

White Paper on Energy Efficiency

# **Generating, Distributing and Using Energy Intelligently**

# Imprint

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Generating, Distributing and  
Using Energy Intelligently

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ZVEI represents the shared interests of the electrical and electronic industry in Germany and the companies operating in this industry. Around 1600 companies belong to ZVEI. These companies employ more than 90% of the people working in the German electrical industry. In 2007 the German electrical industry employed over 820 000 people and generated a turnover of almost €183 billion. The value created by this industry surpasses both the automotive and chemical industries. One fifth of all research and development expenditure in the German economy are carried out by the electrical industry. Around half of the industry's turnover is generated by new products and systems.

White Paper on Energy Efficiency

# **Generating, Distributing and Using Energy Intelligently**

## White Paper on Energy Efficiency: Generating, Distributing and Using Energy Intelligently

The ZVEI – *Zentralverband Elektrotechnik- und Elektronikindustrie e.V.* (German Electrical and Electronic Manufacturers' Association) welcomes efforts to protect our common climate through the use of adequate measures. ZVEI and its members are making useful contributions to this: the companies of the electrical and electronic industry have been consistently investing considerable sums for a number of years now to increase the range of energy-efficient technologies, products and systems.

With its *Initiative für Energie-Intelligenz – EnQ* (Initiative for Being Smart about Energy – EnQ) ZVEI is highlighting these efforts by informing political, industrial and public decision-makers as well as private consumers about the advantages of energy-efficient electrical and electronic technologies and products. One of the key communication elements of this campaign is the ZVEI White Paper on Energy Efficiency.

The white paper details data and best practice examples of energy-efficient technologies in all relevant fields – from energy production and distribution to energy use. It shows that a wide range of highly energy-efficient electrical and electronic products is already available on the market<sup>1</sup>. But depending on the sector and user group, for various reasons, one of which is a lack of information, customers are not yet using these products to a sufficient extent. Therefore, it also highlights obstacles that are hampering widespread use of technologies and puts forward possible political solutions to overcoming these barriers.

The figures and examples of energy-efficient technologies and products presented in this white paper apply to Germany. But, the potential of electrical and electronic technologies and products presented here can be tapped into on a European scale as well.

Through greater use of innovative and highly energy-efficient electrical technologies and products 266 billion kWh (= 266 000 000 000 kWh) can be saved within the European Union every year. This amounts to one tenth of the energy consumption of all EU member states or a possible CO<sub>2</sub> reduction of 115 million tons annually<sup>2</sup>.

Technology-based data show that motor-powered systems (like fans, pumps, compressed-air systems) are responsible for two thirds of industrial electricity consumption in Europe. Approximately one fifth of this energy

consumption, equaling 104 billion kWh, could be reduced in the EU 27 if more efficient electrical motors and variable speed drives were used. This potential equates to the Netherlands' energy consumption in 2006<sup>3</sup>.

Household appliances are durable and, on average, have a service life of almost 14 years. This means that households are still using a large number of old appliances which, although still functional, are no longer energy-efficient by today's standards. Thus, 188 million appliances which are at least 10 years old can be found in private households across Europe. A modern refrigerator or freezer uses 75% less energy than a product that was produced in 1990. If all these old domestic appliances were replaced with highly efficient products, Europe's households could save up to 44 billion kWh a year<sup>4</sup>. This is almost as much electricity as Portugal used in 2006.

In the field of lighting over 50% of installed lighting is still provided by old, economically inefficient technology. Pressure to act is particularly strong for street lighting. On average, 30% of all roads are equipped with old, inefficient technology from the 1960s<sup>5</sup>. Continuing with a standard replacement rate of around 3% per year, it would take some 30 years, in other words more than a whole generation, for this lighting to be completely renewed. Modern lighting systems and products like energy-saving lamps in private households and modern lighting systems and lamps in public street and office lighting constitute a vast potential of 118 billion kWh<sup>6</sup>, which is roughly half the electricity consumption of Spain in 2006.

This ZVEI White Paper on Energy Efficiency illustrates the potential of energy-efficient and electronic technologies and products for Germany.

1 ELECTRA (2008): *Twenty solutions for growth and investment to 2020 and beyond.*

2 ZVEI (2008): *Internal study.*

3 EUROPEAN COMMISSION, DIRECTORATE-GENERAL FOR TRANSPORT AND ENERGY, SAVE II PROGRAMME (2000): *Improving the penetration of energy-efficient motors and drives.* [Note: As the study focuses on the EU 15, an extra 9% of potential has been added, because the new Member States make up a share of 9% of the total electricity consumption of the EU 27.]

4 CECED (2007): *Input to Electra Working Group 1 Energy efficiency and CO<sub>2</sub> reduction as drivers of innovation.*

5 ZVEI (2008): *Internal study.*

6 CELMA/ELC (2007): *ROMS Report, May 2007.*

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# **A Being Smart about Energy**



Dr. Klaus Mittelbach

## Being Smart about Energy

### The intelligent use of energy as an integral component of climate protection

Intelligence is defined as the mental ability to recognise interrelationships and identify solutions. When it comes to our dealings with energy, intelligence means not simply restricting ourselves to cutting down our electricity use by not consuming products or services in the first place. ‘Switching off’ may seem to be the most obvious solution – but lighting, for example, doesn’t just provide illumination but also safety and security.

For this reason we need to examine all available options, particularly as regards the use of state-of-the-art technologies, and combine them in an integral approach. We need to equip power generation and distribution for new challenges, such as the dramatic growth of power generation technologies relying on renewable energies. At the same time, the power generated needs to be used efficiently.

The intelligent use of energy derives maximum benefit from the primary energy deployed and combines appropriate energy-saving with added comfort and long-term cost savings. If we can generate, distribute and utilise energy more efficiently, we will be making an important contribution to climate protection.

### Energy-efficient technologies are the route to energy-intelligent actions

Demand for energy around the globe is growing at an unprecedented pace. The specific use of energy in an intelligent way is a rapid and quantifiable way of reducing this. The electrical and electronic industry already offers a number of technologies which can be put to immediate use and will help to prevent energy being wasted right from the start.

Our industry has the necessary know-how to drive forward the economic integration of these technologies in the production of renewable energy. Our companies also have the products which can assist with effective climate protection through the increased use of technical intelligence for process measuring and control technology.

The key message is that technologies already available on the market offer the greatest energy-saving potential while also offering the lowest CO<sub>2</sub> avoidance costs. These must be used in all areas.

### Promoting the intelligent use of energy means promoting the use of technology

We need new technologies and products, and we already have them at hand. They can be used around the globe. Given that Germany is only responsible for a very small share of the world’s CO<sub>2</sub> emissions, we can help to deliver efficient climate protection to other countries.

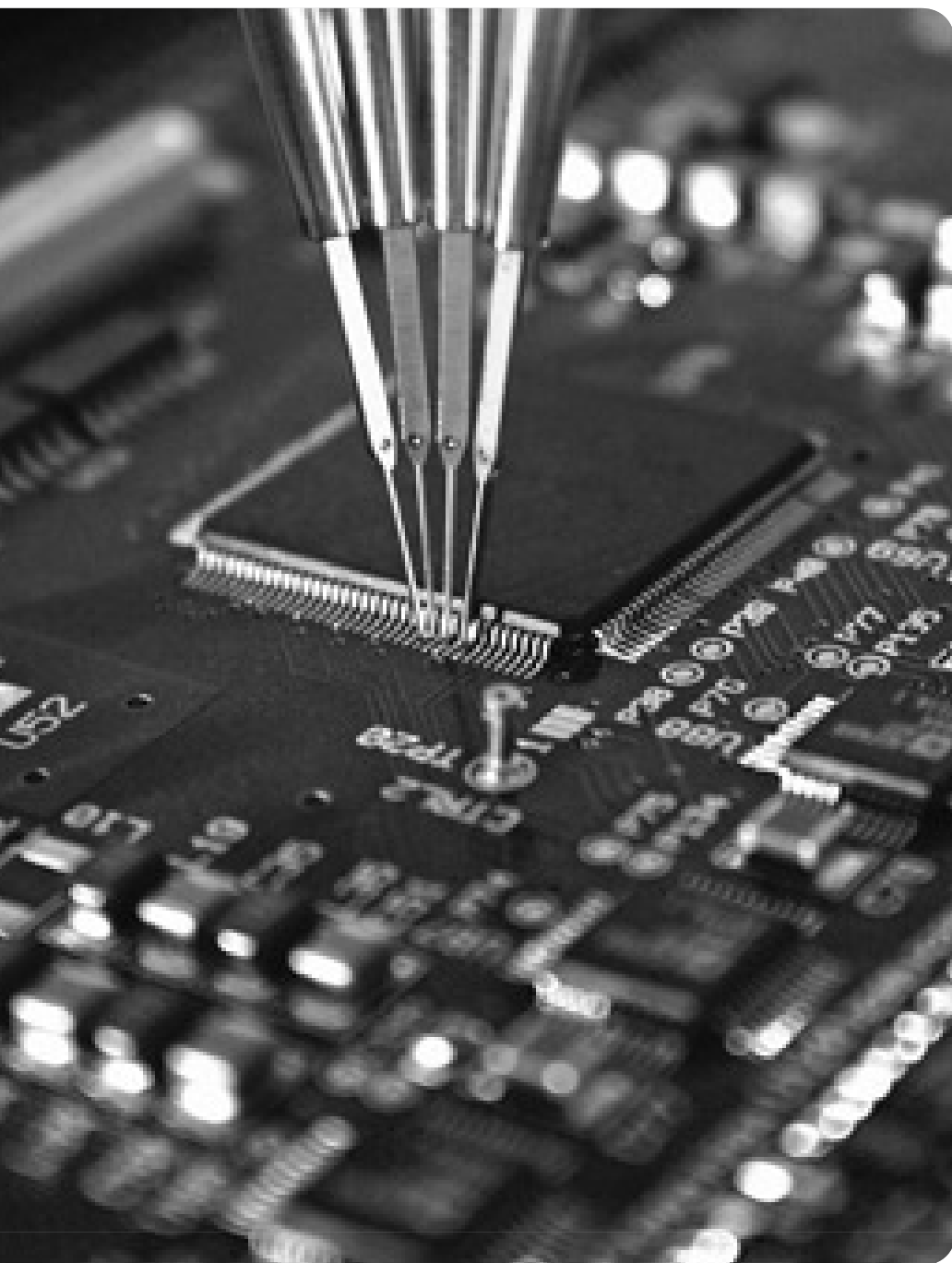
This white paper, entitled “White Paper on Energy Efficiency: Generating, Distributing and Using Energy Intelligently”, provides politicians and decision-makers from industry and the public sector and end users with comprehensive and expert information on our energy-efficient technologies and products and calls for energy and electricity to be used in an intelligent way. It is considered a comprehensive compendium of the potential for saving and optimisation offered by the energy generating, distributing and usage technologies and products represented by the ZVEI. Thus, the white paper covers the entire spectrum of energy-efficient technologies and products in the electrical and electronic industry.

The industry has paved the way by introducing numerous initiatives on the development of energy-efficient products, solutions and systems. This needs to be followed by action. Every citizen, every company and every public body can get involved: even small savings add up if a large number of users are making them. But not every decision-maker recognises the long-term potential for saving and can invest in new, highly efficient technologies.

If governments prescribe ambitious climate targets, this is only forceful if they then also encourage energy-intelligent action through specific political action. Through its “White Paper on Energy Efficiency”, the ZVEI is putting forward specific and feasible proposals to politicians. The result will pay off twice over as the climate targets can be achieved faster and users can save energy costs.

Chairman of the Board of  
ZVEI – Zentralverband Elektrotechnik- und Elektronikindustrie e.V.  
(German Electrical and Electronic Manufacturers’ Association)

## **B Energy-efficient Technologies: Potential and Solutions**



## Introduction

The electrical and electronic industry, as represented by ZVEI, has invested massively in recent years in research and development for energy-efficient technologies. As a result we now have access to products and solutions that reduce energy costs and help to prevent climate change throughout the entire impact chain, from power generation through distribution to consumption. Ample evidence of the tremendous advances achieved in engineering and the commitment of the electrical goods industry is provided by the fact that the electricity consumption of electric drives, lighting and refrigerators / freezers could be reduced by around 60 billion kilowatt-hours (kWh) per year through the use of energy-efficient products. That approximates to 40% of the electricity consumption of all private households in Germany.

The range of energy-efficient technologies now available covers the needs of private households, the public sphere, industry, and power generation and distribution. Individual technologies have tremendous potential to cut energy consumption and reduce greenhouse gas emissions. However, in most cases there are obstacles to the widespread use of these technologies, products and systems – from the political framework to individual buying and usage behaviour. In the chapters that follow, we present these technologies and examine their specific energy-saving potential and the obstacles facing their use.

Each section concludes with a number of proposed solutions.

*In this white paper, technologies are presented using this structure: Potential savings and intelligent provision of energy – Obstacles – Solutions*

## B.1 Innovative Basic Technologies for Energy-intelligent Solutions

The electrical and electronic industry offers not only directly usable end products but also energy-efficient technologies and systems that are essential to the manufacturing of end products or even form part of the product itself, and are the basis for various processes and procedures. We will refer to these technologies as ‘basic technologies’. In addition to electronic components, these include products such as switching devices, industrial control systems, measuring technologies, cables and insulated wires.

### Microelectronics and power electronics make energy intelligent

Components such as microchips, capacitors, power electronics parts and connectors form the backbone of any electricity-consuming unit. When combined to form systems and programmed for the job, they serve as the central control units for the system. By using electronic components in intelligent control and power electronics, it is possible to better adapt the consumption behaviour of a system – from small electrical devices to large industrial plants – to the relevant requirements, and optimise the power input. There is great potential here for reducing the energy input of electricity-consuming devices without any loss of comfort or convenience for the user. We can only save energy without sacrificing the benefits of an industrialised society by making consistent use of highly innovative microelectronic technologies.

The key to energy-saving end devices that offer an equal or better level of performance lies in the use of intelligent power electronics and control electronics optimised for reduced energy input to control power-consuming units. Energy-intelligent solutions in control electronics and, in particular, power electronics are already available on the market

Power electronics is the decisive factor, both in power generation – including conventional power generation and renewable energies (such as wind and solar power) – and on the consumer side, as a component in products like electrical drives, lighting and power supply systems.

*Microelectronics is what makes energy intelligent, and it is at the heart of energy-efficient technologies.*

Europe, and Germany in particular, boasts tremendous expertise in power and control electronics. When it comes to power electronics, the European component industry leads the world. The leading role played by German and European universities and research institutions is globally recognised.

### Outlook

With new developments in microelectronics such as the use of new semiconductor materials, the combination of passive and active components on a single substrate, and new switching concepts, we can expect to see further improvements in energy yield.

However, the development of innovative energy-saving components and products is just one aspect of the success of these technologies. In order to achieve the ambitious climate goals we have set ourselves for 2020, there is an urgent need to introduce energy-efficient products in private households, industry, commerce and the public sphere.

### Energy-intelligent control, regulation and communication

Automation products and systems control and regulate production processes and communicate the vital basic information required for successful energy management, for example to control rooms. They enable plant operators to identify the right strategy for energy-optimised plant operation. Automation as a basic technology therefore makes a significant contribution to a company's energy efficiency.

Energy-intelligent components and systems in electrical drive technology also enhance energy-saving potential as a cross-application technology of automation. Measures such as the use of electronic speed regulation and energy-efficient motors could achieve energy savings of 20%–50%.

