions from air and freight traffic. In the transport sector the aim of a 40-percent decrease cannot be achieved because of the dramatic rise in traffic since 1990.

Measures focused on passenger vehicle traffic

The three traditional strategies for making passenger traffic more environmentally friendly are traffic avoidance, mode switching and improved vehicle design. However, traffic avoidance does not mean restricting mobility. Instead, it is a concept for reducing travel, which anyway often puts a strain on travellers themselves.

A) Traffic avoidance

Our goal is to create incentives for people to avoid using their cars and to make inner cities more attractive places to live. In a "town of short distances", shopping facilities and recreational areas are easily accessible without a car. At the same time, subsidies that encourage sprawling housing structures must be abolished. However, such measures typically have only medium-term and long-term effects and will thus not significantly reduce CO_2 by 2020. Nevertheless, they could significantly contribute to CO_2 reductions in subsequent years as demographic changes take place.

Short-term measures for traffic avoidance include telecommuting and video conferencing, which reduce the number of journeys to and from the workplace. However, these measures are not widespread and will become only slightly more so in the future.

Action plan: traffic avoidance

- Redeploying road construction and expansion funds into road maintenance and restoration. New roads mean more traffic ("induced traffic"). In times of demographic change, they are often unnecessary. Exceptions should be made for roads that are heavily used on a continual basis. However, these roads make up only a small portion of current new road construction.

- Boosting urban renewal programmes and Socially Integrative City programmes with a significant increase in funds for improving residential environments.

- Changing the Federal Building Code so that identifying residential areas near public transport stops is significantly facilitated.

- Reforming the property tax system so that living in cities with low land consumption is cheaper and building on green fields is more expensive.

- Promoting the "town of short distances" development approach.

- Phasing out the commuter tax allowance.

Facts and figures: Little short-term impact on CO_2 reductions by 2020 (less than three million tonnes), with increasing impact later.

B) Mode switching

The potential of switching to more environmentally-friendly modes of transport is frequently underestimated. The Federal Environment Agency predicts that CO_2 emissions could be reduced by three to four million tonnes if five percent of all urban car journeys were made by bus or train instead and if 30 percent of all car journeys under five kilometres were made by bicycle (an average cycling trip of 15 to 20 minutes). With bicycles accounting for approximately nine percent of traffic, Germany lies far behind the Netherlands, where bicycle traffic is at 27 percent.

Pedestrian traffic actually accounts for almost one quarter of all the trips we make. To promote walking we must remove barriers on streets which are hindrances to all pedestrians, not just those with restricted mobility. To create pedestrian-friendly cities, structural modifications as well as changes to traffic laws are necessary.

Public transport must be bolstered. This involves more than just increasing the funds allocated to it. Public transport financing must also undergo fundamental reform that creates more transparency and makes buses and trains more attractive to passengers.

The abolishment of the "Interregio" rail service has left a transport gap, especially between medium-sized centres, that cannot be filled by the market alone. It would make sense to reallocate a portion of public transport subsidies in order to solve this problem.

To induce a modal shift from the air to the rails, there must be a balanced competitive environment. This can be achieved by dismantling subsidies for air transport and simultaneously boosting public investment in and promotion of rail transport for environmental reasons.

Action plan: modal switching

Bicycle and pedestrian traffic

- Centring city traffic around human needs (pedestrian-friendly city, shared space). This means lowering the speed limit to 30 km/h within city limits (except on certain main roads), expanding crossing facilities for pedestrians by adding zebra crossings, lengthening the duration of pedestrian crossing lights, introducing exclusive pedestrian phases (where all lights are green for pedestrians, allowing them to walk diagonally across junctions), making structural changes with wider pavements and traffic-calming measures, identifying city walking and cycle path networks, upgrading paths alongside lakes and rivers and giving priority to pedestrians and cyclists in areas where many people are out and about on foot or by bike

- The Federal Government can support these measures, which have already been documented for bicycle traffic in a national bicycle traffic plan – barely imple-

mented to date – by defining technical standards, identifying good practice models and establishing research and promotional programmes.

- Following the Swiss example, the Federal Government should cooperate with private partners to establish a Cycling Foundation and provide it with €100 million in start-up funds. This money would support innovative local government measures to promote cycling and build a contiguous network of cycle paths in Germany.

- Constructing a nationwide cycle path network ("D-Netz")

- Launching a "Get yourself moving" campaign to promote cycling and walking, emphasising the aspects of improving one's personal fitness and protecting the environment.

Public transport

- Cutbacks in regionalisation funds for public rail transport must be reversed and instead funds must be increased substantially.

- A federal public transport law would bundle all government allowances, which would then be allocated by task managers in fair competition. It would be useful to introduce incentive agreements that honour efforts to increase passenger numbers.

- Introduction of a Germany-wide travel card ("GreenCard") for public transport

- Development of a cost-free system for collecting a city toll to encourage cities to implement the standard by 2020 and encourage modal shift.

- Cooperation with trade associations to boost mobility management initiatives. Mobility management allows traffic to be organised much more efficiently or curtailed.

- Increasing and maintaining rail network investments at a minimum of €4 billion per year and effectively using them to remedy bottlenecks and expand capacities

- The railway network will be transferred to a federally owned infrastructure company and separated from the DB Group (German Railways). Responsibility for regional rail networks can be transferred to individual states, if requested. These measures will increase competition and therefore encourage increased rail transport.

Facts and figures

The Federal Environment Agency predicts that these measures can reduce CO_2 by 15 million tonnes (this figure includes goods transport, however). This corresponds to about ten percent of CO_2 emissions in 1990 (162 million tonnes) or 2005 (164 million tonnes). Because our action plan is much more extensive, we assume a potential reduction of 20 million tonnes by 2020.

C) Environmentally friendly vehicle design and use

A variety of social, as well as technical measures can be used to increase the energy efficiency of vehicles. Technical measures include improving and modifying engines, reducing aeroplane weight and minimising rolling resistance and aerodynamic drag.

To the maximum extent possible, these more efficient vehicles will run on biofuels from sustainable crops or waste materials. Such fuels create much less CO_2 than fossil fuels and can be continually recycled as renewable forms of energy. We support the competitive allocation of research funds to promote the development of alternative drive technologies.

Yet, a great deal of energy can be saved in the way vehicles are used, too. The two previous sections addressing traffic avoidance and modal shifts rely entirely on a change in transport behaviour and therefore depend on demand. It does not matter how good public transport services are; unless they induce motorists to switch to travelling by bus and train they will remain ineffective. Efforts must be accompanied by social science research programmes to identify the preconditions for behavioural changes and whose results can be quickly implemented.

Additional ways of saving energy in the way vehicles are used include:

- choosing to purchase more efficient vehicles;
- using fuel-efficient driving techniques;
- lowering speed limits.

The environmental advantages of buses and trains can only be maintained if technological developments keep up with advancements in automobile technology.

Air transport will continue to skyrocket in the course of increased globalisation and far-reaching liberalisation (e.g. the Open Skies Agreement between the EU and the US). Average growth rates are currently five percent per year. This means CO_2 emissions will double by 2015 and triple by 2030 in comparison to 1990 levels. And the overall impact of air transport on the climate is at least two to five times greater than that of ground-level CO_2 emissions.

Action plan: environmentally friendly vehicle design and use

Cars

- Mandatory limits for new cars, 120 g CO_2/km by 2012 (approximately 4.5 l of diesel or 5.0 l of petrol/100 km) and 80 g CO_2/km by 2020 (approximately 3.0 l of diesel or 3.4 l of petrol/100 km).

