



PowerSwitch!

The Energy Efficiency

Challenge

Achieving higher energy efficiency in the EU

Increasing energy efficiency is a cost-effective, even profitable way of reducing greenhouse gas emissions.

Lack of efficiency means a real waste of resources and money. Efficiency could easily be improved without reducing living standards. But policy makers have neglected its huge potential.

The Energy Efficiency Challenge would establish efficiency at the heart of the European Union energy and climate policy.

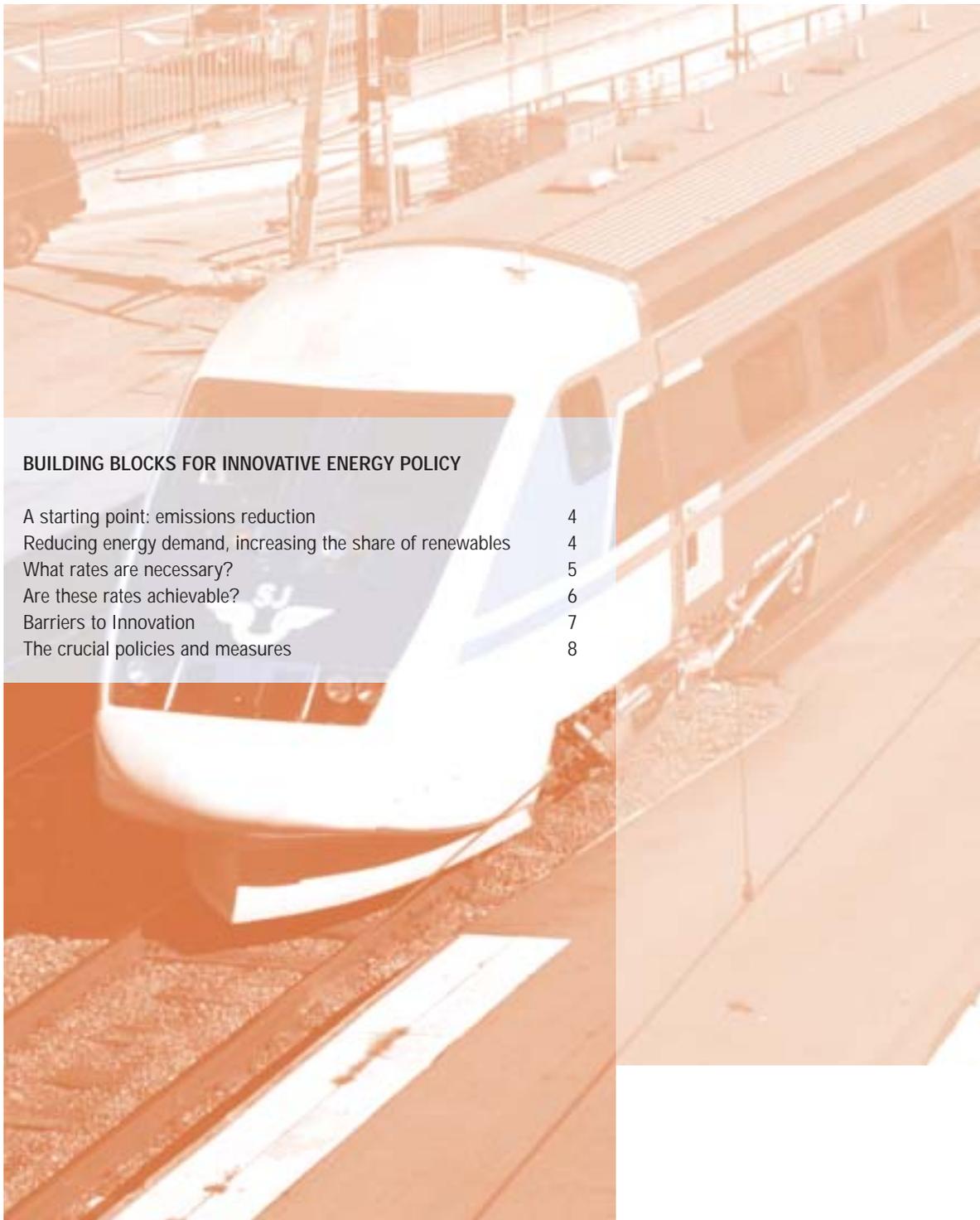
High efficiency standards need to be introduced for new equipment and for the renovation of old installations, especially buildings.