### Automation technology is not just used in industrial manufacturing

Automation technology has become an established part of building technology through the intelligent networking of individual devices and systems. This is another area where it offers a basis for energy-efficient solutions. Building automation offers energy-saving potential because heating, cooling, lighting, hot water, blinds, doors and so forth are all controlled and regulated by a single system.

In addition to numerous applications in industrial manufacturing and buildings, automation technology also has a key role to play in energy

*Intelligent automation technology uses a systematic, integrated approach.*

production. For example, if intelligent automation is used to improve the efficiency of a coal-fired power station, this means that over the lifetime of the power plant significantly less primary energy will have to be used to generate the same amount of electricity.

#### **Efficient networking of devices and systems**

As passive energy transmission systems, cables and conductors link energy-intelligent devices and systems together. This applies to all voltage levels and applications, for example the on-board wiring in cars, electrical installations, and industrial plants. Insulated wires are also passive components, found in the coils of energy-efficient motors, generators and transformers. Adapted energy transmission systems can be used at up to very high voltages (400 kV) in the power supply infrastructure to ensure that electricity is transported to the consumer with minimum loss while avoiding unnecessary balancing power and reactive power. Alongside traditional transmission and distribution technology for AC using overhead lines and cables, innovative solutions in high-voltage DC transmission and the use of gas-insulated and superconductive transmission technologies also make a contribution in this respect.

The efficiency of an entire system is not simply the result of the efficiency of its components; rather, it is increasingly being influenced by the growing use of communication and control technology.

## B.2 Private Households

### B.2.1 Lighting

Lighting may not be a primary reason for high domestic electricity bills, but in most of Germany's 39 million or so private households, it conceals enormous energy-saving potential. Most households still use filament lamps as their source of electric light – the oldest and least efficient technology. First mass-produced in 1888, then as now they still convert no more than 5% of the electricity flowing through the filament into light. The rest is wasted, being emitted to the atmosphere as heat.

In Germany more than 200 million filament lamps are still sold every year, with the total figure for Europe standing at over 2 billion. Theoretically, by switching to energy-saving lamps Germany alone could save 7.5 billion kWh of energy and 4.5 million tons of carbon dioxide. If we assume a price of 20 cents per kWh, German households could save a total of €1.5 billion.

#### Modern high-quality light sources

Although energy-saving lamps have been available on the market since the 1980s and even enjoy general acceptance, they are still not widely used. This is in spite of the fact that the quality lamps available today have long overtaken the justified initial reservations about the light quality and tendency to flicker when switched on. They are now available in the same range of shapes as traditional filament lamps and even a dimmable version was recently launched. The amount of mercury found in energy-saving lamps is very small and thanks to a collection system initiated by the industry, old lamps are easy to recycle.

However, the issue of energy-saving in lighting is about more than simply energy-saving lamps. The industry is energetically promoting other alternatives, such as energy-saving halogen lamps with their brilliant light.

#### Political demands and necessary measures

The call to phase out filament lamps as a matter of urgency, voiced by some politicians, is not entirely unproblematic. Lamp manufacturers would need sufficient time to convert their production chains and develop new technologies, such as LED. The industry is strongly in favour of the politicians' energy-saving targets. However, in order to avoid shortages

*Filament lamps are an old and inefficient technology that convert no more than 5% of the electricity flowing through the filament into light.*

*Despite great improvements in light quality and reduction in flicker, there is still widespread prejudice against energy-saving lamps.*

*The industry needs sufficient time to bring energy-efficient lamps on to the market.*



in lighting equipment, it is proposing a timetable by which inefficient lamps would be gradually eliminated from the market by 2015.

To increase lighting efficiency even further, additional measures are required. The following elements are essential:

- Awareness-raising campaigns aimed at consumers, retail and trades about efficient lighting solutions focusing on more than just cost benefits. Widespread prejudices need to be addressed before new technologies can be accepted. Features such as light quality and the lifetime of modern lamps should be emphasised.
- Rapid adoption of the Energy-using Products Directive 2005/32/EC (EuP directive) and the implementing directives, plus consistent monitoring of the market.

## B.2.2 Domestic Appliances

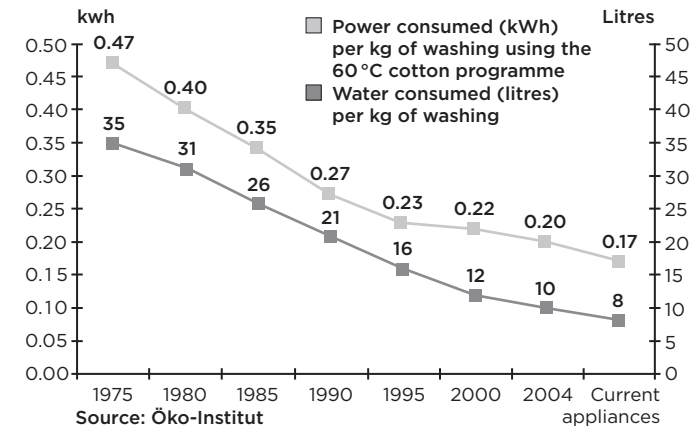
Washing machines, refrigerators or ovens – most households nowadays could not do without domestic appliances. Accordingly, these appliances are responsible for a large proportion of domestic electricity consumption. At around 33 billion kWh, they account for about a third of all domestic power consumption in Germany. This figure would be even higher if the manufacturers had not made a concerted effort to reduce the energy consumption of their appliances over the last few years. The measures introduced include better insulation and high-efficiency compressors in refrigerators, optimised washing programmes, heat pump technology in tumble dryers, induction hobs, sensor-based dishwasher controls, and heat protection glass for ovens. The energy-intelligent use of high technology has allowed the energy efficiency of specific appliances to be significantly improved in recent years.

The key drivers of this development included voluntary industry agreements and the European energy label.

### Voluntary agreements and the energy label – effective but showing their age

As early as 1978, ZVEI reached a voluntary agreement with the German Federal Ministry of Economics and Technology to reduce the energy consumption of domestic appliances. However, the increasing globalisation

of the markets and the introduction of the first regulatory controls by the European Commission required a European approach. So beginning in 1995, wider-scale agreements were concluded between the European Committee of Domestic Equipment Manufacturers (CECED) and the European Commission which resulted in considerable energy savings in all product groups.



Despite their early success, these agreements soon fell victim to the growing glut of no-name manufacturers and importers of products from third countries, which had the effect of diminishing the market coverage of the associations and manufacturers who had signed up to the agreements. As a result, the binding nature of the agreements lost much of its reach and effectiveness and these agreements have not been renewed since 2006.

The European energy label, introduced in the mid-1990s, indicated the performance of an appliance as a category from A to G, so buyers could directly compare the energy efficiency and consumption of different products when buying domestic appliances. This gave consumers a valuable decision-making aid that contributed significantly to the competition to achieve more energy efficiency. ZVEI has been a long-term supporter of the energy label ever since it was first introduced.

There is now an urgent need to update the energy label. Due to ongoing improvements in technology, in most product groups appliances are fighting for space in the top efficiency class. In the case of washing machines, 99% of all appliances fall into class A. Nevertheless, there are no plans to introduce standardised further differentiation in the highest

*The energy label no longer reflects current standards in energy efficiency.*

energy efficiency range above class A. Only for refrigerators and freezers are there additional classes (A+ and A++). This additional distinction, limited as it is to one product group, has attracted criticism from consumers who point out that it only makes for confusion. Consequently, the energy label is no longer of any real use to consumers when it comes to buying appliances.

**Energy-saving potential**

In addition to the specific technological development of individual appliances, there is energy-saving potential to be found in the permeation of energy-saving appliances in households. Consultancy firm McKinsey<sup>1</sup> predicts that electricity consumption in the building sector will fall “slightly from 267 billion kWh in 2004 to 260 kWh by 2020 and 255 billion kWh by 2030”. “Electric appliances are still in the process of permeating the market (tumble dryers, PCs, consumer electronics and dishwashers, for example); but at the same time the average efficiency of these appliances is nearing the current state of the art,” states McKinsey.

“However, significant energy-saving potential could be exploited much earlier if high-efficiency products were introduced more quickly on to the market and into people’s homes.” If we look at the whole range of domestic appliances, says McKinsey, the gap between the average efficiency purchased and the efficiency actually possible today is 22%; in the case of energy-intensive refrigerators and freezers, the gap widens to almost 40%. McKinsey calculates that if the proportion of purchases in the top efficiency class could be increased to 80%, CO<sub>2</sub> emissions would be reduced by almost 5 million tons in 2020.

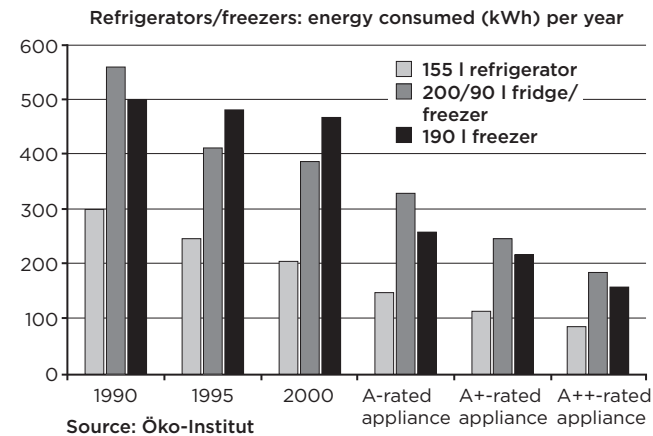
But because people tend to keep domestic appliances for a long time, there is still a huge number of – by today’s standards – inefficient appliances in use. The average service life of a dishwasher is 12 years and a freezer, 17 years. 35% of washing machines and 40% of ovens are over 10 years old. And of the 60 million or so refrigerators and freezers in German households, almost 30 million are 10 years old or more. If all refrigerators and freezers that are at least 10 years old were replaced with high-efficiency appliances, it would be possible to save around 8 billion kWh of electricity per year.

*Almost half of all domestic refrigerators and freezers are at least 10 years old and inefficient by modern standards.*

**Purchase price as a barrier to energy efficiency**

From an economic standpoint it pays to buy high-efficiency appliances as their life-cycle costs are lower than less efficient machines, which may be cheaper to buy but are less efficient in operation. The total savings made in energy and water costs almost always offset the extra amount paid for a high-efficiency appliance – usually by a considerable sum.

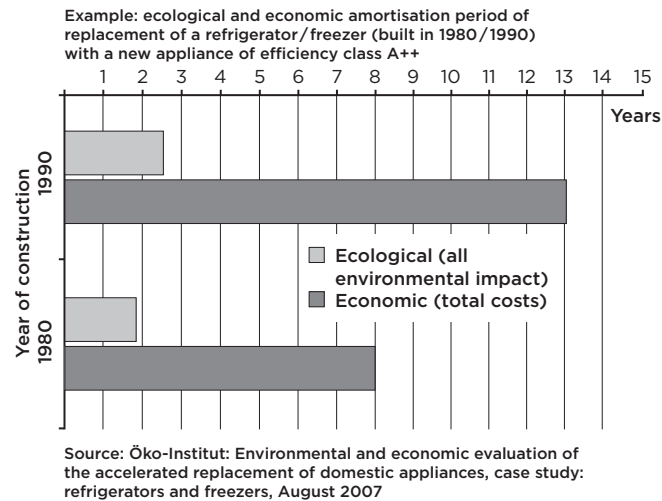
Example: A refrigerator/freezer (with a volume of 290 l) of efficiency class A consumes around 330 kWh per year. By comparison, an appliance of the same size of class A++ only consumes about 180 kWh. If both appliances are used for 15 years and the electricity needed to run them costs €0.20/kWh, the difference in energy consumption is 2250 kWh and the difference in energy costs is €450, which more than compensates for the higher purchase price.



Nevertheless, the lower purchase price often encourages consumers to buy an appliance that only offers second- or third-class energy efficiency. For example, the market share occupied by refrigerators and freezers offering the maximum energy efficiency class of A++ (of which a growing number has been available for over two years) is only about 5%. Two thirds of refrigerators bought in 2007 carried an energy label of A or lower. Consumers are also failing to take full advantage of the availability of high-efficiency washing machines and dishwashers.

*The market penetration of energy-efficiency products is by no means guaranteed; it is strongly influenced by individual buying and user behaviour.*

It is even more difficult to exploit the energy-saving potential in old appliances. In one study<sup>2</sup>, the Öko-Institut (Institute for Applied Ecology) calculated the environmental and economic amortisation periods of accelerated replacement. It was concluded that it made environmental sense to replace old appliances and that the costs would be quickly amortised from an environmental point of view – in no more than three years in the case of refrigerators. In financial terms, however, it would take more than eight years to pay for the costs of replacement.



### Need for action

There is a range of possible measures for exploiting the energy-saving potential of domestic appliances.

- New energy label as key source of consumer information

The demand for high-efficiency appliances could be stimulated by providing accurate, up-to-date consumer information and advice. However, experience shows that individual campaigns run by single market players acting alone only attract modest consumer attention, so their effectiveness tends to be low. The energy label will therefore play an essential future role, provided that it is updated as a matter of urgency and adapted to future market conditions. The manufacturers of domestic appliances

are in favour of an evaluation scale without an upper limit. This would be future-proof and easily understandable, and would allow for dynamic adjustment in line with market developments.

- Incentive programmes for promoting very high-efficiency appliances

Fixed-period incentive programmes for high-efficiency appliances could make a vital contribution to accelerated market penetration. ZVEI has already presented a concrete proposal for such a programme to the German Federal Ministry for the Environment. In its study, the Öko-Institut<sup>3</sup> in Freiburg concludes that an incentive programme could save over 2 million tons of CO<sub>2</sub> from refrigerators and freezers alone.

- Minimum standards

The implementation measures outlined in the Eco-design directive will introduce minimum energy efficiency requirements for the majority of domestic appliances, a move which is fully supported by ZVEI. This will not however be sufficient to exploit the full energy-saving potential available. In markets such as Germany, where the efficiency level is already better than average, harmonised European minimum standards tend to have little effect. Instead, the aim must be to increase the demand for energy-efficient appliances and introduce them into households more quickly to replace old machines.

- Effective market monitoring

Compliance with legal requirements such as minimum standards and the energy label must be accompanied by effective market monitoring. This is one area where Germany has a lot of catching up to do.

### Sources

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- 2 Öko-Institut: *Environmental and economic evaluation of the accelerated replacement of domestic appliances, case study: refrigerators and freezers; final report*. August 2007.
- 3 Öko-Institut, Ö-Quadrat: *Kosten und Nutzen eines Prämienprogramms für besonders effiziente Kühl- und Gefriergeräte*, July 2007.

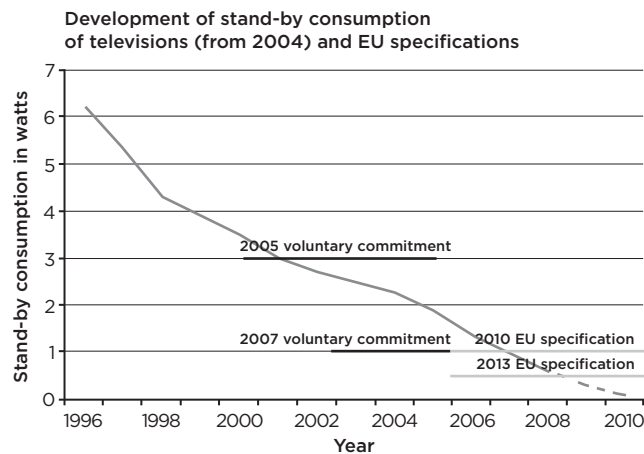
### B.2.3 Consumer Electronics, Broadcasting and Media Technology

*The energy consumption of consumer electronics products is declining.*

The market for consumer electronics (CE) products is growing and with it the range of products found in the average household. This, combined with the rising number of households in Germany, is contributing to a notable phenomenon: the energy consumption per appliance is declining even though total power consumption is on the rise. The Consumer Electronics Division and its members stand for innovation. Products such as televisions and set top boxes can offer functionality and appealing design without sacrificing energy efficiency.