- Changing the motor vehicle tax to a CO_2-related tax that rewards fuel-efficient vehicles and penalises petrol guzzlers much more than is currently the case.

- Market incentive programme for alternative technologies (hybrid, plug-in hybrid) with €100 million a year invested towards the goal of having one million electric vehicles on the road by 2020.

- Promotion of fuel-efficient, lightweight construction as well as technical measures for reducing aerodynamic drag and rolling resistance.

- Basing company car tax on the amount of CO_2 emissions and not providing tax allowances for cars which exceed the limit.

- Environmental certification: labels on new vehicles classifying them according to their efficiency (like the A-E classification currently used for electrical appliances).

- Mandatory installation of gear shift indicators and tyre pressure monitors from 2010 to promote fuel-efficient driving.

- Speed limit of 120 km/h on motorways, 80 km/h on two-lane rural roads, 30 km/h (with exceptions) within town and city limits, 100 km/h speed limit for delivery vans on motorways.

Powered two-wheelers

- European initiative for zero emissions in newly licensed two-wheelers such as motorised bicycles and scooters, for which zero-emission technology is already available (as demonstrated in numerous large cities in Asia).

- Promotion of electrically powered two-wheelers, e.g., by constructing public electricity filling stations, or requiring large companies to install solar electricity filling stations on their premises.

Trains and buses

- Use of electric or gas-powered buses for city transport and tourism, expansion of network of natural gas or biogas filling stations on motorways.

- Promotion of hybrid technology in buses and trains on non-electrified routes.
- Project: 100 cities with zero-emission public transport by 2020.
- Reducing weight and drag of trains and trams.
- Use of biofuel in trains on non-electrified local routes.
- Training courses in fuel-efficient driving for all public transport employees (already implemented at DB).
- Use of green energy and biofuels in (hybrid) buses and trains.

Air transport

- Abolition of tax privileges, introduction of kerosene tax for commercial flights.
- Abolition of VAT exemption for international flights.
- Incorporation of air transport into CO_2 emissions trading.
- Coordinated airport planning at federal level, halting funding for regional airports used by low-cost airlines.
- Lowering specific fuel consumption of aircraft by 15 percent.
- The creation of a single European air space could optimise flight routes and reduce the amount of time planes spend circling above airports.
- Emissions-based take-off and landing fees (plus possible fly-over fees in future) can provide incentives for investment in high-efficiency engines.
- At the same time, it is also necessary to trigger investment in zero-emission technology in the air industry.

Facts and figures:

Simply establishing a speed limit of 120 km/h would already reduce CO_2 emissions by approximately 3.3 million tonnes. CO_2 emissions from cars can be reduced by a total of 40 percent compared to 1990 levels, especially if legal requirements for new vehicles are introduced (and use of biofuels is increased to 25 percent). Installing zero-emission technology in motorised bicycles and scooters would have only gradual effects in the years up to 2020.

The Federal Environment Agency's goal of reducing CO_2 emissions by 15 million tonnes by 2020 through improving technical efficiency (including of goods transport) is not ambitious enough. We believe emissions can be reduced by 25 million tonnes through additional measures.

In the air industry, an ambitious package of measures could help slow down the current excessive growth. According to the Federal Environment Agency, specific fuel consumption savings of 15 percent are feasible. The EU commission expects a six to 12 percent reduction in CO_2 emissions over the next 20 years as a result of improved air transport management. CO_2 emissions trading would initially stabilise the amount of emissions at 2004-2006 levels, although this would be accomplished by purchasing emission credits from other sectors.

3.2 Freight transport: from roads to rails

Trucks are the primary means of transporting goods over land. Their main advantage is that they allow goods to be transported from their source to final destination without interim loading and unloading. Trucks have profited from a decrease in the size of shipments, the increase in mixed cargo, just-in-time deliveries to manufacturing plants, a substantial increase in transportation distances, and a premature, extensive liberalisation of the European road transport market. For decades, the road transport sector has also benefited from preferential treatment over railway transport with respect to infrastructure expansion and taxation. While the size of the road transport network has increased six-fold from 2,100 to more than 12,000 kilometres since 1950, the rail network fell from 41,000 to 35,600 kilometres between 1991 and 2003 alone.

Yet, road transport does not pay for the damage it causes to the environment and health. A toll averaging 12.4 cents per kilometre was only introduced in 2005, whereas a "railway toll" in the form of track access charges had already been introduced ten years previously.

Substantial continuing growth in road transport has been predicted, and this is plausible given the process of globalisation and the resulting increase in world trade. These goods are mainly shipped in containers, which can also be transported very efficiently by rail or barge.

Basic assumptions and goals

- Increases in road haulage vary considerably by region. Whilst a significant increase in road haulage is expected in and around urban centres, areas around ports and on many transit routes, other areas are experiencing decreases.

- Road transport has been made significantly more expensive, even compared to rail transport, by the dramatic increase in oil prices, higher commercial vehicle tolls on national roads, even for vans, stricter working time regulations and higher labour costs for drivers as living standards are levelled throughout Europe.

- Sixty-tonne, 25.25-metre-long trucks are not permitted on German and European roads as they would require a massive programme for re-shifting transport from rail to road and their size and weight would cause additional traffic safety risks, especially with respect to the load-bearing capacity of bridges.

- Hybrid lorries are set to experience widespread use, though somewhat later than their passenger vehicle counterparts. Hybrid-powered engines are especially beneficial for shorter-distance commercial deliveries. Volvo has also recently announced hybrid solutions for heavy commercial vehicles. The company claims the new vehicles can lower fuel consumption by 20-50 percent. In addition, a growing number of trucks can also run on biodiesel or pure vegetable oil. Fuel represents one of the largest costs for road transport. As a result, we predict that hybrid vehicles will be introduced on the market very quickly, as rising fuel prices will quickly lead to rapid amortisation of the initial costs.

- In Europe, technical, organisational and legal conditions for railway freight transport have been harmonised so that transnational trains are now travelling across borders more than twice as quickly as they were in 2006. Mode switching of freight transport from roads to rail is picking up speed. Achievements like this do not require prestigious, oversized projects like the Fehmarn Belt Bridge or the Brenner Base Tunnel. Instead, we are focusing on measures that systematically remove bottlenecks by introducing passing loops, expanding railway junctions and gradually implementing the European Rail Traffic Management System (ERTMS) on main lines, a measure that would increase capacity by up to 20 percent.

- Inland water transport is insignificant, except on the Rhine, and its share of the market is decreasing, especially given the growing dematerialisation of the economy, meaning that less bulk cargo is needed. Barge transport on inland waterways can only be operated cost-effectively on the Rhine. Overall, specific CO_2 emissions from barges will only decrease slightly by 2020 as their replacement rate is extremely low.

- Maritime traffic, especially container shipping, will continue to increase significantly as a result of growing world trade. Emissions could be significantly reduced through international agreements (organised via the International Maritime Organization) aimed at including shipping traffic in emissions trad-

ing. Lowering ship speeds and developing alternative drive systems that use renewable energies such as wind power could have a direct impact on emission reductions.

- The air freight sector will also grow substantially. If CO_2 emissions trading takes hold within the industry by 2011/2012, this growth can be offset by purchasing credits from other sectors.

Freight transport measures

The following freight transport measures are based on the three traditional strategies discussed above:

A) Traffic avoidance

- Strengthening regional business cycles to avoid unnecessary journeys.

- Better utilisation of existing capacities to avoid empty runs.

- Limiting customer pickups (e.g. from package pickup points).