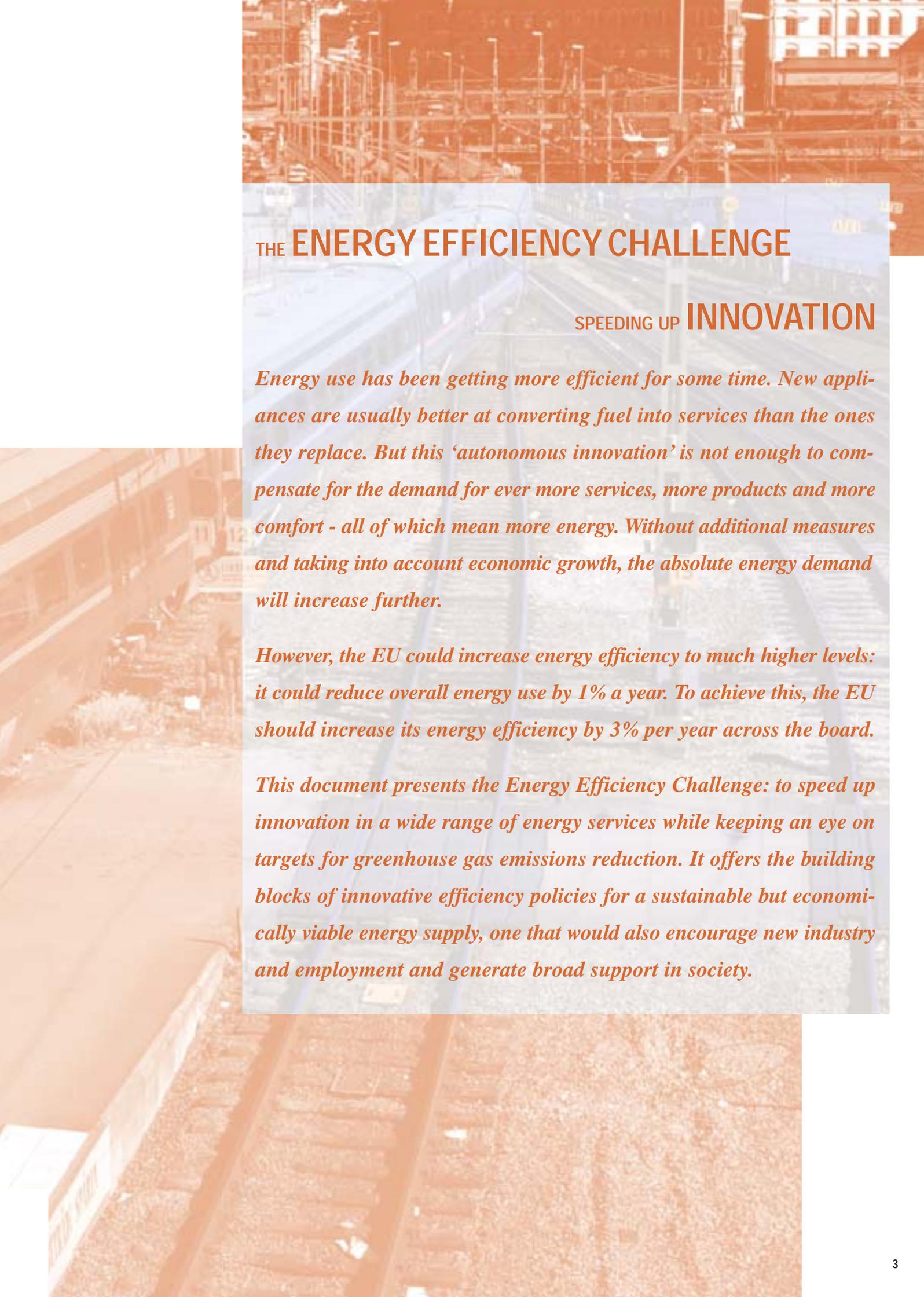
By accepting the challenge, the EU, the world's largest economy, will set a global standard for efficiency. It will increase competitiveness and reduce dependency on external energy supplies. And it will make a vital contribution to controlling climate change.