#### Significant reduction of stand-by consumption

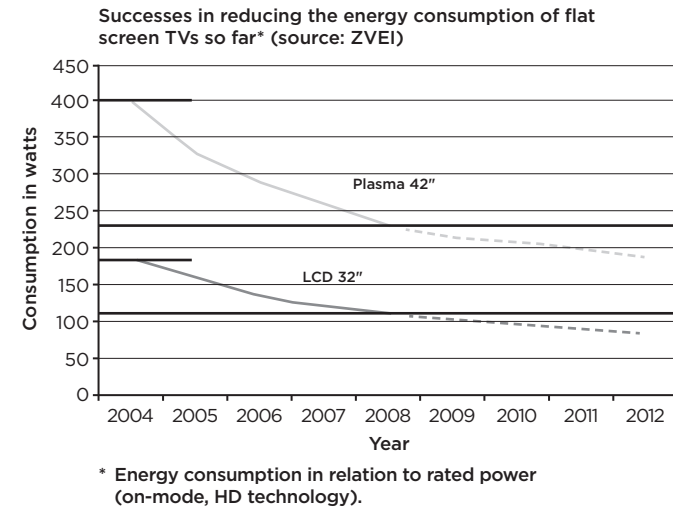
The industry has been strongly committed to reducing energy consumption for the past two decades. Take for example the voluntary agreement on limiting the stand-by losses of televisions: trends in stand-by consumption in recent years clearly show that the industry has long achieved and surpassed its self-set targets. In fact stand-by consumption is expected to fall to an average of 0.5 watts or less by 2010.



#### Improving energy consumption in on-mode

Energy performance in on-mode has also been significantly improved. If we compare a modern flat screen TV using the technology of today with a flat screen TV from 2004, the progress made in reducing energy

consumption is clear to see. As the technology continues to evolve, the energy demands of these appliances will decline even further.



It should be noted that modern flat screen televisions are usually larger than the old CRT televisions and often have additional built-in features like DVB tuners and hard disks. A larger display and more features automatically require more energy. On the other hand, appliances with pre-integrated solutions usually consume much less power than using various individual components.

#### Measures to encourage widespread use of innovative, energy-efficient CE products

To increase the market penetration of innovative, energy-efficient products and system solutions, the Consumer Electronics Division and its members are seeking to work in close collaboration with retailers and politics. In spring 2008 the division and its members launched an energy efficiency marketing initiative for consumer electronics. The division is also actively advocating a European energy consumption label for different quality classes, with a dynamic and non-language-specific design.

As consumers become more environmentally aware, environmental considerations will increasingly have an influence on their buying decisions alongside factors like brand, design and convenience. Having a

*Energy efficiency marketing and a European energy consumption label are expected to increase the market penetration of energy-efficient CE products.*

stand-by mode is not always advisable or technically necessary for all appliances. It is important to distinguish here between active stand-by and passive stand-by. In some cases an appliance needs to switch to stand-by mode to perform certain necessary functions (e.g. updates or a video recording timer). Educating consumers about appropriate ways to use stand-by functions could be an important means of reducing energy consumption. The energy efficiency marketing initiative must include awareness-raising campaigns geared towards specific target groups and issues. Governments could support these efforts not only by providing comprehensive consumer information but also through a financial incentive programme. In particular, the provision of education and training for multipliers such as retailers and the media should be encouraged and developed.

Through technological advances and the associated reduction in energy consumption, combined with the introduction of standards and labels and extensive information campaigns, it is possible to make significant progress towards the environmentally minded use of CE products.

#### Energy efficiency in transmission

Issues like ecology, recycling and energy efficiency are extremely important to the member companies of the Satellite & Cable Division. They are committed to achieving a continuous reduction in energy consumption. This is an area where ongoing technological development will lead to even better results in years to come.

Energy can be used intelligently in the signal distribution infrastructure, in other words the route taken by a television picture to houses, apartments and living rooms – for example by optimising switching power supplies. The digitalisation of transmission paths, which is being actively promoted by the Satellite & Cable Division, and the consistent use of high-quality and energy-efficient components are also making a meaningful contribution to energy-saving.

One special feature here is that components like headends, amplifiers and multiswitches operate 24 hours a day, seven days a week, 52 weeks a year. These components will always have a basic energy consumption level due to their very function, rather like the stand-by mode of set top boxes. The Satellite & Cable Division is therefore calling on end consumers, retail and trades people to consciously choose in favour of quality-inspected, energy-optimised branded products.

*The signal distribution infrastructure can be made energy-intelligent with the help of energy-efficient components.*

## B.2.4 Adapters and Chargers

External power supplies, commonly known as adapters, are indispensable for a wide range of appliances from mobile phones, laptops and digital cameras to electric shavers and halogen lights. External power supplies are also used for medical equipment and in industrial applications.

In these fields, adapters provide over 1.8 billion appliances in Europe with electrical energy. Conventional adapters with primary transformers represent about 25% of all adapters in use.

#### The advantages of modern switching adapters

Compared with conventional adapter technologies, modern adapters like switching adapters offer greater energy efficiency while being considerably smaller. It is already possible to reduce their volume by almost half and their weight by more than 80%. The manufacturers of power supplies are striving to achieve further improvements in energy efficiency through the ongoing development of switching adapter technologies, further miniaturisation and component integration.

However, energy consumption is not determined simply by a product's efficiency but also, primarily, by the way it is used. There is a need for wide-ranging information campaigns to encourage people to use appliances and power supplies in a more energy-aware manner. Appliances should feature appropriate information labels, which should be standardised throughout the EU. The use of efficient switching adapters should also be encouraged by introducing differentiated, high efficiency requirements.

There is enormous energy-saving potential in the use of state-of-the-art technologies for supplying energy to appliances powered by adapters. To tap into this potential requires not only further efforts from the industry but also stronger support and clearer requirements from politicians.

*Further increases in adapter efficiency and awareness-raising campaigns to alter user behaviour could reduce electrical losses by over 10%.*

## B.2.5 Electric Home Heating Technology

In Germany, around one third of primary energy consumption is used for heating, refrigeration, ventilation and hot water. Modern energy-intelligent electrical appliances and systems can achieve greater energy efficiency than the direct use of fossil fuels. At the same time, they reduce greenhouse gas emissions.

*Electric home heating technologies are characterised by the optimum use of available energy combined with on-demand provision of thermal heat and hot water.*

### Energy-saving potential of electrical systems

The wealth of environmental energy available in the air, the ground and near-surface water can be utilised with the aid of a heat pump. In a thermodynamic process it is possible to use 1 kWh of electrical energy to provide 3–5 kWh of thermal heat. This reduces heating costs by up to 50% compared with conventional heating systems.

For little-used rooms and transitional times, electric underfloor heating is ideal. It takes the load off the main heating system and reduces the time for which it is required to operate.

Owing to their high level of airtightness, modern new builds require a carefully thought-out ventilation concept. A regulated home ventilation system with heat recovery uses up to 90% of the energy contained in waste air to prewarm fresh incoming air. Solutions like these make for air hygiene and a comfortable room climate and protect the basic fabric of the building.

Unlike a central hot water system combined with the heating system, a decentralised electric hot water system supplies hot water as and when required, making it more cost-efficient and energy-saving. Electronic flow heaters are particularly suitable; compared with hydraulic flow heaters, they have an energy-saving potential of around 20%. If all hydraulic flow heaters in Germany were replaced, it would result in a saving of around 1.8 billion kWh.

Lastly, solar hot water systems can provide up to 60% of the energy requirements of a detached house; if used as auxiliary heating, the figure is still 15%.

### Obstacles to market penetration

The market for electric home heating technology is closely interlinked with the residential building sector. The economic performance of this sector therefore has a direct impact on the uptake of efficient appliances in electric home heating technology.

A lack of information among consumers, tradespeople, architects and other decision-makers about technical solutions and the associated energy-saving potential is often the reason for a decision not to use energy-efficient technologies in electric home heating. An unstable energy policy framework is also causing delays in or even avoidance of investment decisions.

### Solutions

Tax incentive systems such as the deductibility of purchase costs for efficient appliances, retrospective rebates, or tax reductions for manufacturers of efficient appliances could all be used to encourage the use of intelligent and efficient appliances and solutions.

In terms of legal requirements, there should be more promotion of heat pumps in the market incentive programme for renewable energies and decentralised electric hot water systems should be given equal status with other solutions in the implementation measures for the Eco-design directive. Manufacturers also require enough time to replace inefficient appliances and make the technology transition cost-effectively.

*Recession in the residential building sector and a lack of information are hindering the market penetration of electric home heating technology.*

## B.2.6 Electrical Installation

There are simple ways to save energy in residential buildings. Motion sensors can be used to automate lighting in corridors and stairwells so it is only activated when needed. Individual room control provides additional significant energy-saving potential for the residential building sector. These systems control the heating reduction, stand-by and operating times in lived-in rooms according to when they are actually used and turn down the heating or ventilation when a window is opened. By only providing energy when it is needed, individual room control enables energy savings of up to 20% in heating and ventilation.

Another approach to reducing energy consumption in buildings is the visualisation of energy consumption in residential buildings. This allows the user to monitor in real time how much electricity, gas, oil and water is being consumed. By combining an intelligent domestic meter with building automation it is possible for the user to read, evaluate and display detailed information on energy consumption behaviour using a touch panel, television or PC. If domestic appliances are controlled with an intelligent domestic meter according to tariff, even more energy can be saved.

*Modern electrical installation and building system technology is the basis for intelligent energy use in residential and single-purpose buildings.*

*Visually displaying energy consumption enables you to monitor and control your consumption and therefore benefit from low electricity tariffs.*

*Because the benefits of efficient technologies are all on the user's side, there are no investment incentives for the construction companies.*

**Obstacles to energy-saving investments**

On the residential market, landlords can typically only apportion 11% of the costs of energy-saving investments to the rent per year. As a result, residential construction companies have no incentive to invest in energy-saving technologies, as the benefits are all on the user's side (instant reduction in additional costs) and these investments must be amortised over long periods.

**Use intelligent domestic meters and resolve the investor/user dilemma**

Old energy consumption meters should be replaced as quickly as possible with intelligent domestic meters to create a suitable framework for energy consulting and tariff-based consumption.

Opportunities to amortise energy-saving investments must be improved. To resolve the investor/user dilemma, landlords should be legally permitted to apportion more than 11% of the costs of energy-saving investments to the rent. In exchange, tenants will benefit from lower energy bills. In the interests of tenant protection, rents that included utility bills would have to have a time limit attached and be graded according to energy-saving effectiveness.

## B.3 Public Infrastructure

### B.3.1 Mobility and Transport

Transport accounts for about 20% of all carbon dioxide emissions in Germany. The companies represented by ZVEI offer a range of energy-efficient products and solutions for the rail industry and the rail and road infrastructure to reduce energy consumption and significantly reduce harmful emissions. It is also possible to increase the capacity of the infrastructure by using traffic control.

*Energy-intelligent optimisation of rail and road transport saves energy and increases the capacity and performance of the transport infrastructure.*

#### Rail transport

There are numerous technologies available for enhancing the efficiency of rail transport in particular. The decision to introduce the European Train Control System (ETCS) will result in a much smaller number of signalling systems while increasing track capacity. Lightweight vehicles consume 30% less energy and are now up to 90% recyclable. Feeding braking energy back into the grid or to assist auxiliary drives reduces energy consumption by 50%. A hybrid locomotive consumes up to 40% less diesel fuel, produces much less noise, and reduces particle emissions and nitrogen oxide emissions by 60% and 40% respectively. The use of additional technology innovations such as improved energy management for drives and better use of waste heat will make the railways even more environmentally friendly.

Example: An electric trainset that satisfies current energy efficiency standards consumes 30% less energy because of its lightweight construction, can cover 46% of its energy needs through braking energy recovery, and is 90% recyclable once its service life is over.

#### Road transport

Electronic traffic management systems in road transport increase road capacity by 5%–10% and reduce accident rates by 30%. The use of navigation systems cuts journey times by 5%–10%. This in turn reduces fuel consumption and therefore emissions.



Example: For some years there have been efforts to replace conventional traffic signalling systems (traffic lights) with LED technology and sophisticated new control devices. LEDs have a lifetime of eight to ten years. By contrast, conventional filament lamps need to be replaced after six to eight months in the interests of road safety. LED traffic lights also use about 55% less power on average than filament lamps. These differences in efficiency result in significant cost savings. In addition, investments in modern LED traffic lights amortise after just six to ten years.

*Electric vehicles not only save energy and avoid CO<sub>2</sub> emissions, they could also compensate for load fluctuations in the power grid.*

#### Hybrid and electric cars

The current debate surrounding vehicles powered by combustion engines is stimulated by three factors. Firstly, there are the ever more stringent legal requirements relating to exhaust emissions, CO<sub>2</sub> emissions and fuel consumption, which are forcing car manufacturers and their suppliers to make ever greater efforts in terms of technological design. Secondly, the price of standard fuels has risen to unprecedented levels in recent times. And thirdly, the climate debate has engendered an awareness of harmful CO<sub>2</sub> emissions of all kinds.

Electric cars could make a major contribution to energy efficiency and therefore help avoid harmful emissions – both directly and indirectly. The large-scale production of electrical energy destined to be stored in a battery and then used for driving can be achieved very efficiently. As a propulsion system the electric engine exhibits high energy efficiency in comparison to the traditional combustion engine.

Some network operators have even suggested that the future fleet of hybrid and electric vehicles, equipped with the right intelligent technology, could not only be charged from the power grid but could also be used as buffers and to provide balancing power during marked fluctuations in the supply of regenerative energies. The necessary infrastructure would be installed in both private areas (garages, parking spaces etc.) and public areas (covered car parks, company car parks etc.).

#### Accelerating market uptake

The electrical and electronic industry offers a wide range of energy-saving and low-pollutant technologies for the mobility and transport sector. However, market uptake often only occurs as part of modernisation efforts and is only implemented very sluggishly. Tax incentive measures and other government programmes to stimulate investment could accelerate market uptake.

### B.3.2 Road and Office Lighting

Towns, cities and communities are some of the most important actors when it comes to climate protection. They can make a considerable contribution to joint efforts to reduce greenhouse gas emissions and therefore meet the targets set by the federal government. But climate protection and legal requirements are not the only reasons why energy-saving measures are so urgently needed at community level. In view of the dramatic increases in energy prices and the tight budgets at their disposal, towns, cities and communities also need to save energy for financial reasons.

#### Energy-saving potential in road and office lighting

Local authorities in Germany spend around €2 billion per year on their energy supplies. Lighting is one area that conceals enormous energy-saving potential. New energy-efficient lighting technologies could reduce energy consumption by up to 80% while improving lighting quality for the benefit and safety of local residents.

More than one third of all German roads are still illuminated by inefficient lighting equipment from the 1960s. By introducing modern lighting technology the country could save 2.7 billion kWh and 1.6 million tons of carbon dioxide every year. Local authorities would also be in a better financial position.

ZVEI estimates that up to €400 million could be saved every year in community street lighting alone.

Lastly, there is significant energy-saving potential in office lighting. More than 75% of office lighting is obsolete. By replacing this obsolete equipment with innovative technology, it would be possible to save up to 3.2 billion kWh and therefore up to €475 million in operating costs per year. Local authorities would also benefit significantly from such a change.