B) Mode switching

- Doubling rail freight transport and boosting its market share to 30 percent by 2020.

- Increasing the commercial vehicle toll to 40 cents/km by 2020 (from 12.4 cents/km in 2007) in order to incorporate external costs; expanding the toll to include vans and all important transregional roads.

- Expansion of rail network and construction of new lines, especially for haulage in areas near ports.

- Increased funding for freight handling facilities, rail wagonload freight transport, combined transport and the construction and maintenance of railway sidings.

- Promotion of competition by establishing clear public responsibility for the rail network.

C) Environmentally friendly vehicle design and use

- Setting ambitious CO_2 emissions limits for commercial vehicles, buses, trains (and in future aircraft) in order to promote the development of more technologically efficient vehicles in the freight transport market.

- Promoting sustainable biofuels for trucks, especially natural gas/biogas and hybrid engines for vans.

- Supporting the conversion of barges to biofuels.

- Reintroducing tax concessions for pure biofuels, giving them an advantage over fossil fuels, in order to ensure the long-term competitiveness of biofuels.

Overall figures for freight transport:

According to the Federal Environment Agency, if rail freight transport's share of the market grows 25 percent by 2020, emissions can be reduced by three million tonnes (we predict a 30 percent share). According to the Agency's forecast, the specific emissions from road transport would decrease by 20 percent (compared to today's levels). By extending and increasing the truck toll by only 25 cents, we could, however, reduce CO_2 emissions by three million tonnes. However, all these figures relate to today's figure, not to the 1990 base figure. As road transport has almost doubled since then, one must assume a slight overall increase in CO_2 emissions in relation to 1990. Maritime and air transport are the biggest drivers of growth. However, from 2020 onwards it will become increasingly easier to decouple energy consumption from transport growth. For this reason, we expect CO_2 emissions from freight to increase by approximately eight million tonnes by 2020 even if a certain percentage of freight is shifted to the railways.

3.3 Using renewables in the transport sector

The motor transport sector relies on fossil fuels, and above all crude oil, more than any other sector. Renewable energies make up only 5.6 percent of fuel consumption in the transport sector. This almost always means biofuels, predominantly biodiesel.

Our goal should not be to replace crude oil with biofuels yet continue our current driving habits. The Federal Government made a serious mistake in pandering to the automobile industry and establishing CO_2 limits which allow the use of biofuels to be offset. What is required is a new transport policy that uses the "big three": reducing traffic and making it more environmentally friendly and above all more efficient.

As a result we have set an ambitious yet feasible goal of having one million hybrid or plug-in electric vehicles on Germany's roads by 2020. This will provide the initial impetus for a successive changeover in the following decades.

The electricity required to power one million electric vehicles is far below one percent of the total electricity demand we have forecasted for 2020. These one million electric vehicles will consist primarily of plug-in hybrids as well as a smaller number of purely electric vehicles that will be used mainly as second cars. Vehicles that run partially or completely on electricity have a further advantage in that they can store energy from sources which cannot provide a steady supply of energy, such as wind and solar power. From 2020 the number of electric vehicles on the roads will increase considerably, and thus the percentage of renewable energies involved in power generation.

By 2020, green electricity will make up approximately two percent of total energy consumption.

It is conceivable that biofuels will become the most important alternative to petrol and diesel and will therefore play a key role in reducing our dependence on oil, contributing to rapid advancements in reducing CO_2 emissions from motor vehicles.

We want to see biofuels account for at least 18 percent of the fuel used in vehicles by 2020.

Non-renewable energy sources that nonetheless produce less CO_2 than oil are natural gas (currently accounts for one percent) and electricity from non-renewable sources (two percent). The non-renewable sources will be gradually replaced in subsequent years.

Overall, renewable energy sources can reduce vehicle CO_2 emissions by a total of 15 to 20 million tonnes. This is approximately one third of the total potential reduction in the transport sector.

4. A market for CO_2 / paying a price for CO_2

1. Introduction/overview:

In recent years, free market mechanisms have played an increasingly important role in energy and climate policy. There have been two reasons for this:

Firstly, the use of natural resources carries considerable peripheral costs, i.e., the costs of damage to the environment and human health paid by all citizens. The government must create regulatory policies to ensure that participants in the market sufficiently take into account these peripheral costs as part of the Polluter Pays principle. Quantifying these costs is not always easy, but many studies and methodologies have been produced which can point us in the right direction.

Secondly, a systematic framework should be established to ensure that the functional mechanisms of the market support environmental and climate protection. Environmentally ambitious solutions should be made economically attractive, thus providing incentives for their implementation. This will move climate protection out of the domain of engineers and into the realm of financial analysts and corporate strategists. If climate protection is recognised as a lucrative economic opportunity, it can become a part of great innovation and dynamic entrepreneurship.

In recent years, members of the Green Party in government have been involved in successful initiation of new approaches in the area of ecological market mechanisms.

The **Ecological Tax Reform** was introduced on 1 April 1999 and implemented in five annual steps until 2003. Income from the Eco Tax reduced pension insurance premiums by 1.7 percent to 19.5 percent. Without the Eco Tax, they would have been 21.2 percent. Fuel consumption and vehicle CO_2 emissions from traffic have also noticeably decreased (by over ten percent since 1999) thanks to the price signals of the Eco Tax and the general trends in energy prices.

The Red-Green coalition started to expand the tax reform into an **Ecological Financial Reform**. The primary purpose of the reform was to further reduce ecologically detrimental subsidies. From the standpoint of the Greens, the reform could have been more extensive, but additional measures were not passed because of the hesitance of the SPD. Home ownership assistance was reduced by 30 percent, with equal assistance being provided for old and new buildings. The commuter allowance, previously 40/36 cents per kilometre, was reduced to a uniform 30 cents per kilometre. The government agreed on a roadmap for continual reduction of anthracite subsidies until 2012 that will quickly adapt to world market prices.

Emissions Trading was introduced in Europe on 1 January 2005. It represents a paradigm shift in environmental policy and has huge significance for European climate policy. Emissions trading enables ambitious climate protection goals to be met through efficient allocation of resources. At the same time, it provides a new, broader foundation for climate protection measures within companies. Thanks to emissions trading, CO_2 now has a price and therefore a value and a market. However, the political goals and design of emissions trading policies are also crucial. They must repre-

sent a real boost for the environment and be economically efficient and administratively straightforward.

This was accomplished to only a limited extent with the National Allocation Plan of 2005-2007 (NAP I). Emissions goals were set too high and the results did not come close to the voluntary levels agreed by industry. In response to industry pressure, many special regulations were introduced which have lessened the effectiveness of the system and made it unwieldy. Many of the shortcomings of NAP I were caused by lack of experience with this type of tool, the SPD's close relationship with big industry and substantial pressure from interest groups. The right conclusions must be drawn from these mistakes for the second National Allocation Plan (NAP II).

However, the composition of NAP II, which was passed by the Federal Government in April 2007, reveals that the government has not actually learned very much. Instead of being an effective tool for improving climate protection, NAP II is an instrument for promoting the construction of new coal-fired power plants. These plants are to receive twice as many emissions allowances as gas-fired plants. And lignite-fired power plants will be granted yet another privilege. They will be credited with a much higher number of operating hours than other types of plants (ten percent more than anthracite and natural gas plants). This makes absolutely no sense from a climate policy standpoint as it gives special treatment to generators of the most ecologically detrimental type of energy. The system is thus becoming less attractive – providing fewer incentives – and more complicated. The government is also trying to deceive the public by claiming there are no special conditions for lignite. But these special conditions for lignite-fired plants are there, hidden in the small print. No special conditions should exist, even through backdoor agreements.