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THE ENERGY EFFICIENCY CHALLENGE

SPEEDING UP INNOVATION

Energy use has been getting more efficient for some time. New appliances are usually better at converting fuel into services than the ones they replace. But this 'autonomous innovation' is not enough to compensate for the demand for ever more services, more products and more comfort - all of which mean more energy. Without additional measures and taking into account economic growth, the absolute energy demand will increase further.

However, the EU could increase energy efficiency to much higher levels: it could reduce overall energy use by 1% a year. To achieve this, the EU should increase its energy efficiency by 3% per year across the board.

This document presents the Energy Efficiency Challenge: to speed up innovation in a wide range of energy services while keeping an eye on targets for greenhouse gas emissions reduction. It offers the building blocks of innovative efficiency policies for a sustainable but economically viable energy supply, one that would also encourage new industry and employment and generate broad support in society.

Energy efficiency is constantly improving. It is the natural outcome of replacing old systems with new equipment that is more convenient or more productive.

This natural growth in efficiency typically amounts to 1% a year (*see box*). The actual rate in a particular sector depends on the energy characteristics of the sector and the speed of innovation. For instance, increasing oil prices will have a positive effect on energy efficiency. During 1973-1985, for example, energy efficiency improvement in the OECD countries roughly doubled.

However, this 'natural' rate of 1% annual growth in equipment efficiency is nowhere near enough to compensate for increased energy demand resulting from increased use of transportation, heating or manufactured goods. A growth in energy demand of 1% a year is typical for industrialised countries, cancelling out any benefit from 'autonomous' efficiency improvements.

WHAT A WASTE: ENERGY CONSUMPTION GROWS BY 1% A YEAR

A starting point: emissions reduction

Fossil-fuel use and the greenhouse gases it produces will have to fall drastically. The Intergovernmental Panel on Climate Change (IPCC), the international scientific body that assesses climate change research, has outlined various scenarios for emissions reduction. Based on IPCC findings, the EU in 1997 set an overall target for long-term climate policy: to limit the increase in the global average temperature to 2 degrees C above the pre-industrial era. This was reaffirmed in 2004. It implies that very substantial global emissions reduction is needed by 2050. For rich countries like the EU member states, this implies reductions of 60-80% by 2050 compared to 1990.

Reducing energy demand, increasing the share of renewables

There are many ways to reduce greenhouse gas emissions; developing renewable energy sources and improving efficiency are two. In the last five years, the EU has focused on low-carbon solutions for energy supply, like the substitution of coal with natural gas and renewable energy. Although efficiency is again coming to the attention of policy makers, thanks to some recent EU directives (*see box*), the huge potential has so far been largely ignored.

Given the considerable greenhouse gas reduction requirements of 60-80%, society will need both supply-side and demand-side solutions. Energy efficiency and renewable energy sources are complementary. In the business-as-usual case, with only a 1% efficiency improvement a year, zero-carbon energy sources like wind, biomass, marine or solar energy will have to grow by at least 14% per annum in the coming decades. If efficiency were to improve by 3% a year, zero-carbon energy sources would have to grow only by 8% per annum.

An improvement in energy efficiency makes a strong growth in the share of renewables in our energy mix more achievable and cost-effective.

The ideal balance between energy efficiency and renewable sources depends heavily on cost. Energy efficiency measures, in general, are very cost-effective, especially if the timing of investment is right, for example, if they are planned to coincide with the replacement of equipment or large-scale maintenance. In many cases, energy efficiency improvements are profitable. Consumers and companies, for example, can save a lot of money on energy bills. Countries can reduce their dependency on fossil fuels, which are often imported and subject to price volatility.

ENERGY EFFICIENCY IS VERY COST-EFFECTIVE

What is energy efficiency?

Historic data show that the 'autonomous' efficiency improvement differs widely from one service to another, but typically the efficiency increases by about 1% per year. This efficiency improvement is often defined as the decrease of the specific energy consumption.

An example: In 1996, a new residential home in the Netherlands used about 1400 m³ of natural gas per year. According to the Dutch standard in 2006 a similar new home will use 800 m³ of natural gas per year. As a result, the specific energy consumption has dropped by 43%. The energy efficiency improvement is 5.4% per year.

North versus South

Because of the very different starting points in prosperity, most of the required emissions reductions will have to be in OECD countries. The economies of many developing countries, where around 2 billion people completely lack access to any form of energy, are growing rapidly and energy demand will increase accordingly.

Industrialised countries will have to compensate for this with further reductions. Energy efficiency is in general a highly cost-effective means of achieving major emissions reductions.