*The operation of inefficient road and office lighting costs Germany €875 million every year.*

*The ZVEI community lighting roadshow demonstrates that many local authorities have upgraded their road lighting and made considerable savings.*

The community lighting roadshow run by ZVEI demonstrates that this energy-saving potential is more than just theoretical figures. The roadshow presents examples of best practice from communities that have successfully upgraded, which serve to illustrate the scale of the potential savings – from €10 000 to €100 000 depending on the project. Crucially, all investments pay for themselves within a few years because of the savings in energy costs.

Over the last 15 years the lighting industry has developed technologies that are three times as efficient as older equipment. As well as saving energy, they offer other advantages:

- lower maintenance costs
- lower disposal costs
- improved ergonomics
- better lighting

When we consider that this energy-saving potential could be exploited relatively easily by introducing modern technologies, which would simultaneously improve lighting quality, it is astonishing that so little use is made of these technologies. In road lighting, for example, only 3% of old mercury vapour lamps are converted each year to more energy-efficient systems. If this rate of change remains the same, it will take 30 years for the benefits of new technologies to take full effect. Given the impact of climate change, this is longer than we can afford to wait.

#### Obstacles

The reasons for the slow rate of change are often a lack of information about the economic and environmental potential of energy-intelligent technologies, uncertainty due to inadequate technical knowledge, and uncertainty as to the costs of financing such projects.

This last reason is often the greatest barrier, given the still overstretched local authority budgets. Counter-productively, some local authorities are even switching off some of their lighting so as to achieve short-term savings. Switching off part of the road lighting system like this poses a danger to all road users, as it disrupts the even lighting coverage prescribed in the relevant standards. Driving through alternating zones of light and dark is fatiguing for motorists, and makes it more difficult to spot pedestrians. Instead of opting for these cost-cutting measures with the associ-

*A lack of information and overstretched local authority budgets are the main reason for the slow pace of upgrading. Cost-cutting measures like switching off parts of the road lighting system are associated with safety risks.*

ated safety risks, communities should switch to energy-efficient solutions. All the necessary technologies are already available.

#### Requirements of an efficient lighting solution

Lower costs are not the only incentive to forge ahead with the upgrading of community lighting. People are spending a growing proportion of their daily lives in artificial light. 80% of all the information we take in is perceived by the eyes. It follows that poor visual conditions make work more difficult, impinge on our leisure time, and are dangerous – particularly on the roads. The lighting industry is therefore focusing more and more on this particular domain.

The European standards DIN EN 12464 (Lighting of work places), and DIN EN 13201 (Road lighting), list the key objectives of lighting systems:

- Visual comfort means good visual conditions; it should promote well-being and contribute to increased performance.
- Ease of vision means that sufficient light is available for visual tasks to be performed without error or additional effort, even under difficult conditions and over an extended period.
- Safety is considered to be fulfilled if the requirements for visual comfort and ease of vision are met.

Efficient lighting solutions are available for all community requirements, be it administrative offices, kindergartens, schools, hospitals, sports facilities or roads. However, expert advice and planning is needed in order to achieve energy savings while improving the lighting quality required in a given situation. For example, simply replacing a lamp could save up to 10% in energy costs while a complete system upgrade including presence and daylight sensors could save as much as 82%.

Finally, it is important to remember that local authorities act as role models. They set an example and encourage residents, businesses and industry to become more environmentally active and start saving energy.

*Lighting systems have a major impact on our quality of life and must therefore be optimised in terms of visual comfort, ease of vision and safety.*

*Public efforts to make lighting more efficient sets an example to private energy consumers.*

**Measures**

If we are to make a significant difference to the rate at which road and office lighting is being upgraded, a number of coordinated measures is required. Once a list of specific obstacles has been drawn up, ZVEI proposes the following measures:

- Awareness-raising campaigns aimed at local authorities, planners and electrical installers.
- The procurement guideline for federal states and local authorities must include a mandatory consideration of life-cycle costs (similar to the requirement for federal properties).
- Special support programmes offered by the Kreditanstalt für Wiederaufbau (KfW) for lighting, including start-up financing for best practice models.
- Binding specifications for upgrading inefficient lighting systems as part of the National Energy Efficiency Action Plan (NEEAP).
- Rapid adoption of the Energy-using Products Directive 2005/32/EC (EuP directive) and the implementing directives, plus consistent monitoring of the market.
- Deployment of an interdisciplinary panel of experts including representatives from federal, state and local level and business on the planned revision of the next NEEAP.



## B.4 Industry and Commerce

### B.4.1 Process and Production Automation

In industries like metal processing and petrochemicals, energy costs may represent 30%–50% of the costs of production. This makes the energy cost factor an absolutely crucial criterion.

There is enormous energy-saving potential in the consistent use of new products, systems and solutions in automation. In order to exploit this potential, all production and engineering processes and procedures must be energy-optimised. The necessary technology already exists, but must be put into wider use. Intelligent applications and solutions in process and production automation often work ‘behind the scenes’, with the result that their potential is widely underestimated. In fact, they serve as control centres for energy-intelligent processes and production stages. They provide the essential basic information needed for successful energy management and therefore make an important contribution to a company’s energy efficiency.

#### Energy-saving potential in automation technology

In process and production automation, measurements and computer programs not only show how a system is working but also simulate various operating statuses. This makes it possible to identify the right strategy for energy-optimised plant operation. The software used is capable of learning and can shorten response times, predict trends and optimise maintenance intervals.

By employing intelligent automation technology it is possible to use 10%–15% less energy – in some cases even more – for example as a result of better measurements and more accurate process control. For an energy-intensive company operating in a primary industry, this soon translates into annual savings of millions of euros in the cost of electricity, oil, gas, steam and compressed air. In the medium and long term this reduces the user company’s production costs, makes it more competitive, and safeguards local jobs while creating new ones. It also cuts down on CO<sub>2</sub> emissions and therefore makes a key contribution to climate protection.

With the aid of modern automation solutions, German companies could save at least 10 billion kWh per year in electricity alone. This would

*Intelligent automation technology cuts down on production costs, freeing up resources for growth and development. At the same time it contributes to climate protection.*

save them at least €1 billion in energy costs every year and reduce CO<sub>2</sub> emissions by at least 6 million tons. Intelligent process automation could also significantly reduce the consumption of primary energy sources such as coal, oil and gas. These commodities offer even greater potential savings than electricity.

#### Diverse possible applications

1. Modern automation technology is already used to great effect. In one lime works, for example, it contributes to efficient energy consumption in the burner control system. When the mass and pressure of the various liquid or gaseous fuels are regularly recorded, the incoming fuels can be constantly monitored online and consumption can be regulated to the optimum level for the process. The density and temperature of the fuel can be measured as additional parameters. By using an energy calculator it is possible to keep track of the mass of consumed fuels and therefore monitor CO<sub>2</sub> emissions.

2. Intelligent automation technology also plays a key role in power stations. If the efficiency of a power station is increased by 1%, for example by means of process analysis and power station control technology, then over its entire lifetime the plant will burn many millions of tons less of coal to generate the same amount of energy.

3. By modernising its bottle transport system, one brewery reduced its electricity consumption by around 40%. The conventional technology previously in use was replaced by energy-efficient drives and control technology. The modernisation of the bottle transport system also provided an opportunity to give all units a coat of environmentally friendly paint and use biodegradable oil for lubrication.

## B.4.2 Electrical Drives

Two thirds of the electricity consumed in industry is used by machines powered by electric motors, including some very old drive systems. If these were to be replaced with modern technology it would be possible to save 27.5 billion kWh of electricity. This figure calculated by ZVEI corresponds to 15% of total industrial electricity consumption and energy costs of €2.2 billion, as well as 17 million tons of CO<sub>2</sub> given Germany's current energy mix.

#### Energy-saving potential in detail

There are two approaches to exploiting the energy-saving potential of electric drive systems. Firstly, there is the use of electronic speed control systems with frequency converters, which represents four fifths of the total energy-saving potential. The other one fifth could be met by the use of energy-saving motors in the efficiency class EFF1. Electric motors and drives can be found everywhere – in main and auxiliary industrial processes, in commerce, in buildings and municipal utilities like waterworks, wastewater treatment plants, swimming pools and airports.

#### *Electronic speed control systems*

These can be used wherever the feed rate of a machine powered by an electric motor is dependent on speed. In auxiliary industrial processes, this often applies to pumps, fans and compressors. In many cases these units still rely on mechanical controls such as flaps, throttle valves and overflow valves. If the desired control function were handled by electronic speed control systems with frequency converters, the machines would only be supplied with exactly the amount of energy required for a given process. In other words, control is based on demand.

Another energy-intelligent technology is energy recovery frequency converters, which feed braking energy back into the public grid instead of dissipating it through braking resistors or mechanical brakes. This technology is used in lifts and electric transport systems, for example.

In total, the use of frequency converters for speed control could save 22 billion kWh. That's roughly the equivalent of nine power station units with an output of 400 MW.

*Electronic speed control systems and energy-saving motors exploit the high energy-saving potential of electric drives.*

*Energy-saving motors*

Energy-saving motors are standard motors optimised for low internal losses. They convert electrical energy into mechanical energy with minimum losses while retaining the required technical properties. Energy-saving motors have been available for the past 15 years. Initial demand was low owing to the lack of necessity to save energy, but they made their breakthrough in 1998 when European motor manufacturers concluded a voluntary agreement with the European Commission to market more energy-saving motors. This initiative, which meant a considerable financial commitment for the manufacturers, led to a perceptible growth in energy-saving motors. To date, approximately nine million motors of efficiency classes EFF2 and EFF1 have been sold in Germany. Last year they enjoyed a market share of 85% in the case of EFF2 and 12% in the case of EFF1.

Whereas just a few years ago the somewhat cheaper EFF2 motors were still the favoured option, there is now a clear international trend towards EFF1. Many non-European countries have already legislated for its introduction, and in Europe it will become mandatory in the next few years under the Energy-using Products Directive 2005/32/EC (EuP directive). EFF1 motors are 2%–3% more efficient on average than EFF2 motors.

If we assume that EFF1 energy-saving motors will gradually replace the 30 million or so old motors currently in use, this gives an energy-saving potential of 5.5 billion kWh. However, if the current replacement cycle remains unchanged it will take about 70 years before all old industrial motors are replaced with the more economical EFF1 motors. The mandatory introduction of these motors as hoped for by the European Commission as part of the EuP directive would theoretically reduce this time to 10 years, assuming of course that businesses were willing to make the change.

**Intelligent use of energy**

In the broad field of application for electric drives, intelligent use of energy refers to the purposeful selection and effective combination of energy-efficient components to form a machine or system, in an integral approach. Analyses have shown that 40% of the energy-saving potential in old installed systems comes from the electric drives themselves and 60% from mechanical system optimisation. It follows that the optimisation process should cover mechanical components as well as electric motors and electronic speed control.

**Energy-saving case studies**

Of the more than 30 million drives installed in German industrial plants and municipal utilities, around 10 million are classified as non-energy-efficient and therefore in need of modernisation. The energy-saving potential of individual systems ranges from 20% to 50% of the energy consumed. The amortisation periods for the costs of modernisation or replacement range from one year to four years. Here are two examples:

1. In the paper industry, the installation of a frequency converter reduced the energy demand of a pulper drive with a 400 kW motor by 40%. The investment of around €65 000 was offset by annual energy cost savings of €68 000, so the investment costs were amortised after just one year.
2. The mechanical throttle control in a 75 kW sewage pump in a wastewater treatment plant was replaced with a modern electronic speed control system. The annual energy costs were cut by €13 760 and energy consumption by 172 000 kWh. The investment paid for itself after just six months.

**Obstacles to rapid market transformation**

The reason for the short amortisation periods for energy-saving investments is the magnitude of the energy cost savings in relation to the total life-cycle costs. In the case of an electric drive, depending on use, cumulative energy costs may account for over 90% of these total costs while the cost of purchase accounts for less than 10%. Buyers who focus on the low purchase price and disregard the subsequent energy costs can only be described as short-sighted. Often, however, they are simply complying with prescribed purchase requirements, which shows that companies striving to portray an exemplary environmental image in other areas are in fact cutting corners in their internal procurement processes.

We must also bear in mind that machine constructors experience difficulties in making their machines more energy-efficient because of the associated financial outlay. Their selling argument is the selling price of a machine, not the operating costs. Only when there is demand for such machines on the market will the manufacturers start supplying them.

*The energy costs of electric drives account for over 90% of the total life-cycle costs.*

*Good energy efficiency requires a shared commitment from everyone involved, from the machine or plant constructor to the end customer.*

### Responsibility of the operator / end customer.

Energy efficiency must be enshrined in the corporate philosophy and implemented accordingly. The first step is to perform an energy efficiency analysis. The individual characteristic values, control processes and operating data of machines and systems must be recorded and evaluated. It is then possible to calculate individual energy-saving potentials and identify energy-efficient technical solutions. The results can be incorporated into an energy efficiency action plan along with the amortisation calculation, and the company management can link this action plan to their medium-term investment planning.

To facilitate this process it would be useful to introduce ways of recording energy consumption and load cycles. Among other benefits, this would allow the later introduction of energy management systems, for example with the allocation of energy costs to cost centres.

### Need for action: measures to accelerate implementation

At present, the environmental policy debate and rising energy prices are stimulating demand for energy-efficient machines and drives. An upturn is already evident on the market. However, this is still not sufficient to leverage the enormous energy-saving potential of the machines and systems currently in use within the time considered desirable as part of environmental policy.

In addition to the awareness-raising and information campaigns run by ZVEI and manufacturers, political measures would be a welcome source of guidance. The following measures could have an accelerating effect:

- Raising the profile of energy efficiency within companies to give it the same priority as occupational safety and environmental protection. Setup of an energy efficiency authority.
- Life-cycle costs (LCC) taken into account in enquiries and quotations.
- Mandatory inclusion of LCC (wastewater treatment plants, drinking water plants, waste disposal etc.) in public tendering processes.
- Incentive programmes for energy efficiency analyses in industrial plants, and also particularly for local energy consumption measurement and energy-saving investments; i.e. including better amortisation conditions for the use of energy-efficient solutions.
- Inclusion of energy efficiency issues in the curricula of schools, technical universities and universities of applied sciences.

## B.4.3 Industrial Lighting

In industry, where a great deal of effort is normally devoted to achieving optimum performance in return for cost, the issue of lighting is often neglected. Instead of being recorded separately, operating costs are simply included in the total energy costs for production machinery. This is at least partly due to the fact that lighting systems are usually inconspicuous and in some cases have been running for decades without any malfunctions. There is also a tendency to forget that better light quality has a positive impact on productivity, because it improves occupational safety and also employee performance.

### Energy-saving potential

ZVEI estimates that industrial lighting offers an energy-saving potential of 8.3 billion kWh per year or €1.2 billion. This reduction in energy consumption would also cut carbon dioxide emissions by five million tons.

In addition, effective illumination enables companies to trim down their production costs because of enhanced employee performance. These benefits are not directly quantifiable, but the amount of energy saved can most certainly be quantified. Using a combination of lamps, lights with optimised reflectors and daylight sensors could cut energy costs by up to 70%.

### Obstacles

Medium-sized companies in particular lack the staff resources to address the issue of lighting and the associated energy-saving potential. As this type of company represents – in numerical terms – the majority of German industry, this is where the greatest energy-saving potential is going untapped.

*Efficiency-optimised industrial lighting not only reduces operating costs, it also improves productivity and safety thanks to better light quality.*

*Political measures are needed to provide a sense of direction to further increase the demand for energy-efficient machines and systems.*

### Measures

A number of selected approaches should be considered for the effective implementation of efficient industrial lighting:

- Address the information deficit through extensive energy advice which covers the issue of lighting quality.
- Improve capital allowance possibilities for upgrading old lighting.
- Rapid adoption of the Energy-using Products Directive 2005/32/EC (EuP directive) and the implementing directives, plus consistent monitoring of the market.