Nevertheless, thanks to pressure from the EU Commission, two of the Greens' demands are now being met. Volume goals have been greatly reduced to just 453 million tonnes per year and the long-term guarantees of up to 18 years for new power plants have been abolished. This is good news, but the German government cannot take credit for this progress as it staunchly resisted the Commission's demands.

NAP II has additional major flaws. By insisting on giving away emissions credits instead of auctioning them, the German government is doing nothing to siphon off the surplus profits of power suppliers to invest in useful technologies. With its insistence on fuel-specific limits for the energy industry, the government is failing to provide incentives for a switch to low-emission or zero-emission energy production.

2. Ecological Financial Reform:

A key component of the Ecological Financial Reform is the abolition of ecologically detrimental subsidies. Although the Red/Green and Black/Red coalitions developed initial approaches to reducing these subsidies, there are still very many subsidies that are environmentally counterproductive. These approaches are not only ecologically harmful; they are also fiscally incorrect, economically questionable and trade-distorting. This applies equally to the federal budget as well as European fiscal policy. Doing away with ecologically detrimental subsidies at all levels is indispensable if we are to create a sustainable environmental and fiscal policy. This would primarily involve the following:

- phasing out the commuter allowance;
- reducing discounted Eco Tax rates for the production industry and agriculture and forestry;
- removing tax exemption for aviation fuel (i.e. introducing kerosene tax);
- abolishing VAT exemption for international flights;
- removing tax exemption for diesel used in agricultural and shipping (barges);
- reducing company car privileges and reforming them on an environmental basis;
- abolishing privileges for the oil industry;
- accelerating the phasing out of anthracite subsidies and removing all hidden privileges for the lignite industry;
- levying taxes on crude oil not used for energy production.

In addition, the principle of using tax incentives to promote more efficient use of resources and energy has proved successful in Germany and other European countries. Despite so much resistance from society, the Ecological Tax Reform has been able to steer the public in an environmental direction and reduce ancillary labour costs. Such a successful tool is crucial for achieving ambitious climate goals. It is even more important when one considers that prices do not even come close to representing ecological reality.

We aim to use taxes and duties to create further incentives for environmentally friendly behaviour and thus ensure ecologically sound pricing. Environmentally friendly products such as electricity from renewable sources should be taxed at more favourable rates. The impact of fossil fuels should gradually become something felt by the companies themselves instead of just the environment. The Federal Environment Agency's current calculations offer a suitable basis for taxing companies. The resulting revenue can be repaid to citizens as an annual energy credit. Families, people who consume less energy and low-income citizens will profit the most.

3. Emissions trading:

Successful emissions trading will be crucial for successful climate protection in the coming years and decades. Emissions trading puts a price on CO_2 as a climate killer, creates a tangible economic value for CO_2 prevention, provides the preconditions for effective use of financial resources and is a promising tool for global collaboration and networking.

In order to shape emissions trading as an effective environmental policy, it is necessary to act on three levels: the design of NAP II, the revision of the European Emissions

Trading Directive and the integration of the emissions trading system with that of other countries, such as the US or Japan.

Firstly: Parliamentary proceedings for NAP II for 2008-2012 (and the 2012 Allocation Law) are currently taking place.

Two corrections are essential:

- The planned preferential treatment of coal-fired power plants must be revised. These plants are to receive twice as many emissions allowances as modern gas-fired power plants (750 g/kWh compared to 365 g/kWh). Instead, we are calling for a uniform limit independent of fuel type. The same rules must apply to coal-fired and gas-fired plants, based on kilowatt hours of electricity generated. The limits must be based on the most environmentally friendly technology available for comparable power plants and must therefore not exceed 365 g/Kwh.

- From 2008, ten percent of credits must be auctioned. This will make allocation more transparent and straightforward, and will create an immediate price signal on the market. An increase in the mandatory percentage of credits to be auctioned is also to be expected. For this reason, experience with this method should be gained as early as possible. We want to invest the resulting revenues of up to €1 billion per year in climate protection. This will create an energy savings fund which will provide incentives for investing in energy conservation.

Unless these corrections are made, emissions trading will have insufficient effects on climate change policy and the goal of reducing emissions in Germany by 40 percent will not be realisable.

Secondly: In late 2006, the European Commission introduced a review process for the Emissions Trading Directive. The Commission announced it would make proposals for revisions to the directive in the second half of 2007. The European policy framework on emissions trading after 2013 must be designed well, to ensure its credibility, effectiveness and level of international influence.

We are pushing especially for the following changes:

- One hundred percent Europe-wide auctioning of emissions credits. This is the only way to stop the outrageous tug of war within the individual member states and ensure transparent, straightforward allocation. It will also allow us to collect substantial government revenues that can be invested in climate protection: climate protection funds, research, modification measures (both at home and in developing countries).

- The inclusion of other sectors and industries such as air transport, shipping, and any other industries not involved. However, we object to the immediate inclusion of the entire transport sector in emissions trading. There are other instruments that are more effective and easier to implement.

- Ambitious upper limits that guarantee the attainment of the EU's minus-30-percent goal by 2020.

- Harmonisation of allocation rules, ranges of application and procedures at European level.

- Implementation of a strict and transparent procedure for reviewing allocation plans on the basis of clear criteria.

- Clear option for integrating EU emissions trading with other systems currently emerging, such as the Regional Greenhouse Gas Initiative in the Northeast US and programmes in California, Japan and New Zealand.

Thirdly: EU emissions trading must aim to become the centre of a worldwide CO_2 market. To do this, it must have ambitious and credible climate policies as well as the legal and institutional conditions for integration with other trading systems. This means implementing the following:

- The appropriate legal prerequisites through revision of the EU Emissions Trading Directive.

- The appropriate institutional and organisational prerequisites through harmonisation of registers and monitoring, reporting and allocation methods.

- The appropriate political prerequisites and necessary political will on both sides. To accomplish this, the dialogue with existing and emerging systems must be intensified at all levels.

5. A new competitive environment

The absence of government regulation during the early years was poison for competition. Although market players set their own rules at the government's behest, these concessions went only as far as public pressure demanded. As a result, the electricity and gas markets are dominated by a few large corporations. Under such conditions, it is difficult to implement environmentally safe energy technologies. Consumers are paying disproportionately high prices and innovative companies are being robbed of market opportunities. As a result, we urgently need fair competitive conditions.

No competition without new players

In an effective competitive electricity grid environment, all suppliers must be treated equally and without discrimination. However, grid operation is frequently under the same corporate umbrella as power generation or gas procurement and energy sales. Integrated infrastructure companies are always motivated to work in the corporate interest and favour their sister companies over outside companies. Various unfair methods are used, including cross-subsidisation, early provision of information, discriminatory practices in purchasing power plant output or granting grid access, isolation of the power regulating market and price fixing on the electricity market. This has the heaviest impact on energy providers without their own grids and, ultimately, the end customers, who suffer from increasing prices. Many big grid operators also continue to treat new players from the renewable energy sector unfairly, even though these providers are supposed to receive privileged access to the grid according the Renewable Energies Act.

For this reason, the power industry must become more open to competition so that new players can participate in and revitalise the market.

Unbundling is necessary

An important step in opening up monopolised markets is to neutralise grids. We must unbundle transmission networks. To this day, four companies generate over 80 percent of Germany's electricity and also operate the country's transmission grids. As a result, these companies have an enormous information advantage with respect to the use of generation capacities. This can have an effect on the peak-load energy as well the electricity market. Unfair conditions are imposed on the expansion of capacities. On the gas market there is often talk of "potential competition" with regard to long-distance pipelines. However, there is no indication that such potential actually exists. As a result, the long-distance pipelines must be subject to mandatory regulation.