Promoting efficiency in industrialised countries will also have a beneficial effect on the developing world. Higher efficiency standards set by the European Union will contribute to higher efficiency standards in the world.

EU directives on efficiency

Following the two directives on the promotion of combined heat and power and on energy efficiency in buildings, the European Commission has recently drafted two important directives concerning efficiency:

- In December 2003 the Commission proposed a new Directive on End-Use Efficiency and Energy Services. The draft contains an energy savings target of 1% a year in households, agriculture, some sectors of industry and transport, and a 1.5% savings target for the public sector.
- The Commission also proposed a Framework Directive on the Eco-Design of Energy-Using Products. The draft defines the environmental characteristics of products like electronic devices and heating appliances. It sets a framework for establishing minimum energy efficiency standards for products sold in Europe, which means phasing out the products which perform worst.

WWF believes that both directives, if implemented, are a major step towards an improved energy efficiency policy for the EU. Detailed recommendations by WWF can be found at:

<http://www.panda.org/downloads/europe/energybriefingsept2004.pdf>

What rates are necessary?

In order to reduce absolute energy use by 1% a year and taking into account economic growth, a yearly average growth rate of energy efficiency by 3% has yet to be realised across the board. In the past, some sectors actually *surpassed* it. With common products such as refrigerators or cars, the specific energy consumption of new items dropped by 5% to 7% a year over an extended period of time (1973 – 1985) in the United States.

The most effective way to introduce energy-saving equipment is to plan replacement along economic lifetimes. We can then calculate backwards from the required *overall* efficiency improvement to the efficiency rate for *new* equipment (*see box*). These calculations show that a 3% yearly efficiency improvement over all sectors requires *new* equipment that improves its efficiency by almost 5% a year. The next pages will show that this figure is realistic.



Efficiencies: overall and for new equipment

The economic lifetimes of equipment differ from sector to sector. Cars or appliances have a lifetime of typically 10-15 years, while large-scale equipment for industrial processes and power plants have lifetimes of about 30 years.

In the table below, the average required progress in energy efficiency of new equipment is calculated for several reduction rates for overall specific energy consumption.

Table 1. Relation between the reduction of specific energy consumption for total sectors and for new equipment.

Efficiency rates for <i>total sectors</i> per year	Efficiency rates for <i>new equipment</i> per year
1%	1%
2%	2.7%
3%	4.7%
4%	6.9%

Are these **rates achievable?**

A close look at **four key sectors** shows the **targets are feasible.**

1. RESIDENTIAL BUILDINGS

Space-heating and hot water production are responsible for approximately two-thirds of the energy demand in dwellings. A good example of development within this sector is the residential sector in the Netherlands. Using a progressive standard for newly built dwellings from 1996, energy efficiency improvement accelerated to more than 5% a year. Moreover, these developments have led to efficient housing initiatives in the market, reaching far beyond legal requirements. If the present Dutch proposal to further strengthen the standard in 2006 is accepted, this will imply a yearly efficiency improvement for new houses of 5.4% over a ten-year period.

In addition to this, further developments in insulation materials, solar water heaters, heat pumps, storage systems and building systems offer ample opportunities to even further decrease the average energy consumption to half the 2006 Dutch standard, implying an efficiency improvement of nearly 7% a year.

Renovation programmes in key sectors

The building sector and certain energy-using devices like industrial motors have long replacement cycles. In these sectors the ongoing progress of efficiency standards makes renovation programmes profitable, at least once during the lifetime.

NEW BUILDINGS: 5-7% A YEAR MORE EFFICIENT

2. HOME APPLIANCES

Almost one third of all electricity in OECD countries is consumed by home appliances like washing machines, refrigerators, dishwashers and ovens. History shows enormous progress in energy efficiency for these devices. For instance, refrigerators in the US became almost 5% a year more efficient from 1973-1985, but despite this, huge further potential still exists. The potential increase of energy efficiency through improved compressors, insulation, fan motors and heat-exchangers is estimated at 40%.

A recent International Energy Agency study (*Cool Appliances*, 2003) shows the potential for energy efficiency in appliances is very large and cost-effective. While reducing the average appliances' electricity consumption projected for 2010 by 25% and that for 2030 by 33%, the profit per ton of CO₂ emissions avoided is expected to be €169.