### B.4.4 Building Automation

*Building automation is the basis of intelligent energy use in single-purpose buildings.*

In single-purpose buildings it is possible to save energy using relatively simple technology measures while at the same time improving comfort and safety. Motion and presence sensors can be used to automate lighting in corridors and stairwells so it is only activated when needed and when normal daylight is insufficient. Likewise, light level and presence sensors in offices determine the level of artificial light needed according to the available daylight. Usage-dependent lighting control can save 40%–50% in light energy.

Individual room heating control offers another important means of saving energy in functional buildings. These systems adjust the heating reduction, stand-by and operating times in office premises according to usage and presence profiles and automatically turn down the heating, air conditioning and ventilation when a window is opened. In total, the energy consumption of heating, air conditioning and ventilation systems could be reduced by 60% through the use of needs-based individual room control.

As far as air conditioning is concerned, the amount of heat generated by sunlight could be reduced by optimising the position of the slats in window blinds. This could reduce the energy needed for cooling by up to 20%.

#### Smoke escapes in lift shafts

In buildings with lifts, the German government building regulations require lift shafts to be equipped with a permanent opening for smoke to escape in the event of a fire. These openings represent a major breach

in the overall heat insulation system. The flue effect causes warm air to flow from the individual storeys through the shaft doors and into the lift shaft, from where it escapes to the outside. Because of this breach in the building shell, the 600 000 or so lift systems in Germany are responsible for significant energy losses amounting to around 3 million tons of CO<sub>2</sub> every year.

These losses could be drastically reduced by means of smoke escapes for lift shafts. When the system detects smoke gases in the lift shaft, an alarm is triggered and an electric drive opens the smoke vents at the top of the shaft, allowing toxic gases and fire smoke to escape. Under normal circumstances these vents are closed to prevent heat from escaping. In this way, energy losses are as good as eliminated, ventilation is controlled and smoke removal is guaranteed in the event of a fire.

#### Obstacles to energy-saving investments

During the construction phase, investors tend to consider the construction and management costs as separate items. Since the investor and the operator are rarely one and the same party, higher construction investments are not offset against the potential savings in the utilisation phase. As a result, investors have no incentive to invest in energy-saving technologies, as the benefits are all on the user's side (instant reduction in additional costs) and the investments must be amortised over long periods.

#### Measures to increase energy-saving investments

The opportunities for amortisation and the support framework for energy-saving investments must be improved. In particular, investments in building automation should be promoted through the building redevelopment programmes of the Kreditanstalt für Wiederaufbau (KfW).

To resolve the investor/user dilemma, the law should permit higher diminishing depreciation rates for energy-saving investments. Finally, the public sector should take into account the use of building automation technology in tendering processes and the subsequent awarding of contracts for public properties.

*Because the benefits of efficient technologies are all on the user's side, there are no investment incentives for investors.*



## B.5 Power Generation and Distribution

Germany has a strong power supply infrastructure. To maintain this national advantage, the following requirements must be satisfied:

- The supply and consumption of energy must be viewed as one complete system; only an integrated process of optimisation will have lasting impact.
- Innovative technologies that are already available must be exploited without delay in order to leverage the enormous existing potential to reduce energy consumption and greenhouse gas emissions.
- The necessary climate protection measures cannot be had for free. There needs to be a concerted effort to overcome inhibitions about the use of innovative technologies, in the power supply infrastructure too.

The German electrical industry is still a global technology leader, which makes a major contribution to the success of a thriving export economy. To maintain and reinforce the exporting clout of this key industry, we must first make possible and then actively encourage the use of innovative technologies in Germany.

### B.5.1 Innovative Energy Technology for Intelligent Networks

The power supply infrastructure in Germany and Europe as a whole is having to satisfy a whole new set of requirements for which it is simply no longer fit. These include:

- The integration of planned fluctuating energy sources with high outputs (onshore / offshore wind energy) into transmission grids (high voltage and very high voltage).
- Formation of a European single energy market with a corresponding growth in trading volume beyond national borders.
- Increase in production of energy a long way from the site of final use as a consequence of the deregulation of the energy market and therefore more transport of high power levels over long distances.

- Integration of the anticipated major increase in local production capacities with sometimes fluctuating characteristics (e.g. photovoltaics), particularly in distribution networks (medium and low voltage).
- Leverage of energy efficiency potential through the use of energy management systems in consumer control and the avoidance of balancing power.

In terms of identifying a solution for a suitably adaptable intelligent infrastructure, equal priority should be given to three criteria for the complete power supply system: cost-effectiveness, security of supply and environmental compatibility.

Now that liberalisation has allowed the energy production structure to develop along its own lines, the traditional integrated planning of energy production and transmission has become obsolete. In fact, the various renewal and upgrading programmes for production capacities in Germany and other parts of Europe are delivering a growing number of new energy providers to the market with their own production capacities, giving the energy trading market another base. The aim must therefore be to maintain the current high level of security of supply under much changed conditions. This will require much more operating flexibility in transmission grids, for example in voltage stability and efficient load flow control.

It remains to point out that the electricity grid is a technically complex link between producer and consumer, and that it can only perform the new tasks expected of it if the network is adequately upgraded and technical innovations are employed. Measures aimed simply at short-term cost-cutting will not satisfy the more stringent requirements being placed on the grid.

The intelligence of the future power supply infrastructure will increasingly depend on the use of electronic, communication, and control technology components and systems.

*Increasing competition on the energy market is making new solutions necessary for integrating energy production into power grids.*

## B.5.2 Transmission Grids

The growth in cross-border energy trading and feed-in from wind turbines, particularly in regions with low consumption, is increasing the number of bottlenecks in the German and European transmission grid (high voltage and very high voltage). In addition, there is a growing risk of potential power oscillations and voltage problems due to the concentration of wind turbine feed-in in peripheral areas of the grids. Combined with a high basic utilisation of the interconnecting lines, there is a fast-growing demand for quickly adjustable elements to control the active and reactive power flows.

These unusual levels of grid load are caused by incalculable shifts in load flows, for example caused by the feed-in of wind power and energy trading. They are easier to manage with flexible AC transmission systems or even high-voltage DC transmission (HVDC). With the aid of power electronics, technologies like HVDC and FACTS (Flexible Alternating Current Transmission System) present potentially very promising solutions thanks to the technical benefits they offer compared with conventional three-phase current technology.

One barrier to investment in innovative technologies is the fact that national regulatory systems (Anreizregulierung) actually provide no incentives for innovation, as in many cases these technologies only prove efficient in a longer-term economic view. Secondly, the extremely long planning and approval processes – which for a very high voltage overhead line system (380 kV / 400 kV) may result in implementation phases of up to 12 years – also act as an obstacle to investment.

ZVEI therefore welcomes the legislative initiative to accelerate the expansion of very high voltage grids and in particular the possibility of approving, in principle, innovative technologies such as HVDC and buried cables despite the higher investment costs for pilot projects. This would create an opportunity to build reference models for technologies that are not yet used in Germany. Not only would these reference models allow an in-depth examination of the intrinsic system costs and operating benefits in actual operation, they would also provide a basis for a successful export business for the German energy technology industry. Innovative technology combined with the part-cabbling of power grids also makes an important contribution to increasing public acceptance of the expansion of energy transport networks, reducing the still time-consuming construction of cable routes.

*Bottlenecks caused by the growth in cross-border energy trading can be countered with modern power electronics.*

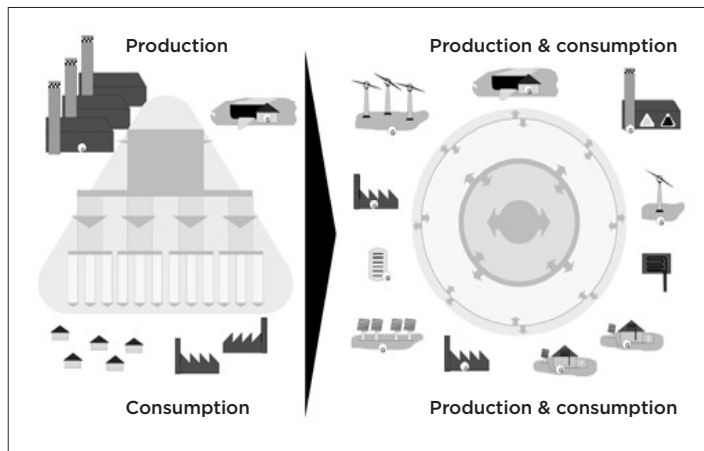
*To meet the new challenges of a liberalised market, the expansion of power grids must be encouraged with the use of technical innovations.*

### B.5.3 Distribution Networks

*An active distribution network can intelligently balance production and consumption.*

At the level of distribution networks (medium and low voltage), we are currently witnessing a paradigm shift from the simple power distribution of a passive distribution network to an active distribution network that attempts as far as possible to intelligently balance production and consumption. In the context of a virtual balancing group, decentralised energy management in the distribution network includes both typical decentralised production plants like combined heat and power plants in base load operation and fluctuating production technologies (wind / photovoltaics). The external sourcing and supply of energy from the balancing group are also taken into account.

**Paradigm shift - from a passive to an active distribution network**  
(source: Siemens)



The intelligence of a decentralised energy management system lies in the sophisticated control technology used to manage the complexity of optimised power demand and production plants that can be influenced in different ways. The objective is to avoid inefficient peaks in load and production through internal balancing in the virtual balancing group, thereby avoiding the provision of corresponding reserve power in the supply system.

One key instrument for avoiding peaks in consumption is smart metering (see below). With smart metering, consumption data is made avail-

able online so that consumers can optimise their energy consumption. The EU Directive on Energy End-Use Efficiency and Energy Services (EDL 2006/32/EC) requires billing to be carried out on the basis of actual consumption at a sufficient frequency to enable customers to control their own energy consumption.

The eEnergy study<sup>1</sup> commissioned by the German Federal Ministry of Economics clearly illustrates the energy-saving potential of smart metering among residential customers alone, with a figure of 9.5 billion kWh of electricity per year.

In order to create a suitable framework for healthy competition in nationwide use of all the technical possibilities of smart metering, political measures are required. Intelligent domestic meters are the technical basis for the use of flexible tariffs in energy provision as a precondition for efficient load control.

### B.5.4 Smart Metering - Intelligent Domestic Meters for Transparent Consumption

'Intelligent' meters are energy consumption meters fitted with a data interface. This interface can be used to transmit the current consumption values at almost any interval and make them available to the user as valuable information. In this way, intelligent meters can make a significant contribution to energy efficiency. As demonstrated in the eEnergy study, access to better information motivates people to be energy-aware, because they can see and check whether energy efficiency measures are actually having the anticipated energy-saving effect. The energy-saving potential in this area is estimated to be 5% to 10%.

This new generation of meters is also essential to flexible electricity tariffs. Currently, private end consumers pay the same price for electricity at all times, irrespective of the actual load on the grid and feed-in from renewable sources (solar and wind power). Fluctuations in load during the course of the day or in the event of varying power feed-in have to be compensated for with costly and inefficient balancing power. Flexible tariffs allow householders to reduce their consumption of high-loss balancing power by giving them an incentive to use electrical appliances like washing machines, tumble dryers and dishwashers at specific times of day.

*Intelligent electricity and gas meters give end customers the necessary transparency to be more energy-aware and energy-efficient.*

Because tariffs would be lower when energy was plentiful (for example when there are strong winds or at night) and higher during periods of high demand (midday) or when the supply of electricity is low (gentle winds), consumers would play an indirect role in controlling the power grid.

In view of the plans to use more renewable energies with fluctuating feed-in, which is not geared towards actual demand, consumers must play a more participatory role in order to ensure maximum efficiency in the integration of renewable energies. Flexible tariffs and intelligent meters as a basic technology represent a building block of the intelligent power grids of the future.

#### **Legislation to liberalise metering stimulates competition in electricity and gas**

The introduction of legislation to open up competition in the metering market is a necessary first step. However, this measure is not sufficient by itself to bring about the rapid, widespread and efficient introduction of new, intelligent meters, even though the introduction of these new meters is a declared political goal in view of the benefits outlined above.

The liberalisation of the energy market has assigned different roles to different actors. The opening up of the metering market adds an extra role, that of metering point operator or metering service provider. This calls for answers to a series of questions. The points to be ascertained include:

- Data content
- Frequency of data collection
- Open data interfaces
- Basic technical definitions
- Organisational issues (change of metering service provider)

Industry proposals for open, non-manufacturer-specific standards should be implemented as soon as possible and used for further legal or regulatory definitions. As far as possible, these definitions should be standard throughout the country instead of being drawn up by individual grid operators. Otherwise we could see a range of very different, incompatible systems that would counteract the desired liberalisation of the metering market.

*There is a need to define technical and organisational minimum standards if the new generation of meters is to be introduced economically. Intelligent meters should be introduced throughout Germany.*

The above-mentioned European requirements should be consistently implemented and a monthly electricity bill or similar consumer information should be established to create an economic incentive for introducing intelligent meters.

The current practice of yearly billing does not yet satisfy EU aspirations. This would require the introduction of intelligent meters within a reasonable implementation phase of four to six years, combined with regular information on consumption or consumption statements. Even though monthly statements would only be a first step towards improving the provision of energy consumption information, this step would satisfy the European directive, encourage the nationwide introduction of intelligent meters over the next few years, and therefore set the scene for additional ranges of information products and energy services.

The consumer benefits of using intelligent meters are as follows:

- Regular information about energy consumption means more transparency and empowers householders to be energy-efficient.
- Flexible tariffs are a fairer way of supplying energy, and a cheaper way for cost-conscious customers.
- Instead of the energy provider estimating the current data, tariff changes are calculated using real consumption data collected on key dates.
- Simplified processes make it easier to switch to a cheaper electricity provider.
- As in other areas, innovative new services will be created on the basis of modern technologies. One possible example might be energy consumption advisory services.

### B.5.5 Reactive Power Compensation

Many electrical appliances, particularly those in industrial use such as AC and three-phase motors, need active and reactive power. The active power is converted into mechanical energy, while the reactive power is needed to create and remove magnetic fields. It moves back and forth periodically between generator and load and results in system losses in the grids.

Unlike private residential customers, large industrial electricity consumers must pay not only for the active power they use but also their reactive power consumption. However, industrial customers can avoid consuming reactive power by installing a reactive power compensation system on their premises. Reactive power compensation is a well-known and trusted technology. But if electricity suppliers do not take it into account in their charges, for example for marketing reasons, there is no market incentive for industrial customers to invest in reactive power compensation. In such cases, the unnecessary transmission of reactive power with the associated system losses is often paid for by the electricity-consuming public. Reactive power compensation normally pays for itself through the reduction in system losses and the avoided reactive energy costs. It would therefore be advisable to create a suitable framework and market incentives to encourage more widespread use of reactive power compensation and therefore improve the energy efficiency, capacity and voltage quality of the grids.

### B.5.6 Combined Heat and Power

The expansion of the decentralised electricity and energy supply in the field of combined heat and power (CHP) contributes in many ways to better energy efficiency, environmental protection, and the reduction of CO<sub>2</sub> emissions. By making efficient use of primary energy, efficiency rates of up to 90% can be achieved. The fact that CHP plants are so close to the consumer makes it possible to implement tailor-made solutions and takes the burden off the general power supply grids.