Unbundling is thus the key. All European regulatory authorities also came to this conclusion, with the exception of the German Federal Network Agency, which voted against the recommendation. Even the European Commission favours unbundling.

Deconcentrating market dominance

Even after unbundling of transmission networks, energy giants would continue to dominate the market. They can still strongly influence prices in direct sales and on the electricity market. The big corporations have also started to take control of the distribution grid in recent years. They now have shares in almost 300 public utility companies and exert significant influence on this market segment. We need to use all the tools available to stop this trend.

Regulation is urgently needed for a further level of corporate unbundling, namely deconcentration. According to German competition law, parts of companies can only be sold as part of a merger process. The government must be given the right to force overly dominant companies to sell parts of their company. This policy has been practised successfully in other countries such as the US for years.

Germany's gas market is dominated by just one company: E.ON/Ruhrgas. Given E.ON's power in the electricity market, this greatly inhibits competition: a single corporation in Germany now has significant influence over the important interface between gas and electricity and can promote gas as a source of power. It is becoming increasingly clear that allowing the merger of E.ON and Ruhrgas, which was carried through despite serious objections, was one of the government's biggest mistakes.

Promoting biogas

More biogas must be fed into the natural gas pipelines. A biogas feed law must be enacted so that new players, especially medium-sized companies, have the opportunity to compete. The law must allow all new players privileged access to the gas grid, create reliable conditions for investment and provide sufficient long-term remuneration for the supply of biogas.

Enabling and promoting horizontal cooperation

The demand for grid efficiency created by the regulatory authorities through the Energy Economy Law puts great pressure on small, often municipal companies. Once they reach a certain size, small companies have trouble meeting current unbundling regulations while at the same time responding to the pressure to economise caused by the effects of network charges on revenue.

Such companies must begin cooperating on network operation with other municipal utilities, or even merging with them. Current discriminatory competitive conditions provide the public utilities with few options other than selling to the energy giants. This runs completely counter to fair and open competition.

We aim to strengthen the competitiveness of public utilities. Above all, this means improving the power generation and grid repurchasing options of municipalities and

municipal utilities. Utility amalgamations on a local, cooperative basis should be supported on the demand side as well.

Consolidating peak-load energy markets

Despite the existence of a legal obligation to call for bids for peak-load energy services, the power plants of the established energy corporations (RWE, E.ON Vattenfall and EnBW) are dominating the market within their respective distribution zones. Apart from the agreed exchange of electric power between members of the Union for the Coordination of Transmission of Electricity, peak-load energy is rarely traded at all across the zones' borders. Because power plants have to be specially started (or shut down) to provide peak-load energy, this form of power supply is very expensive. The additional cost is applied to the electricity price. Market volume in German distribution zones is estimated at €1 billion.

A uniform national bidding process for peak-load energy would create price pressure in the sector and make pricing more transparent. It would balance out simultaneous oversupply and undersupply in the different zones. This has been estimated at up to 75 percent. Consolidation would therefore significantly reduce the demand for peak-load energy. It would also stimulate competition between the major electricity producers and with smaller specialised power plant operators. These providers could then compete in the sale of peak-load energy capacity under equally transparent conditions.

Fostering European liberalisation

The EU played an important role in stimulating the last energy sector reform. It must also drive the development and harmonisation of competitive structures in European energy markets. This is the only way a domestic European market for electricity and gas can be realised.

Promoting energy competition at international level

Around the world, the oil and gas markets are dominated by cartels and monopolies. As a result, a large portion of the capital and technological expertise available on the world market has become barred. International rules are not observed, market power is used as a political tool and political instability is encouraged. Global access to renewable energies is hindered. For this reason, we need to switch to using different sources of energy, which have as much competitive neutrality as possible.

6. Sustainable bioenergy policies

Around the world, countries are establishing standards and setting the course for the production and trading of bioenergy. As an essential part of this process, the opportunities and risks of bioenergy production must be thoroughly evaluated. Such an assessment must take into account the technological possibilities and conditions specific to the various products and countries.

Renewables are the most important energy sources of the future. Firstly, they will lead us out of the cul-de-sac of fossil fuels and nuclear power, which are finite resources with a limited time span. Unlike fossil fuels, renewable energies will still be available in infinite supply 100 years from now. Furthermore, renewable energies are largely climate neutral. The use of these energy sources does not cause any CO_2 emissions worth mentioning.

The latter aspects also apply to bioenergy. But, unlike renewable energies like wind, solar and hydroelectric power, bioenergy is not an unlimited resource. Its quantities are limited by the availability of land which can be cultivated in an ecological way, and of the technology needed to make efficient use of bioenergy. Around the world, fertile land is a scarce resource which is often threatened by erosion and climate change. The expansion of agricultural land or plantations to grow crops for biomass energy production must not threaten natural expanses such as forests, savannas or wetlands. The unsustainable agricultural methods of intensive farming jeopardise biodiversity, pollute water and soil, increase the risk of erosion and create greenhouse gases. And we must remember that biomass also has to be available for use as materials in the chemical and plastics industries. However, its material use can be linked to energy generation.

Another factor is that a large percentage of this land is being used to produce food. Food production has utmost priority. That is why it is not our goal to cover the world's fuel requirements completely with biofuels. No bioenergy strategy will be successful unless it focuses on efficiency with respect to both consumption and production.

We thus need to take a careful, ecologically sustainable approach to bioenergy. Increasing demand must not cause further overexploitation of nature and threaten biodiversity. Nor must it compete with food production. This would mean that wealthy emerging and industrialised nations might be able to satisfy their energy requirements while developing countries have increased difficulties meeting their populations' food needs. And the production of crops for bioenergy generation must also not be exploited as a hidden way of introducing agricultural genetic engineering. No one needs agricultural genetic engineering, whether for food production or biomass production. Only multinational seed producers profit from genetic engineering, which threatens biodiversity, traditional farming and GM-free production.

At the same time, bioenergy has many advantages. It can help developing countries reduce their horrendous raw materials costs and open up new development opportunities. Today, many developing countries are already paying more to import crude oil than they receive in development aid. An intelligent expansion strategy can even help such countries generate foreign exchange proceeds in the medium term. In addition, a

well-considered, environmentally minded expansion of the appropriate energy and raw material crops can help stop desertification. Initial experiments with jatropha plants have been encouraging. In addition, energy crops can help create or maintain jobs in many countries and improve the value of rural areas. Therefore, cooperative environmental and developmental aid efforts should be taken to promote such environmentally and socially useful projects for growing energy crops, provided that food production is not compromised.

We believe there is potential for a massive increase in the amount of bioenergy produced worldwide. However, this process must be managed properly in order to prevent undesirable developments around the world. The debate on palm oil from Indonesia is a good example. Indonesia has become the third-largest producer of greenhouse gases as a result of its slash-and-burn methods. Palm oil obtained in this way does not offset CO_2. By contrast, palm oil cultivated without destroying ancient forests and drying up marshes can offset CO_2 very effectively. Countries can employ these methods without needing to fear ecological or price competition from biofuels from the EU.

Before this can happen, an internationally sustainable and approved certification system for ecological and social standards must be developed in the coming years. The Forest Stewardship Council (FSC) has gathered a wealth of useful experience of wood usage and marketing, although not all of it can be applied. The final goal of this process, which must involve the most important players, is to introduce a mandatory certificate to prove the sustainability of bioenergy crops.