3. TRANSPORTATION

Another important energy-consuming sector is transportation. Passenger cars, responsible for about two-thirds of energy use in this sector, have demonstrated interesting efficiency progress in the past few decades. During the 1990s the average energy consumption of all cars in the EU was about 7 to 8 litres of fuel per 100 kilometres. A 1998 voluntary agreement between the European Commission and the car manufacturing industry proposes that in 2008 the average new car should consume less than 6 litres per 100 kilometres.

Prospects remain good. Hybrid vehicles from Toyota and Honda combine a conventional motor with an electric drive, achieving a consumption rate of 4.3 litres per 100 kilometres. US car manufacturers already foresee hybrids consuming 3 litres per 100 kilometres. Weight reduction and alternative fuel-cell propulsion could achieve 2 – 3 litres per 100 kilometres in hybrids or fuel cell cars. There are even suggestions this figure might eventually be halved. Assuming a progress from 8 litres per 100 kilometres in 1995 to 2 litres per 100 kilometres in 2020, passenger cars would demonstrate an energy efficiency improvement of 5.4% a year.

NEW CARS: OVER 5% A YEAR MORE EFFICIENT

4. MANUFACTURING INDUSTRY

Studies of efficiency improvements in industrial sectors have analysed best practice, identified future technologies and calculated the theoretical minimum energy required for the production of paper, steel and fertiliser base. One remarkable conclusion is that the majority of options could be in place within 15 years, halving energy usage. This implies a specific energy consumption reduction of 4.5% a year.

Although looking beyond the fifteen-year horizon is difficult, there is no reason to assume energy efficiency progress will end there, as the theoretical minimum will still not have been reached. Recycling and advances in the use of materials also offer huge possibilities.

The efficiency cases above have been extensively studied. Together the sectors cited cover a very substantial part of all energy consumption in OECD countries.



SUMMARY OF FINDINGS

Three major conclusions may be drawn from the case studies:

- Efficiency improvement rates of new equipment by 5% and more are feasible, at least in the next 15 years.
- Efficient technologies identified now can be commercialised within this period.
- The limits of efficiency improvement cannot be projected beyond a period of 15 years. But historic data show lasting progress in efficiency, for example in iron casting, aluminium, ammonia and electric lighting. Automobiles and space heating already show positive developments over the long term.

EFFICIENCY IMPROVEMENT FOR NEW EQUIPMENT **BY 5%** A YEAR IS FEASIBLE

Barriers to Innovation

History proves that increasing energy efficiency is not easy, for several reasons:

- In many sectors energy consumption gets less attention for innovation than production, speed, comfort and design appeal.
- Payback times may only be a few years, but the required investments can be a barrier for companies or households. For companies, energy is often not a core factor in their business. Households have other priorities too.
- Energy service companies could have a stimulating role in this. They could pre-finance these investments and be paid back through the energy bill, but this has yet to be widely developed.
- Proven technology is often preferred because new technology can be risky.
- Finally, the long lead times for the introduction of new technologies into the market often exceed the short-term vision of industries that want a profit on new equipment.

These barriers are blocking the realisation of very high potentials in energy efficiency. Hence, it may be concluded that increased pressure to innovate is required from governments. This will have a profound influence on energy efficiency, but it is important to identify the influence this will have on 'industrial metabolism' as well.

Up to now, the most important instrument that governments have used to stimulate innovation is the funding of research and development. The problem is that R&D funding only concerns the *input* of the innovation process, not the *output*. Innovation needs more than just R&D. It is important to create markets for the deployment of energy efficiency measures.



The crucial policies and measures

Europe urgently needs legislation and support systems to create greater market demand for energy efficiency and to ensure that the drive for energy efficiency goes well beyond 'business-as-usual' levels. Setting a progressive efficiency standard is the most promising pathway for accelerating the drive for greater efficiency and for reducing greenhouse gas emissions. A yearly improvement rate of 5% for new equipment will result in a yearly overall efficiency improvement of approximately 3%. Such a progressive efficiency standard should be introduced through the implementing measures under the European Commission's directive on the eco-design of energy-using products.

TOUGH MANDATORY STANDARDS

WILL FORCE INNOVATION

Prescribing high efficiency standards for the next few years will force the development of efficient equipment that consumers will buy. A good example of this policy is the 1990 Californian law that requires a proportion of zero-emission cars in all corporate fleets by 2010. Although the targets were adjusted in 2001, it is clear that legislation is a primary factor for car manufacturers in introducing efficient technologies. The Dutch example of a standard for new buildings has proved successful.