CHP is of particular interest to the members of ZVEI's ESCO Forum (ESCO = Energy Service Companies). Contracting, in other words outsourcing of energy supply and transferring it to a specialist contractor, makes a significant contribution to improving energy efficiency. This

makes the fast-growing contracting sector a potential driver for the attainment of the legally prescribed goal: to double the proportion of electricity sourced from CHP. In many cases contractors are faced with a purely economic investment decision when it comes to choosing between CHP technology or non-CHP-based technology. Currently, the CHP option often fails to see the light of day for economic reasons.

#### Legal inconsistencies significantly curtail incentives to invest in CHP solutions

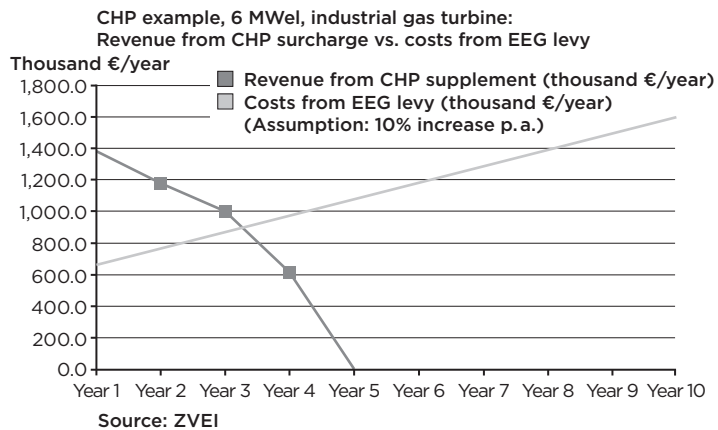
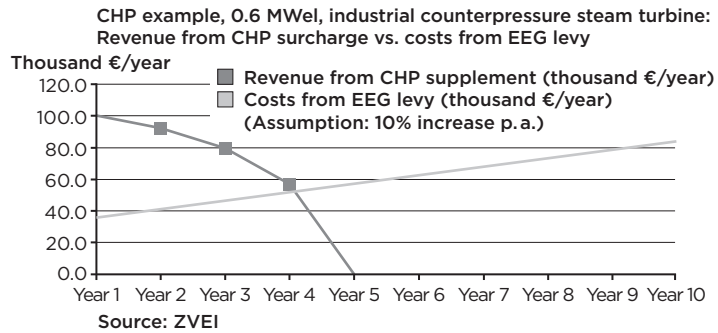
The promotion of CHP production in power plants enshrined in §4 Para 3 a of the German Combined Heat and Power Act (KWKG), which goes beyond the previous limitations of feed-in to the general supply grid, would appear in principle to be a workable approach to tapping into the potential of CHP.

However, it is largely cancelled out by the simultaneous inclusion of CHP plants in the balancing regulations of the Renewable Energies Act (EEG). These regulations nationalise the costs of the EEG requirement as part of a multi-level balancing process from the grid operator who acquires the EEG energy through the transmission grid operator to the end customer. As CHP is being actively promoted on the one hand yet made more difficult by the EEG on the other hand, there is no long-term incentive for investments in CHP as a contracting solution, as the CHP subsidy would be cancelled out after three to four years at the most by constantly rising EEG contributions. Until this inconsistency between the EEG and KWKG is resolved, contracting solutions cannot be expected to make a meaningful contribution to the attainment of the German government's CHP target.

To avoid an energy policy stalemate between the EEG and the KWKG and achieve equality of competition between contracting and self-production, energy production in contracting solutions must be given equal status with self-production. Furthermore, both forms of electricity production should be exempted from the EEG contributions system as direct or indirect forms of self-production.

*The example of the KWKG and EEG demonstrates how cannibalisation and an unfair competitive framework can jeopardise the sustainability and attainability of legally prescribed targets.*

*For a sustainable energy policy, legislative measures must be optimally coordinated with each other.*



The absorption resulting from EEG contributions means that the level of encouragement from the KWKG is limited to the yellow area rather than all of the integral below the KWKG revenue curve. The EEG charges prevail after 3 to 4 years at the most.

### B.5.7 Renewable Energies

According to the Renewable Energies Act (EEG), electricity that is produced and consumed by one and the same company is exempt from EEG contributions because it is ‘self-produced’. By contrast, electricity that is not produced and consumed by the same corporate entity but is produced by a contractor or infrastructure operator (site network operators, industrial parks etc.) especially for one or more end consumers, often

using efficient and environmentally desirable CHP technology, is subject to the EEG system of charges. In structural terms this is in fact self-produced energy – even though, for organisational reasons, it is produced in different corporate entities – but in any case not electricity from the general supply grid.

Because production takes place locally, the end consumer sources not only electricity but also process steam, heat/refrigeration and so forth, because entrusting its energy supply to a professional contractor guarantees a comprehensive high-quality energy supply. In addition, outsourcing and the subcontracting of the energy supply to a professional contractor is usually the only way in which energy efficiency investments can be made.

To establish equality of competition between contracting and self-production and allow them to compete on an equal footing while focusing on efficiency, energy production in contracting solutions should be given equal status with self-production and be exempted from EEG contributions. This would not apply to the sourcing of electricity from the public supply grid in industrial parks, contracting properties, etc., which would still be subject to EEG load balancing as it is considered general supply electricity.

### B.5.8 Contracting

Contracting is the outsourcing of energy supply tasks to an external service provider whose core business includes the reduction of energy costs, the increase of energy efficiency and the provision of optimised useful energy services. It is possible to achieve improvements in efficiency of 10%–25%, in some cases much more, compared with the performance of a power plant or other equipment when it is taken over. The market for industrial contracting in Germany is estimated to be worth €1.5 billion, with market growth rates of 10%–15% per year. The market is responding to sustained price increases for energy products, which according to the Federal Statistical Office increased by 7% between February 2007 and February 2008, making them significantly higher than the average increase of 3.8% for the producer prices of industrial products. The sustained, disproportionate increase in energy prices has prompted many companies, for whom the self-production of useful energy and media was previously part of their core business, to consider outsourcing

*To increase competition in the energy supply market, ZVEI is calling for the removal of unequal treatment of self-production and contracting in the EEG contributions systems.*

*Contracting as an external energy service is counterbalancing rising energy prices in industry and the housing industry.*

these services. There is particularly strong pressure to act in industry, an energy-intensive sector, but also among operators of commercial properties. To date, only a small proportion of the estimated theoretical market potential of around €20 billion has been exploited, as in all application areas the comparatively new and innovative service of contracting is confronted with numerous structural obstacles.

#### Political goals and the legal framework

The political framework for contracting is confusingly inconsistent. On the one hand, policymakers praise the contracting industry for its undisputed contributions to increasing energy efficiency and reflect this approval in a number of positive approaches. The European Energy End-Use Efficiency and Energy Services Directive (ESD), for example, which came into force in 2006, was intended to compel member states to remove obstacles to the expansion of the contracting industry. In October 2007 the CDU/CSU parliamentary party in Germany even proposed a new law to accelerate energy contracting. Finally, the fundamental efficiency-boosting impact of contracting is anchored in the German government's Integrated Energy and Climate Programme (IEKP).

On the other hand, current policy still perpetuates competitive disadvantages which, in many cases in industry, make handing over the energy supply to a contractor with the associated energy renovation of the plant an unattractive option. The reasons for this are inconsistencies between the Renewable Energies Act (EEG) and the Combined Heat and Power Act (KWKG), the unequal treatment of self-production and contracting solutions in the EEG and emissions trading, and an inadequate framework in the KWKG. Although minor improvements are being made, there is still no real change in the overall policy position.

#### Energy Service Companies within ZVEI – the ESCO Forum

The ESCO Forum, part of ZVEI, brings together different companies whose business models are geared towards acquiring and optimising energy supply facilities on behalf of third parties. ZVEI's key demand is equality of opportunity for self-production and energy services, which necessarily represents the basis for fair competition – because in spite of legal and political barriers, contracting is a highly dynamic business with growth rates in double figures.

In the housing industry, ZVEI has set itself the goal of resolving the so-called investor/user dilemma. This term refers to the stalemate that

*The positive political will to encourage contracting is at odds with current legal discrimination.*

*ZVEI is calling for equality between the legal framework for contracting and that for industrial and other forms of self-production.*

occurs when a landlord chooses not to use a contractor or invest in energy-efficient solutions because the costs cannot be passed on in sufficient measure to the tenant (user), who for their part would benefit from lower running energy costs. Landlords can however pass on running energy costs to tenants under the Heating Costs Ordinance. In this set of circumstances, the landlord has no incentive to be concerned with energy efficiency or contracting solutions.

This dilemma springs from the changeable case law of the German Federal Court of Justice (BGH), which since 2003 has been frequently involved with the question of whether and under what circumstances the landlord in an ongoing tenancy relationship is entitled to hand over the initially self-managed heat supply to contractors. In 2005 the BGH ruled that individual tenants must consent to the switch to supplied heat. The court modified this verdict in a decision in June 2007 for leases signed after 1989.

Statistics compiled by the chimney sweep trade and the German trade association for home, energy and environmental technology (BDH) show that only about 10% of boilers in Germany correspond to the current state of the art. According to a survey by Energie- und Umwelt-Managementberatung Pöschk, published in autumn 2007<sup>2</sup>, the annual efficiency of fully contracted heating equipment in Berlin is about 90%, making it much higher than equipment self-managed by housing companies (about 70%).

#### Profiling and promoting contracting: approaches by ZVEI

Since autumn 2007, ZVEI has been examining the legal requirements of and possible solutions to the investor/user dilemma. An initial independent report by the Institute of Energy Management Law at the University of Jena<sup>3</sup> concluded that a revision of the German Civil Code (BGB) to leverage the energy efficiency potential of heat contracting was unavoidable. Another report<sup>4</sup> came to the conclusion that, assuming a market penetration of 90%, contracting in the German housing industry could provide energy-saving potential of around €10 billion, 27 million tons of CO<sub>2</sub> and 120 billion kWh of energy by the year 2015 compared with self-production.

Greater exploitation of the available market potential would require consistent policy measures and clear sense of direction from the legislator. This is the only way in which the market conditions for contracting can be stabilised and improved in the long term. The problem that con-

*The investor/user dilemma is a major obstacle to contracting in the housing industry.*

*To obtain the maximum increase in energy efficiency from contracting, we need a clear and consistent policy framework.*

tracting as an organisational innovation is not always compatible with existing structures must not serve as a pretext for neglecting its economic and ecological potential.

#### **Contracting with the seal of quality: a voluntary commitment by ZVEI's ESCO Forum**

The members of the ESCO Forum have voluntarily committed to “Contracting with the seal of quality”, reflecting the high quality standards of the industry which ZVEI represents. Contracting is the skilled management of complex processes and optimisation strategies with inherent value creation, where operational responsibility is often borne by the contractor. In the spirit of a network of experts, the members of ZVEI's ESCO Forum have committed to undertake a voluntary self-categorisation into defined service levels for their service offerings. This commitment gives potential customers a starting point from which to assess competitors on the market in terms of competency and performance.

*By launching the “Contracting with the seal of quality” initiative, ZVEI is setting standards for the industry in an environment in need of structuring.*

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## B.6 Initiatives of ZVEI

Energy efficiency is a top priority for ZVEI and all the companies it represents. The electrical and electronic industry offers a wide range of energy-efficient technologies that enable wide-scale intelligent energy-savings. ZVEI estimates that through the consistent use of these technologies it would be possible to save 60 billion kWh per year. To respond to the serious lack of information among professional decision-makers and end consumers and the fact that technology has not so far been included in the political and public debate on energy-saving, ZVEI launched the *Initiative für Energie-Intelligenz - EnQ* (Initiative for Being Smart about Energy – EnQ). The campaign kick-off was held at the Hannover Messe in April 2008. The key media that form part of this initiative are outlined below.

ZVEI has also put forward a series of concrete proposals for the use of energy-intelligent technologies in Europe through ELECTRA, in an attempt to take the general approach of EnQ to European level.

### EnQ magazine

There are many different approaches and potential solutions for using energy more efficiently. At the same time, various studies and surveys repeatedly come to the conclusion that, now as in the past, neither businesses nor private householders know much about energy-efficient technologies. One reason for this is the fact that the debate surrounding energy efficiency and climate protection concentrates almost exclusively on the various energy sources, such as oil, gas and wind power, and therefore has too narrow a focus. The aim of the initiative, and the purpose of EnQ magazine, is to stimulate the demand held back by the lack of focus on the modern technologies offered by the electrical and electronic industry.



*EnQ magazine focuses exclusively and uniquely on the whole range of intelligent and energy-efficient technologies.*

*It is important for people to be able to get involved with the initiative on the intelligent use of energy. EnQ magazine is the ideal platform for this.*

*All energy-intelligent technologies are clearly explained at [www.en-q.de](http://www.en-q.de).*

*A journalistic, attractively presented look at energy efficiency.*

The quarterly publication *EnQ* –, the periodical published for this initiative, is aimed at decision-makers in business and politics, but also private end consumers. In launching the magazine, ZVEI has created a format that puts the issue of energy efficiency in the spotlight in a way never attempted before. The professionally written and attractively designed magazine covers the whole range of intelligent and energy-efficient technologies.

*Raising awareness of energy efficiency and highlighting solutions*

The editorial team's aim is to make consumers more aware of energy efficiency issues while offering appropriate solutions for the responsible use of resources. In this spirit, *EnQ* magazine presents new technological developments and interesting management approaches, introduces leading figures in industry, quizzes decision-makers in the political debate and highlights case studies, solutions and products. The key message of every issue is that consciously using energy-intelligent and energy-efficient technologies saves energy without reducing quality or comfort.

But *EnQ* magazine is also a platform for ZVEI members, which they can use to present their latest developments to their target audiences in a practical context. This makes it an excellent example of how the initiative on the intelligent use of energy allows people to get involved.

#### **www.en-q.de**

The Initiative for Being Smart about Energy - *EnQ* has an online platform. As one of the key media of *EnQ*, the website [www.en-q.de](http://www.en-q.de) is accessible to a large target audience. The site provides professional decision-makers from business and politics, end consumers and interested members of the public with a wide range of information on the huge energy-saving potential of at least 60 billion kWh per year.

*On a virtual journey of discovery with EnQ*

The site takes the visitor on a trip to a virtual city, where they can learn about numerous different ways of saving energy and optimising energy use in the home, public buildings and industry. Visitors can take a journey of discovery in a typical example of each scenario: a private home, a public facility and an industrial plant. By clicking on selected energy consumers scattered around the different locations, it is possible to view clear explanations of the energy-saving potential in particular areas. Be

it lighting, electric home heating, drive systems or domestic appliances, the site contains a brief summary of the current situation before showing the scope of the potential savings and the technologies available to achieve them.

This fun, interactive approach to the important issue of energy efficiency helps to drive home the key message of *EnQ*: that consciously using energy-efficient technologies saves energy without imposing any personal limitations.

But the *EnQ* website is not limited to highlighting the possibilities of modern electrical engineering. It also aims to dispel the widely held belief that these technologies are expensive and would not give a good economic return. On the contrary, all these technologies pay for themselves quickly because of the significant reduction in running energy costs, even taking the sometimes higher procurement costs into account. So illustrating the cost benefits of being energy-intelligent is an important part of the information provided in all areas of [www.en-q.de](http://www.en-q.de).

*The EnQ test: how much do you know about intelligent energy use*

After taking the journey of discovery visitors have the chance to evaluate their knowledge of intelligent energy use in the *EnQ* test, and print out the results in a certificate. The test consists of 11 questions covering different topics. The results indicate whether an individual is familiar with the many possibilities of energy-intelligent consumption or whether there are any gaps in knowledge that still need to be filled. Rather than appearing like a school lesson, the questions are designed to present energy-saving in an entertaining and surprising way.