7. Energy foreign policy

Energy foreign policy, inextricably tied to climate and development policy, faces gigantic tasks ahead

Fossil and nuclear resources are finite and often originate from politically unstable regions. At the same time, global demand is increasing. A climate disaster can only be prevented if the nations of the world cooperate – according to the principle of shared responsibility. A reliable global energy supply for the future cannot be secured using finite, fossil-based and nuclear resources. Progress in energy and climate policy cannot be achieved unless we have motivated role models, unless the industrialised nations play their part. These countries are the cause of the climate disaster. More than any other countries, industrialised nations must take massive steps: they must set ambitious goals for emissions reductions, energy efficiency and the shift to renewable sources of energy. The consequences of climate change and failed international energy policies have had the greatest impact on developing countries. As many as 1.6 billion people, i.e. over a quarter of the earth's population, have no access to electricity. And 2.5 billion people have to use wood and dung for heating and cooking. We will not reach the UN's Millennium Development Goals this way. Underdeveloped regions need renewable energies if they are to progress. We can only achieve a global paradigm shift if new players such as Brazil, China, India, Mexico, South Africa and South Korea are included in a future-proof global energy policy.

Energy foreign policy as a strategic policy of peace

Instead of competing to the bitter end for fossil fuels, we must build our energy foreign policy around shared rules and markets. Global access to renewable energies, global energy efficiency and decentralised, energy-saving technologies can contribute to world peace.

Contributing to peace in a global move away from fossil-based and nuclear resources

Oil and gas are extremely powerful factors in world politics today. The global economy's dependence on oil and gas defines the international agenda, fuels wars and conflicts and prevents successful multilateral conflict resolution. Revenue from oil and gas finances major military budgets and supports extremism and terrorism. The only solution is to generate energy using renewable energy sources on a global scale.

Kyoto Plus!

Ending unilateralism with a multilateral energy and climate policy

The situation in Iraq is an example of the disastrous effects of a unilateral and military energy foreign policy. To tackle global challenges effectively, we need a multilateral climate regime that is bound to international law and that combines emission reduction obligations with technological cooperation. The Kyoto Protocol, in which industrialised nations agreed to lower their greenhouse emissions by 2012, was a step in the right direction. After 2012, there must be an agreement on further, more legally enforceable reductions in greenhouse gases. The United Nations Framework Convention

on Climate Change (UNFCCC) must negotiate a follow-up "Kyoto Plus" protocol by 2009.

- As a tangible target, The Framework Convention on Climate Change must specify that the average global temperature must not increase more than 2°C over pre-industrial levels.

- All industrialised countries – including the US – must commit to ambitious goals for reducing emissions and creating renewable energy source strategies. We cannot wait for the post-Bush era; initiatives with individual US states are already possible.

- Emerging economies must limit their greenhouse gas increases; developing countries must also be involved. These countries must be empowered to decouple their economic growth from increases in emissions. The best way of accomplishing this is by satisfying the global demand for energy with renewable sources instead of fossil-based resources.

- The industrialised nations must provide much more financial assistance to help developing countries implement future-orientated energy policies and tackle the consequences of climate change. The World Bank currently estimates that US$319 billion a year will have to be invested in energy in developing and transitional countries until 2030.

A key instrument of the Kyoto Protocol is emissions trading, which currently only exists within the EU. **Kyoto Plus** must expand emissions trading worldwide. Air and water transport must be included in the **Kyoto Plus** agreement.

CO_2 emissions from air and water transport

Studies by the International Civil Aviation Organisation (ICAO) confirm that emissions trading would be a cost-effective tool for reducing CO_2 emissions from air transport. This also applies to shipping. According to a recent study by the German Aerospace Center, shipping accounts for 2.7 percent of the world's CO_2 emissions. The European Commission predicts that water transport will increase by almost 60 percent by 2020. As a result, there is urgent need for action in this sector.

- The most important goal is to include air and water transport in emissions trading and therefore in the trading of CO_2 credits. At the same time, we aim to initiate innovations aimed at zero-emissions technology in the transport sector.

- The EU member states must take a leading role within the ICAO and the International Maritime Organisation (IMO) and reduce CO_2 emissions from aviation and shipping. They should introduce eco taxes in addition to pilot initiatives for zero-emissions technologies, stricter environmental standards and better traffic management.

Multilateral energy policy: institutional structures

Effective global energy policies require powerful institutional structures, something which is lacking today. The International Energy Agency is an OECD organisation which does not include many of the countries that will play a pivotal role in future global energy policy.

- We need a global energy agency that includes China and India as large importers as well as key OPEC countries. In this way, the interests of supplier, transit and consumer countries could be better linked for the mutual benefit of all members. Such an organisation would agree on mandatory rules for all members and, like the WTO, it would also act as a mediator in the event of disputes.

- We need to establish an "International Renewable Energy Agency" (IRENA) for worldwide dissemination of knowledge on renewable energies.

- The United Nations Environment Programme (UNEP) must be upgraded to a United Nations Environment Organisation (UNEO).

- UN Energy, the United Nation's coordinating mechanism in the energy sector, must become the driving force behind the switch to renewable energy sources.

- The WTO should do away with trade barriers standing in the way of renewable energies and electricity from renewable sources and abolish subsidies for fossil-based and nuclear energy.

- Informal partnerships such as REN21 (Renewable Energy Policy Network) and REEEP (Renewable Energy and Energy Efficiency Partnership) remain indispensable.

2007 UN Committee on Sustainable Development

The UN Committee on Sustainable Development (CSD) met in May 2007 to agree on policy guidelines for energy strategies and climate change and to firm up the guidelines set down at the World Summit on Sustainable Development in Johannesburg in 2002. However, the committee failed to agree on sufficiently ambitious goals. Now we need to do the following:

- Initiate a new round of CSD talks on energy and climate change.

- Implement pilot initiatives based on the Johannesburg resolutions to work towards a global review mechanism for energy issues.

Industrialised nations must take responsibility for sustainable energy policy

With an ambitious initiative for future-proof energy policies and climate protection, the industrialised nations could show their willingness to make radical changes and assume responsibility. The resolutions that emerged from the G8 summit in Heiligendamm are not sufficient. If G8 members like the US are not prepared to set binding obligations to reduce CO_2 emissions and countries like Canada openly announce that they do not intend to fulfil their obligations even after they have ratified the Kyoto Protocol, then countries like China and India will not be willing to engage in serious negotiations about their contribution to climate protection.

- The G8 members must commit to reducing greenhouse gases by **30 percent by 2020**.

- Germany must take the lead among industrialised nations in abandoning nuclear energy.

- The G8 members must launch practical initiatives that provide consumers and companies with incentives to act in more environmentally friendly ways.

- The G8 members must build up their markets for renewable energies, for example by regulating the supply of electricity from renewable energy sources or creating tax breaks for renewable energies, so that market penetration accelerates industrial development.

The EU as a pioneer in a multilateral system

Unless the European Union **becomes a global pioneer**, there will be no progress in international climate protection policy. European countries have the market power to develop an energy system that can spread to other regions of the world. By 2020, the EU can reduce its greenhouse emissions by 30 percent, while abandoning nuclear energy.

- To reach these goals, renewable energies must comprise 25 percent of the EU's total energy consumption by 2020. This will require a European directive for feeding in power from renewable energy sources as well as tax breaks for renewable energies. In addition, we need to shift the burden of the peripheral costs of fossil-based and nuclear energy to the producers and do away with subsidies for these forms of energy.