*The potential cost benefits are highlighted in addition to the energy-saving potential of the technologies.*

*ELECTRA sets out concrete proposals for the use of energy-intelligent technologies in Europe.*

### **ELECTRA**

ELECTRA is ZVEI's European agenda for fostering growth, innovation and competitiveness in the electrical and electronic industry. It was jointly drawn up by the industry and the European Commission. In June 2008, they presented their "20 solutions for growth and investment to 2020 and beyond". The policy recommendations cover three areas:

- Energy efficiency and CO<sub>2</sub> reduction as drivers of innovation, concentrating on the technologies and innovations produced by the industry that contribute to energy efficiency;
- How to generate more growth in key European electrical engineering sectors by building high-tech infrastructures across Europe: this includes a review of the potential future lead customer markets for the industry;
- The internal and export markets of the industry, looking at the challenges in the area of the framework conditions in the EU, as well as in the area of regulation and standards on the internal market and on export markets and policy.



ELECTRA shows that the largest area of profitable CO<sub>2</sub>-reduction potential is found in buildings (commercial, industrial, residential), industry, transport and energy generation, transmission and distribution. Policy recommendations are targeted at both member states and the EU:

- The EU should refocus its policies more on developing growth and jobs through its programme for CO<sub>2</sub> reduction, including developing incentive schemes and policies other than the Emission Trading Schemes (ETS) to mobilise economically attractive investment potential in the defined sectors;
- To foster the perception that energy efficiency must be tackled everywhere, a massive information and education campaign aiming at raising the general awareness of all actors – architects, contractors, and the general public – must be launched;
- Regulation must continue to support energy efficiency: in buildings and homes, to include the active energy part, and in products and systems by progressively introducing appropriate minimum energy efficiency requirements which evolve over time.

ELECTRA is the most recent of the European Commission's sectoral policy dialogues with industry based upon its 2005 Communication "Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – towards a more integrated approach for industrial policy".

The full ELECTRA Report with all 20 recommendations can be found at: [http://www.europa.eu/enterprise/electr\\_equipment/electra.htm](http://www.europa.eu/enterprise/electr_equipment/electra.htm)

## **C The Framework for the Intelligent Use of Energy: Market and Legislation**

## C.1 Market Mechanism and Climate Protection

*Without government intervention, the market mechanism is unable to provide climate protection.*

The electrical and electronic industry fully supports the German government's efforts to tackle climate change. It has made enormous investments in recent years to significantly increase the range of available energy-efficient technologies. The fact that demand is still lower than supply, and therefore in need of impetus, is primarily due to market failure. To change this situation would require government intervention. Below, we attempt to explain why the market mechanism fails in more than one respect where climate protection is concerned.

*The market fails if firms or consumers have an information deficit and therefore make distorted decisions.*

### Information problems

A functioning market mechanism requires that market participants have access to all the information of relevance to their economic decisions. Only then can market players adequately evaluate their investment and consumption decisions and assess their consequences. If on the other hand firms or consumers have an information deficit, they will make distorted decisions. As a result, the market fails.

*McKinsey demonstrates that simply implementing economically profitable investments in energy efficiency could save 130 megatons of CO<sub>2</sub> a year by 2020.*

In the case of climate-friendly technologies, the lack of information is a significant problem. Without adequate information, businesses and consumers fail to invest in or acquire energy-efficient products in spite of the fact that they make good economic sense. Numerous recent studies provide evidence of this dilemma, particularly the climate study<sup>1</sup> carried out by McKinsey & Company on behalf of the Federation of German Industries (BDI), entitled "Costs and potentials of avoiding greenhouse gas emissions in Germany", the initiators of which include ZVEI. According to this study, Germany could reduce its greenhouse gas emissions annually by around 130 megatons by the year 2020, simply by implementing those energy efficiency measures which make good economic sense for the respective decision-makers.

### Government and industry called on to improve transparency

More transparency in relation to energy-saving and climate-friendly technologies which are also economically beneficial would remedy the problem of information deficits and therefore leverage considerable CO<sub>2</sub> reduction potential. This calls for government and industry action equally.

The customer information, press relations, public relations, communication and marketing measures provided by industry need to be accompanied by public-financed advice or mandatory labelling.

Example: If a company wants to buy an electric motor, for example to install it in an industrial pump system, the main criterion at present is a low procurement price. In many cases the reduction in life-cycle or operating costs that can be achieved with the new motor, which often amount to many times the purchase price, are not taken into account in the economic calculus (return on investment). This is often due to the fact that the buyer is not responsible for controlling these costs. In the case of electrical drives, however, energy costs often account for more than 90% of the total life-cycle costs.

### Externalities or the environment as a public good

Externalities are another reason for market failure. Externalities occur when businesses or consumers make microeconomic decisions without taking into account the impact of these decisions on third parties or the economy in general. This impact may be positive or negative. The decisive factor is that, in either case, it is not fully reflected in the price mechanism, which generally leads to poor decisions.

An extreme example of (positive) externalities is public goods which can be consumed by several or all market participants at the same time (non-rival consumption). The market mechanism fails in the provision of public goods because of the problem of "free riding". Few people would voluntarily make a financial contribution to the provision of public goods because nobody can be excluded from using them – which, by the way, would not make economic sense.

The climate has many of the key characteristics of a public good. Consequently, there are strong externalities in the area of climate protection. The effects of economic activity on the environment, be they positive or negative, are not taken into sufficient account in microeconomic decisions. Climate protection is certainly in the interest of all market participants, but individual economic players have little incentive to take the initiative, preferring instead to wait for others to act, while these others remain inactive for the same reason.

*Effective climate protection usually fails because of strong externalities.*

### Public measures to internalise externalities

One direct consequence of this problem is that neither companies nor consumers will generate an economically desirable, i.e. effective, level of demand for climate-friendly and energy-saving products. The policy objective must therefore be to internalise externalities in order to bring both microeconomic and macroeconomic interests into harmony with one another. There are various instruments and measures available to achieve this internalisation (see table in appendix), for example the government leading by example in public procurement, voluntary commitments, the trading of emissions rights, environmental taxes and subsidies, and imperatives and prohibitions in environmental policy. These instruments must be distinguished according to their level of market compliance, i.e. their fundamental compatibility with the market and price mechanism.

One of the primary tasks of the government is to create the right incentives to encourage companies and consumers to consider the impact of their investment and consumption decisions on the climate as a public good. Effective incentives are a way to achieve the necessary impetus to remedy market failure. By assigning a time limit to government regulation and thereafter continuously reducing the scope of the measures taken, the government could gradually withdraw from the market once the internalisation of externalities is assured. An approach of this type would also prevent windfall profits – i.e. economic players taking advantage of incentives as a reward for actions they would have taken anyway.

Example: A consumer buying a new refrigerator, when choosing which appliance to buy, does not take into account the positive impact on the climate of replacing his old appliance with a new, more climate-friendly appliance of energy efficiency class A++ and therefore the overall impact on the economy. In other words, the new appliance would be of more value to the economy as a whole than to the individual consumer. To internalise the (in this case positive) externality, the consumer needs the right incentive to buy the energy-efficient product. A public subsidy (ideally reflecting the difference between the macroeconomic and microeconomic value of the A++ refrigerator) could provide this incentive.

*Effective incentives are needed to remedy market failure.*

### Capital market imperfections

If we were dealing with a perfect, unflawed capital market, it would be possible to finance all economically profitable investment projects even taking account of the specific associated risks. However, the reality is different. Worthwhile investments are failing at the financial hurdle because of numerous imperfections on the capital market. This has the same ramifications as the market failure described above. One reason for these imperfections is, yet again, a lack of information, as potential investors cannot fully assess the risks of parties requesting credit and therefore decline to provide the necessary cash resources.

*Because of imperfections on the capital market, it is difficult to find finance for worthwhile investments.*

### Corporate survey by Kreditanstalt für Wiederaufbau on energy efficiency barriers and successes in business

The problem of capital market failure has a particular impact on investments in climate-friendly products and systems. This was the conclusion reached by a corporate survey carried out in December 2005 by Kreditanstalt für Wiederaufbau (KfW) on the barriers to and success factors for energy efficiency in business<sup>2</sup>. The survey addressed the issue of why investments in energy-efficient and climate-friendly projects are not being financed, when they would actually offer a good return – not only in macroeconomic terms but in microeconomic terms as well. The following two main obstacles were identified:

- There is a lack of resources for project implementation; in particular there are no banks or other investors prepared to provide these resources.
- Companies must choose between several investment alternatives, all of which are profitable. When it comes to the actual decision, energy-efficiency projects tend to fall by the wayside because of a lack of financing opportunities.

The capital market failure described above could be remedied firstly by addressing the lack of information. This would help investors providing credit for energy efficiency measures. Secondly, government subsidised loans for investments in environment- and climate-friendly systems and projects would contribute to remedying market failure.

*Investments in energy efficiency measures should be calculated by the net present value method.*

**Miscalculation of energy efficiency measures**

Capital market shortcomings in the broadest sense also occur when investment projects for energy efficiency measures are not evaluated by the net present value method, but by the amortisation period method. As the example below illustrates, this can result in poor decisions, particularly if the cash flow gained through the investment does not materialise for a number of years. This situation could be redressed by a government-financed programme of awareness-raising in investment and finance calculations.

Example: Let us assume that an investment requiring a procurement pay-out of €100 000 today will generate annual payments of €20 000 over the total duration of 10 years. If we apply a required rate of return of 10%, the project will have an earning power of around €123 000. Taking into account the initial outlay of €100 000, we end up with a positive net present value of €23 000. Therefore, the investment is profitable. However, if the (interest-bearing) initial pay-out is required to amortise within five years, the project will fall at the hurdle of the evaluation.

**Summary**

Left to its own devices, the market mechanism is incapable of guaranteeing effective climate protection. Government intervention is necessary, because the market is failing in several respects: in the provision of information, in the correction of externalities, and in the financing of climate protection measures.

Ultimately, effective climate protection requires a high level of energy efficiency. With its wide range of energy-saving cross-application technologies, products, systems and services, the electrical and electronic industry can make a huge contribution to improving energy efficiency in a manner that encourages growth while keeping costs under control. But because of the market failure described above, there is a need for public support in order for these technologies, products, systems and services to be put to actual use.

The table in the appendix presents a clear overview of the various forms of market failure in the area of environmental and climate protection and summarises the key instruments for resolving the problem.

*The high level of energy efficiency required for effective climate protection cannot be achieved in a free market left to its own devices.*

**Measures to internalise externalities**

Problem (form of market failure)	Instruments to solve the problem
<p><b>(1) Information deficit</b> In particular: failure to purchase energy-efficient products even though these would pay for themselves economically, even in microeconomic terms.</p>	<p><b>Increase transparency by means of</b></p> <ul style="list-style-type: none"> <li>customer training</li> <li>press and public relations, marketing measures, communication</li> <li>labelling: voluntary (private) and mandatory (public)</li> <li>public financed advisory service</li> </ul>
<p><b>(2) Externalities or the environment as a public good</b> In particular: the effects of economic activity on the environment, be they positive or negative, are not sufficiently taken into account in microeconomic decisions.</p>	<p><b>Internalise externalities by means of</b></p> <ul style="list-style-type: none"> <li>the government leading by example</li> <li>public procurement/public expenditure</li> <li>voluntary commitments or non-mandatory standards</li> <li>market instruments</li> <li>emissions and certificate trading</li> <li>positive or negative incentives</li> <li>taxes</li> <li>subsidies</li> <li>cash-back programmes</li> <li>cost increase programmes/intermediate bodies between the public and private sectors fulfilling a public mandate (e.g. EEG contributions)</li> <li>imperatives and prohibitions</li> <li>mandatory standards</li> <li>legal requirements, product bans</li> <li>binding standards</li> <li>top runner approach</li> <li>minimum efficiency requirements</li> </ul> <p>(Measures are listed in order of their degree of compliance with the market mechanism.)</p>
<p><b>(3) Capital market imperfections</b> In particular: the necessary financial resources cannot be obtained externally.</p>	<p><b>Provision of information for investors and publicly finance aids</b></p> <ul style="list-style-type: none"> <li>Subsidised loans</li> <li>Discounted loans</li> </ul>

**Sources**

- McKinsey & Company: *Kosten und Potenziale der Vermeidung von Treibhausgasemissionen in Deutschland, September 2007.*
- KfW survey on barriers to and success factors of energy efficiency in business, December 2005.

## C.2 Evaluation of Selected Implementation Measures for the German Federal Government's Integrated Energy and Climate Programme

On 5 December 2007 the German government enacted the Integrated Energy and Climate Programme (IEKP), which is intended to set standards in global climate protection policy. The programme consists of 29 measures, which echo the government's orientation decision made at the cabinet meeting in Meseberg in August 2007. From the point of view of the electrical and electronic industry, the implementation measures in place thus far can be appraised as follows.

### Electrical drives

The enormous energy-saving potential in industrial drive technology is to be exploited at corporate level with the assistance of independent, qualified energy efficiency consultants. As part of the Federal Ministry of Economics and Technology/Kreditanstalt für Wiederaufbau programme "Special fund for energy efficiency in small and medium-sized enterprises (SMEs)", subsidies are to be paid for highly efficient drive systems. Since February 2008, energy advice has been subsidised by up to 80% of the energy consultancy fee and low-interest investment loans have been available for energy-saving measures such as energy-saving motors and frequency converters.

### Public tendering

In future, public procurement and the energy renovation of federal buildings and the social infrastructure are to be based on the life-cycle cost principle. This was laid down in the administrative regulation on the procurement of energy-efficient products and services at federal level, passed in early 2008. As a result, energy-efficient products and services will be in a stronger position to compete on equal terms on the market as the focus will now be on operating costs instead of just the initial purchase price. The technologies mentioned as examples in the administrative regulation are energy-saving lamps and energy-efficient electronic appliances.

*Advice on energy efficiency is largely subsidised by the Federal Ministry of Economics and Technology/Kreditanstalt für Wiederaufbau programme "Special fund for energy efficiency in SMEs".*

*In future the life-cycle costs of purchased products and services are to be taken into account in public tendering and procurement.*

### Market launch programmes

There are also plans to introduce market launch programmes for very high-efficiency appliances or 'top runners', with the aim of encouraging faster uptake of these products. This is the ideal platform for the time-limited cash-back programme proposed by ZVEI to promote the use of A++ refrigerators and freezers.

To increase the market penetration of high-efficiency appliances, current energy consumption labelling needs to be updated and more widely used at EU level. To make the labelling system flexible enough to allow for future technological advances, ZVEI suggests keeping the principle of different categories but having no upper limit. Specifically, there would still be seven categories but they would be given numbers instead of letters. The lowest category would be given the number 1 (low energy efficiency) and the highest category number 7 (high energy efficiency). Higher categories could be introduced if necessary without altering the classification of products already on the market. The German government is in favour of the urgent revision of the labelling system, and is also discussing the ZVEI proposal outlined above.

### Expansion of very high voltage grids

The draft bill passed by the German cabinet in June 2008 for the acceleration of the expansion of very high voltage grids describes in detail the considerable challenges facing power grids over the coming years (the requirements of cross-border energy trading and the integration of renewable energies, in this case, particularly offshore wind capacities). The long-term redevelopment of the power grids will require investments in innovative technologies, which in principle are supported by the draft bill. The intention is to simplify the approval processes for expanding the grid and to increase public acceptance by laying underground cables instead of overhead lines. The bill takes account of technology neutrality, after the abandonment of the original intention to exclude cable solutions. However, finding a solution to Germany's innovation deadlock and the development of 'smart grids' in line with incentive requirements to work towards an efficient energy supply system will remain a key task of industry associations.