    - We can increase efficiency as well as induce a shift in energy resources by implementing an ambitious emissions trading system which has no resource-specific provisos and which includes auctioning and careful allocation of credits. In this way, the use of natural gas will increase in the short term, but will be gradually replaced by biomass. Efficiency could be further increased by using more combined heat and power plants.

- Higher energy prices for conventional forms of energy provide greater incentives for efficient use of energy in the industrial sector.

- In the private household sector, energy can be saved by rehabilitating old buildings to ensure better energy performance.

  - In the transport sector, emissions can be reduced through the use of biomass fuels, modal shifts to public rail transport and setting emissions limits for vehicles.

Innovative energy policies promote development

Affordable energy is a prerequisite for socioeconomic development and the struggle against poverty. In sub-Saharan Africa, only eight percent of the rural population and 51 percent of the urban population have access to electricity. In South Asia, electricity is available to only 30 percent of rural inhabitants and 68 percent of city dwellers. The UN predicts that, given current policy approaches and investment trends, 1.5 billion people will still be without electricity in 2030. According to the 2002 World Health Report, household air pollution caused by cooking and heating with wood or dung is to blame for 1.6 million deaths of women and children and for 2.7 percent of the world's disease burden. The dependence on traditional forms of energy is a barrier to equal rights for women in developing countries. Without innovative energy polices, we will not reach the UN's Millennium Development Goals (MDGs).

The dependence of poorer countries on oil hinders progress. The financial strain on developing countries that do not export oil is now exceeding development aid payments. Developing countries have inadequate energy infrastructures or none at all, especially in rural areas. Thanks to their decentralised nature, renewable energy sources such as wind, solar, hydroelectric, geothermal and bioenergy are the ideal solution for these countries. Renewable energy sources, energy efficiency and energy conservation are the key to reliable, affordable and socially and environmentally sound energy, also in developing countries. German, European and international development policies must accomplish the following:

- Programmes for localised, sustainable energy systems and the phasing-out of funding for fossil-based or nuclear energy systems must be expanded.

- Technological expertise and the relevant institutions in developing countries must be promoted.

- Ensuring access to energy means ensuring access to finances. Technical aid must strengthen money and capital markets in developing countries and offer microcredit for "microcompanies", especially those run by women.

- Provisions of contributions to the Global Environment Facility (GEF), which finances environmental and climate protection projects, must be increased and the GEF portfolio expanded. Since 1991, the GEF has awarded US$6.8 billion and generated over US$24 billion through co-financing. The GEF's financing would have to be two to three times as high just to ensure the sustainable introduction of efficient renewable energy technologies on the market.

- Funds granted as part of a KfW Special Facility for Renewable Energies and Energy Efficiency in developing countries have largely been exhausted. We are calling for mixed financing to generate €800 million for the facility each year.

- The World Bank and regional development banks must completely replace funding for fossil-based energy with funding for renewable energy by 2010. This would follow the recommendations in the "Extractive Industries Review" submitted by the World Bank itself in 2004.

- It is important to include the private sector in joint projects such as the Global Initiative on Transport Emissions (GITE), a joint UN/World Bank initiative.

- Innovative development financing from the kerosene tax and airline ticket tax must also be used to fund energy projects.

Climate change is a barrier to development

The effects of climate change have had the severest impact on developing countries. In Africa alone, some 250 million people will probably suffer from water shortages by 2020, and crop yields will decrease by up to 50 percent. The World Bank estimates that the additional costs of adapting to the unavoidable consequences of climate change will total US$10-40 billion a year. However, according to the latest estimates, less than one percent of development assistance and funding are being channelled into measures to help these areas adapt to climate change.

Adaptation to climate change must be financed in the spirit of solidarity. Therefore, future revenues from emissions trading should also go toward protecting the environment and resources in developing countries. The World Bank's new Vulnerability and Adaptation Facility (VAF) must receive appropriate funding.

- Efforts to tackle climate change must be systematically incorporated into all development assistance programmes.

- Public-private partnerships, such as the joint EU/World Bank initiative Global Index Insurance Facility (GIIF), must supplement government measures.

- Rainforest protection must be promoted as an important element of climate protection. We must also develop and implement the appropriate innovative financial tools, especially for "avoidable deforestation". These tools should also be incorporated into "Kyoto Plus".

Oil and gas: conflict resources

In countries rich in resources, the export of oil and gas rarely goes hand in hand with a fair distribution of wealth. In countries like Nigeria, Chad, Sudan, Ecuador, Peru and Turkmenistan, resource wealth has led to rampant corruption, authoritarian structures, alarming rates of debt and a disregard for environmental standards. Countries like China and Russia are serving only their own national interests and refusing to imple-

ment coherent human rights policies. The US and the EU are applying double standards when dealing with resource-rich countries with poor human rights records and shaky democracies. Responsible energy and resource policies **must promote the rule of law, transparency, good governance and human rights in the exporting countries.**

- Anti-corruption efforts in the resource sector are being assisted by the NGO campaign Publish What You Pay as well as by the Extractive Industries Transparency Initiative (EITI), which works at government level. The goal of these initiatives is to enable public supervision by disclosing the various payments made by oil, gas and mining companies to governments. We are calling for broad political support and international recognition of these initiatives and believe that these approaches must be developed further. The banking and investment sector must be included in this process.

- Companies, banks, investment firms and pension funds must redirect their investments and divert a growing percentage to renewable energy sources in emerging economies and the developing world.

- Multilateral committees and institutions must pursue credible human rights polices when dealing with resource-rich countries such as Sudan.

- The United Nations must define "conflict resources" in terms of international law. As in the Kimberly Process (on "blood diamonds"), the purpose here is to outlaw and eliminate the trade and mining of conflict resources.

- Export funding should not be granted without compliance with EITI criteria and OECD guidelines that require multilateral companies, including German companies since 2000, to maintain international environmental, transparency and social standards.

- To improve transparency, the implementation of OECD guidelines must also be promoted through an institutional reform of the National Contact Points.

- We must make it possible for developing countries to receive compensation for not exploiting energy resources.

Technology transfer

Without affordable cutting-edge technologies, new players like Brazil, China, India, Mexico, South Africa and South Korea will not be able to solve their energy problems. These countries must **develop their own infrastructure and expertise**, taking into account local conditions. To do this, it is essential to remove barriers on exporting modern technologies to countries with problematic economic and political environments. A barrier to exporting modern technologies to China is its insufficient protection of patent rights. Because time is running out, we need to implement a mixture of practical initiatives including:

- Agreement on technological cooperation with developing countries in the United Nations. This would include financial support for multilateral technological cooperation through expansion of the Global Efficiency and Renewable Energy Fund (GEREF) launched in Nairobi.

- Continuing discourse with developing countries which began during the 2004 Conference for Renewable Energies in Bonn. Special focus on strengthening the REN21 Policy Network.

- Coordination of research priorities in domestic programmes and launch of international research programmes in key areas. EU energy research must focus more strongly on renewable energy and energy conservation technologies.

- Focusing on technology transfer in our cooperation with developing countries.

- Provision of assistance for renewable energy companies so that they are more willing and able to export technology, for example by facilitating access to international financial instruments and export credit agencies. Using the Kyoto Protocol's Clean Development Mechanism (CDM) and the Joint Implementation Mechanism (JI) specifically for technology transfer.

- Expansion of the EU's cooperation with China to improve patent protection in China.

Should there be a security and defence policy for energy?