*ZVEI is proposing the modernisation of the classification system used for energy consumption labels.*

*The intelligent expansion of very high voltage grids is being accelerated by legislation.*

*The effective utilisation of potential in heat contracting requires a revision of tenancy law and equality with the self-production of energy in industry.*

### Heat contracting

In the field of heat contracting, the ESCO Forum within ZVEI has drawn up a set of concrete proposals for the necessary adaptation of tenancy law based on two reports (a legal report and a potential study) by the Institute of Energy Management Law at the University of Jena<sup>1</sup>. These proposed changes are intended to protect the option of allocating heat contracting costs and to enable energy-saving potential to be exploited. However, no action has been taken at political level with respect to the revision of tenancy law, which could help to resolve the investor/user dilemma. The call to put energy contracting on an equal footing with self-production in industry was not taken into consideration in the Renewable Energies Act (EEG). This continues to act as a deterrent to the development of an energy-efficient contracting industry.

*Industrial self-production has been put on an equal legal footing with feed-in to the public grid.*

### Industrial self-production

The draft amendment to the Combined Heat and Power Act (KWKG) was originally to contain a greater degression of 0.2 cents/kWh in overhead cost rates for the self-production of “industrial power”. This would have put self-production at a disadvantage compared with feed-in to the public grid and further reduced the incentives to invest in combined heat and power. However, the proposal of ZVEI’s ESCO Forum in favour of equal treatment for industrial self-production and feed-in to the public grid was realised in the KWKG, passed in July 2008. Contractors will benefit from the increase in the number of funded full-use hours from 20 000 to 30 000.

*The otherwise laudable legal measures to promote intelligent domestic meters and the introduction of flexible electricity tariffs are not sufficiently exact or binding.*

### Smart metering

In the field of smart metering, a new law has been passed to open up the market for gas and electricity metering. The aim of the new law is to encourage the use of new, intelligent domestic meters with a communication interface and thus also the introduction of flexible electricity tariffs. The metering liberalisation law and the draft ordinance based on it, passed by the federal government in June 2008 and enacting the regulation of gas and electricity metering equipment, can be considered a step in the right direction. Energy suppliers are now required to offer load-based electricity tariffs and additional information and services, such as monthly electricity bills. The decisions made thus far will not result in the attainment of the government’s original target of nationwide introduction of new metering technology within six years. New meters will

only become obligatory for new installations or at the request of the end customer, and not until 2011. There is also no obligation to standardise communication interfaces.

### Night storage heating

The draft amendment to the Ordinance on Energy-Saving (EnEV 2009) passed by the German cabinet in June 2008 will provide for the gradual elimination of night storage heating systems. However, the obligation to remove these systems from service will not apply until 2020 and then only for buildings with more than five apartments. On the positive side, however, only products that are 30 years old or more will be subject to this requirement. At the same time, these products need not be replaced if this would be uneconomical.

*Night storage heating systems over 30 years old must be taken out of service.*

### Heat pumps

The promotion of heat pumps is embraced in the government’s Integrated Energy and Climate Programme and was implemented in December 2007 through the Guideline on Promoting Measures for the Use of Renewable Energies in the Heat Sector. It is possible, however, that the evidence for the technical requirements set out in the guideline (annual operating figures for heat pumps) might preclude a large number of already available heat pumps from being subsidised.

*Subsidies for heat pumps are linked to stringent requirements to provide supporting evidence.*

### Sources

- 1 Report: “Rechtliche Voraussetzungen einer Steigerung der Energieeffizienz durch Wärmecontracting in der Wohnungswirtschaft als Beitrag zu Energiesicherheit und Klimaschutz”; Dr. Dietrich Beyer, Prof. Dr. Michael Lippert, Institute of Energy Management Law at Friedrich-Schiller-Universität Jena, October 2007.

## C.3 Energy Intelligence as a Global Challenge

Rising energy prices around the globe have intensified the need to use energy-saving technologies. The combination of efficient energy generation, transmission and distribution enables savings not only in terms of energy costs but also in terms of CO<sub>2</sub> emissions. This is particularly beneficial to emerging and developing countries because a reliable energy infrastructure is an essential precondition for building a competitive economy. It would also allow these countries to make a crucial contribution to achieving international climate protection targets.

The very different situations in which the various countries find themselves, be they industrialised, emerging or developing countries, require very different solutions. It follows that there cannot be one single energy policy that applies to the whole world, only a regulatory framework for more energy-efficient global economic activity. While a country building a number of new power plants could significantly increase energy efficiency – often cheaply – in energy generation, countries like Germany, where few new power plants are being built, can approach the problem from the consumption side.

In emerging and developing countries the main efficiency potential is to be found in renewable energy generation, energy transmission and distribution, industrial processes, lighting in private homes and public buildings, building and installation technology, and the transport infrastructure. There is also considerable potential in the consumer goods sector, in the replacement of old appliances.

Energy-intelligent technologies improve sustainable energy generation. The efficient use of renewable energies, which are usually generated in regions remote from densely populated areas, can only be assured by minimising transmission losses and compensating for fluctuations on the grid. In developing and emerging nations in particular, there are often high losses in the transmission and distribution of power. Here the use of renewable energies must be combined with an efficient, intelligent power grid. In many developing countries, the upgrading or optimisation of power grids and the introduction of energy management systems are essential in order to achieve secure energy supplies and therefore help tackle climate change, because of the associated increase in energy efficiency.

*In many developing countries, upgrading or optimising the power transmission grids is essential if renewable energies are to be utilised efficiently.*

### What contribution can Germany make to increase global energy efficiency?

Energy efficiency is not only a global necessity, but globally feasible. As a supplier of cross-application technologies, the electrical engineering industry has a wide range of solutions to offer. The overall aim must be to raise the market profile of German technologies abroad, and this can only be achieved by merging the international activities of German departments and organisations. The German government's Energy Efficiency Export Initiative is already making a key contribution in this respect.

One basic precondition is, firstly, that emerging and developing countries create the appropriate legal framework for sustainable energy generation and intelligent energy transmission and distribution. In the second stage, incentives could then be created to achieve an optimum ratio of energy input to economic output. Germany can contribute to this by participating in international committees and bilateral working groups.

One essential ingredient for encouraging the use of energy-efficient technologies in developing and emerging nations is the inclusion of the twin issues of energy and energy efficiency in development-related activities. To this end, it is necessary to adapt the requirements for the country programmes of the German Federal Ministry for Economic Cooperation and Development (BMZ) and the implementing organisations to incorporate energy efficiency as the Ministry maintains a dialogue with the recipient country, which often still has to establish the right framework conditions for the efficient transmission and distribution of energy. In addition, the use of energy-efficient technologies can be specifically defined in tendering processes.

Germany can support other countries primarily by providing expertise and policy advice, but could also act as a lender. The industry can provide both the necessary know-how and equipment. German technologies are among the best in the world and could make a vital contribution to the efficient and intelligent use of energy.

*Raising the profile of German technologies abroad through the Energy Efficiency Export Initiative and including energy efficiency issues in development cooperation are key steps towards more efficient energy use abroad.*

## C.4 Eco-design Directive and German Energy-using Products Act

By introducing the Directive on the Eco-design of Energy-using Products (also referred to as the EuP directive), the European Commission has defined new energy efficiency standards for products. This directive establishes a new framework for advancing the integration of environmental considerations into the development and design of energy-using products and improving the negative environmental impact of these appliances.

### Elements of the Eco-design directive

The EuP directive has been in force since 2005, and must be implemented by all member states in line with the concept of a uniform EU single market. The directive has such a wide field of application that it covers all energy-using products, regardless of energy form, apart from means of transport. In this respect it reflects the European Commission's "New Approach", which aims to achieve the following:

- Only products that satisfy the basic requirements can go into circulation.
- The free movement of compliant products must not be hampered.
- If a product complies with the relevant harmonised standards, it is assumed that it meets the basic requirements.
- The application of the harmonised standards is voluntary. Manufacturers may resort to other solutions if they can demonstrate that these offer the same level of safety.
- Compliance with the basic requirements is verified in a formal compliance evaluation process. As much of this process as possible is entrusted to the manufacturer, depending on the potential risk of the products.

In Germany, the EuP directive was implemented by the Energy-using Products Act (EBPG) of 6 March 2008. The EBPG came into force on 7 March 2008.

### Implementation measures

The European Commission is defining product-specific eco-design requirements for certain products and product groups in a set of implementation measures. These may include requirements relating to qualitative and quantitative descriptions of key environmental considerations. To prepare for the enactment of the implementation measures, in spring 2006 the Commission initiated preliminary studies for 13 product groups and one cross-application aspect. Since then, six other product groups have been added. The Commission started defining product-specific design requirements such as limit values for energy and resource consumption in the second half of 2008.

### Preparatory studies

The European Commission has initiated the first preparatory studies for a number of product groups. The purpose of these studies is to develop a basic framework for appropriate implementation measures. The data collection and evaluation studies will be carried out according to a standard procedure, based on an underlying methodology study.

### Consultation forum

The results of the preparatory studies are being discussed in a consultation forum and initial draft versions of the implementation measures put forward. The wide spectrum of stakeholders represented in this forum can influence the decision-making process in the implementation of the EuP directive, and helps to create wider acceptance of it. The consultation forum also assesses self-regulation measures, reviews the effectiveness of market surveillance, and discusses and develops the work programme.

### Regulatory committee

The regulatory committee is made up of delegates from each member state and representatives from the European Commission, which presides over the committee. The committee advises the Commission on the definition of the work programme and submits opinions on the draft implementation measures. On 7 July 2008 the regulatory committee approved the Commission's first new proposal for an implementation measure for the reduction of stand-by and off-mode losses in electrical appliances.

*The European Commission is defining product-specific eco-design requirements for certain products and product groups.*

*The regulatory committee reaches decisions on the implementation measures proposed by the European Commission.*

**Work programme**

The EuP directive only sets out framework conditions for the range of products and product groups to be addressed. The European Commission is specifying these product groups in a work programme after hearing the consultation forum and in coordination with the regulatory committee. A new work programme is defined every three years. In the first work programme the Commission named 18 product groups and one cross-application topic for further evaluation, and initiated corresponding preliminary studies for the preparation of implementation measures. A work programme for the period 2009 –2011 is currently in preparation.

**Sources**

- 1 *Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.*

## C.5 Standards

As the debate surrounding the climate protection targets of the European Union and its member states intensifies and energy efficiency becomes more widespread, new challenges are emerging for standardisation. While environmental considerations and efforts to reduce energy consumption have been playing a role in the design of business processes for quite some time, on account of widespread implementation of the management system standard ISO 14001 Environmental Management Standard, these considerations are not yet incorporated in product standards.

### Technical regulations and standardisation

The application of standards is essentially voluntary. However, the New Approach introduced in Europe has established a mechanism whereby legal product requirements and standards are closely interlinked. In the New Approach, the EU sets out product requirements that must be satisfied but does not specify how this should be achieved in technical terms. Manufacturers have the freedom to choose their preferred technical solution but can also follow EU-specified standards (harmonised standards). If these standards are met, the EU assumes that the product meets the necessary requirements (presumption of conformity).

Experience shows that standardisation leads to faster, more practical and much more flexible solutions than can be achieved with European legislation. Industry should therefore endorse the use of this principle for the implementation measures of the Directive for the Eco-design of Energy-using Products (see C.4). General and specific energy efficiency requirements in implementation measures should define targets to be met and not particular design principles or technical solutions. To provide evidence of compliance with these requirements, standards on suitable measuring procedures should be used. The relevant standards should be based on corresponding international standards. Energy efficiency considerations would then be taken into account across a wide range of products in product standardisation.

### Standardisation

The aim of standardisation must be to create a consistent set of standards (generic, product family and product standards) among European and international standardisation bodies. No requirements of conformity assessment should be permitted in the standards. Existing standards,

for example standards relating to energy efficiency labelling, should be reviewed to make sure they comply with the structure described above and the relevant aspects of the New Approach, particularly with regard to their applicability in conformity assessment. Existing, deviating standards must be adapted to the harmonised body of laws and standards.

### Conformity assessment and management system standards

The Energy-using Products Directive 2005/32/EC (EuP directive) specifies internal design monitoring or the introduction of a management system as a means of furnishing evidence of compliance with requirements. Generally speaking, preference should be given to the use of internal production monitoring on the part of the manufacturer without involving third parties. In accordance with the EuP directive, other procedures with the mandatory involvement of third parties should only be used in individual cases where special reasons are stated. This option should only be used as a last resort. Innovative product development is urgently needed in the field of energy efficiency. For this reason, there is no additional benefit given the manufacturer's particular technical expertise if third parties are involved.

To provide evidence of compliance by means of a management system, the EuP directive states that an organisation already registered in the Community system for the Eco-Management and Audit Scheme (EMAS) for design activities fulfils the management system requirements. At the same time, a management system standard published as a harmonised standard provides a basis for presumption of conformity. Most companies have already implemented requirements from various management system standards. This applies particularly to ISO 9001 Quality Management and ISO 14001 Environmental Management, the most widespread international standards. Meanwhile, companies are faced with a whole range of additional management system standards. In the electrical and electronic industry, the average company applies five management system standards to its business processes. Of these virtually all companies have introduced ISO 9001 and ISO 14001.

This situation should be taken into consideration in the publication of harmonised standards. The most important aspects are already covered by existing management system standards, which have already been introduced into businesses. Creating more standards will not lead to more energy-efficient product design – the parameters for this should be de-

*Internal production monitoring without the involvement of third parties is the most suitable method for providing evidence of compliance with requirements.*

*The widespread establishment of management system standards in most companies allows for practical conformity assessment.*

*The freedom given to manufacturers to choose how they achieve compliance with the product requirements, enshrined in the New Approach, is a very positive development and enables the technical standardisation process to evolve freely.*

*Rather than encouraging energy-efficient product design, the creation of more management system standards usually only results in excessive costs for the company.*

*To get round the problem of limited resources for market surveillance, use should be made of the existing institutional and technical infrastructure.*

*The considerable efforts that companies must invest in implementing legal requirements must be compensated for with effective market surveillance.*

defined in product standards – but rather to additional, unjustified costs for companies. To ensure presumption of conformity, therefore, use should be made of the standards that companies have already introduced, with mention of the fact that design activities are covered by the management system and that energy management is part of this same system.

#### **Market surveillance**

The new requirements for the energy efficiency of products are adding to the activities of market surveillance bodies.

Neither voluntary labelling based on third-party inspection nor labelling based on a manufacturer's declaration are proof against misuse or falsification. Whenever the government legally codifies requirements it is also obliged to ensure compliance with the law, and this applies equally to energy efficiency requirements. Notwithstanding the reference to standards, general and specific requirements should be formulated in such a way that market surveillance bodies can evaluate the conformity of a product directly using the corresponding implementation measure, as described in article 15, paragraph 7 of the EuP directive.

There are often complaints about shortcomings in the market surveillance system, which are due to insufficient resources. In terms of the official allocation of market surveillance in the EuP directive, given the limited resources for this public responsibility, use should be made of the existing institutional and technical infrastructure. Market surveillance as defined in the EuP directive should therefore be implemented by trade inspectorates.

Fair market conditions can only be assured if there is purposeful market surveillance. Companies invest a significant proportion of manufacturing costs in the implementation of legal requirements, and also considerable efforts in incorporating legal requirements in product standardisation. The requirements of the EuP directive will demand considerable efforts in product development for manufacturers. Market surveillance must protect their products against less reputable manufacturers and at the same time, everybody must enjoy the same competitive opportunities.