According to the concept of networked security, energy security is an integral part of security policy. However, it is wrong to assume that energy security can be ensured by military means. Although the Federal Government's new white paper on defence policy defines energy security as part of national security, we must not conclude that it is the German army's job to maintain energy security. Military measures and war cannot secure our energy supply. The protection of transport routes by the military has had no effect on the production of oil and gas, it does not influence whether they reach the market by fair means and cannot change the fact that such resources are finite. The military cannot create peace where the situation is unstable. At best, it can enable and support peace processes. Military deployments are not a suitable means of protecting energy imports. We do not need a NATO for energy, and the need to secure our energy supply must not open the door for neo-colonial policies.

- The only way to ensure energy security is through a comprehensive, humanitarian energy foreign policy that supports principles of global energy justice and focuses on energy development and technology transfer.

- Renewable energy sources reduce our dependence on oil and gas. Global access to renewable energy therefore plays a key role in guaranteeing energy security.

- Ensuring transport security and protecting geo-strategic routes for the global power supply is the role of the UN's system of collective security. Expanding local capacities and constitutional structures is a vital part of these efforts.

A bilateral and regional energy supply policy in the EU

The EU's energy supply policy must be integrated into a comprehensive multilateral energy policy that promotes energy justice, accelerates the switch to renewable energy, promotes Kyoto Plus, strengthens the United Nations and focuses on development policy.

In the coming years, the EU will continue to meet some of its energy needs by importing fossil-based resources. It is important to use these resources efficiently. The power-political agendas of countries that want to form monopolies (e.g. Russia) cannot be supported. Therefore, imports must be diversified. Regional cooperations that pool interests strengthen energy security. An excellent example of this is the Energy Alliance with southeast Europe, the world's largest single market for electricity and gas. Energy solidarity and crisis response mechanisms are also important. An EU strategy for energy supply security should include the following:

- Maintaining a responsible political dialogue with energy-producing countries.

- Focusing on energy efficiency and renewable energy, including a European biogas strategy and renewable energy trading. Until now the EU has focused on oil, gas and pipelines.

- Abolition of EURATOM and its replacement with a new EU renewable energy agreement.

- Regulation of energy policy in a partnership and cooperation treaty with Russia. This means agreeing on the core principles of the European Energy Charter, such as ensured mutual access, minimum guarantees for energy investments and transit rules. The agreement must include an intensification of energy dialogue on renewable energy sources, energy efficiency and energy conservation.

- Diversifying sources and routes.

- Regional cooperation initiatives such as the new Black Sea Synergy. Expansion of the Energy Alliance with southeast Europe to include Norway and countries in the Black Sea region, especially Armenia, Azerbaijan, Georgia, Moldova, Turkey and Ukraine.

- Cooperation with MENA nations (North Africa, Middle East) on renewable energy sources.

- Incorporation of an energy partnership in the new EU/Africa strategy.

- Incorporation of an energy dialogue in talks with China.

- Energy solidarity, crisis response mechanisms, advance warning through a network of energy security correspondents and an energy monitoring centre.

Nuclear power – no thanks

Nuclear power is not the answer to the world's energy problems. Over 1,000 reactors would have to be built across the world to replace just ten percent of the power generated by coal, oil and gas. Despite this, international committees and institutions are currently trying to initiate a nuclear power renaissance. Another compelling argument against nuclear power is the threat of terrorism; we must reduce the risk from terrorist attacks on nuclear power plants.

- Therefore, we are committed to terminating the EURATOM agreement.

- We object to G8's support of nuclear power.

- Enrichment and reprocessing must take place only under international supervision, and the loopholes in the Nuclear Non-Proliferation Treaty must be closed.

- The nuclear agreement between Germany and Brazil and other nuclear agreements must be replaced by a renewable energy agreement.

BIBLIOGRAPHY

Arbeitsgemeinschaft Energiebilanzen, Auswertungstabellen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2004, Cologne, 2005

BMVBS (editor): Verkehr in Zahlen 2006/2007, Berlin, 2006

bremer energie institut, DLR, Analyse des nationalen Potenzials für den Einsatz hocheffizienter KWK, einschließlich hocheffizienter Kleinst-KWK, unter Berücksichtigung der sich aus der EU-KWK-RL ergebenden Aspekte, Bremen, 2005

Bundesindustrieverband Deutschland Haus-, Energie- und Umwelttechnik e. V. (editor)**:** Modernisierungsstau in Gebäuden auflösen. Berlin 2007

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) (editor)**:** Leitstudie 2007 "Ausbaustrategie Erneuerbare Energien", Berlin, 2007

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU) (editor)**:** Ökologisch optimierter Ausbau der Nutzung erneuerbarer Energien in Deutschland. Berlin 2004

Bundesverband Erneuerbarer Energien (BEE): Energieszenario für 2020 als Vorlage anlässlich des Energiegipfels

Bündnis 90/Die Grünen Bundestagsfraktion: Möglichkeiten einer europäischen Biogaseinspeisungsstrategie, Berlin, 2007

Bündnis 90/Die Grünen Bundestagsfraktion: Ein Stromsparfond für den Klimaschutz, 2007

DGS (Tomi Engel). Studie zu Elektromobilität im Jahr 2020 (forthcoming)

DLR/BMU (Franz Trieb): Solarthermische Kraftwerke für den Mittelmeerraum, 2007

Dr. Matthias Fawer: Solarenergie 2006, Licht- und Schattenseiten einer boomenden Industrie. Basel, 2006

EUtech/Greenpeace: Klimaschutz: Plan B: Nationales Energiekonzept bis 2020

FNR: Biokraftstoffe: eine vergleichende Analyse, 2006

IE/Öko-Institut: Möglichkeiten einer europäischen Biogaseinspeisungsstrategie

IFEU-Ökoinstitut: Potenziale zur Minderung von Treibhausgas- und Schadstoffemissionen: Integrierte Betrachtung von Kraftstoffen und Antrieben, 2006

ISUSI (Dipl. Ing. Stefan Peter, Dr. Harry Lehmann) Erneuerbare Energien und Kraft-Wärme-Kopplung für den Ersatz überalteter Kraftwerke in Deutschland, Aachen, 2004

ISUSI (Harry Lehmann, Stefan Peter): Erneuerbare Energien und Energieeinsparung als Ersatz überalterter Kraftwerke in Deutschland, Aachen, 2005

Prof. Dr. Jur. Stefan Klinski: Eckpunkte für die Entwicklung und Einführung budgetunabhängiger Instrumente zur Marktdurchdringung erneuerbarer Energien im Wärmemarkt. Berlin, 2006

Schiffer, Hans-Wilhelm: Deutscher Energiemarkt 2005, in Energiewirtschaftliche Tagesfragen 3/2006

SRU (2005) Sondergutachten des Rates von Sachverständigen für Umweltfragen. Umwelt und Straßenverkehr: Hohe Mobilität - Umweltverträglicher Verkehr, Berlin, 2005

TAB: Möglichkeiten geothermischer Stromerzeugung in Deutschland, 2003

Treibhausgas- und Schadstoffemissionen: Integrierte Betrachtung von Kraftstoffen und Antrieben; 2006

Umweltbundesamt (editor): Klimaschutz in Deutschland bis 2030, Endbericht zum Forschungsvorhaben Politikszenarien III. Berlin, 2005

Umweltbundesamt (editor).: Langfristszenarien für eine nachhaltige Energienutzung in Deutschland. Berlin, 2002

Umweltbundesamt (editor): Climate Change: Entwicklung der spezifischen Kohlendioxid-Emissionen des deutschen Strommix; 01/07

Umweltbundesamt (editor): Klimaschutz in Deutschland: 40%-Senkung der CO2-Emissionen bis 2020 gegenüber 1990; 2007