As well as the eco-design directive, there are many other supporting policies and measures that could achieve higher efficiency throughout industry. These policies and measures, along with a recommendation about a progressive efficiency standard, are outlined below.

1. ECO-DESIGN DIRECTIVE

The European Parliament and national governments must strengthen the Eco-Design Directive, proving they are taking the huge efficiency potential seriously by setting a tough 5% progressive efficiency standard for new equipment. The directive's implementing measures must be ambitious and aimed at keeping only the most efficient appliances on the EU market, on the basis of standards based on simple principles (such as the Least Life Cycle Cost approach), and updated regularly to reflect technological progress.

2. ENERGY SERVICES DIRECTIVE

The 1% energy demand reduction target of the End-Use Energy Efficiency and Energy Services Directive, currently under discussion, must be increased to 2–3% in order to capture the huge potential for demand savings and to grow the market for energy services. 2–3% is achievable as Member States will be able to take into account early measures and both vertical and horizontal measures will be probably accounted to achieve this energy demand reduction target.

3. ENERGY EFFICIENCY LABELS

Providing customers with information about the energy use of their equipment obviously influences purchasing behaviour and the market. The 'top ten' information website (www.topten.ch) in Switzerland works like this, encouraging the market to supply, and consumers to purchase, the most efficient products (*see box*).

An important mandatory instrument is the EU's A-G label, which is now widely used across the world. This label, now mostly used for cold appliances (fridges and freezers), washing machines and light bulbs, should be updated and extended to a whole range of other energy-using products, as suggested in a draft directive the European Commission is working on. It could also be extended to products that affect energy consumption, such as windows.

<http://www.topten.info> is an initiative of Schweizerische Agentur für Energieeffizienz, S.A.F.E., Consuprint (Saldo) und Oerlikon Journalisten AG. The site lists energy efficiency and other data for around 1000 products in 7 sectors. In their fourth year (2004) the site recorded 550,000 visitors and 21 million hits, a 50% increase compared to 2003. This initiative is currently being extended to other European countries.

In addition, subsidising the most efficient products in the top ten list or in the A – label category, or providing tax breaks, helps to create a market for these products. In the Netherlands, inefficient fridges were dropped from sale while subsidies helped highly insulated glass windows into a market they now dominate.

4. ENERGY PRICES

Energy prices currently do not reflect their true cost to current or future generations. Further reform is necessary to ensure that:

- Cross-subsidy of inefficient and polluting electrical heating is phased out.
- Prices include all external environmental costs. In addition, the EU should agree on environmental tax reform, providing a tax shift from labour towards environmental use, supplemented by the reform or removal of environmentally adverse subsidies. Environmental taxes can be an efficient instrument for fostering a more rational use of natural resources and for reducing pollution, and a good incentive for technological innovation.
- Tax cuts and financial advantages given to environmentally harmful energy systems are phased out and replaced with tax incentives (e.g. low VAT rates, accelerated depreciation and tax reductions) for energy efficiency investments and appliances purchase in all sectors.

5. COOPERATIVE TECHNOLOGY AGREEMENTS

Industry and governments agree on cooperating on future targets. For example, the US Partnership for a New Generation of Vehicles is working towards a prototype family car for 2005 whose fuel economy will be three times 1993 models. This is a clear example of how industrial and governmental R&D can work together.

6. PUBLIC PROCUREMENT

A big customer like a public body has the power to enforce efficiency measures in new equipment. This concept was successfully applied in Sweden for heat pumps, for example, quickly facilitating a 30% efficiency improvement and a 30% reduction in price.

7. R&D

The above measures are all market-based, stimulating the market for efficient equipment. It should be stressed that R&D must also advance to keep pace with innovation.

8. RETROFIT PROGRAMMES

Without further policies, progressive efficiency standards will not have as much effect on overall improvement in sectors with equipment lifetimes of 30 years or more. Buildings and electric motors are good examples of such sectors. Here extensive renovation programmes will create substantial reductions in energy use. Energy service companies could play an important role because they have regular contact with the consumer (both households and businesses).

Literature and links

Policy recommendations by WWF can be found at www.panda.org/downloads/europe/energybriefingsept2004.pdf.

WWF briefing: *Meeting Kyoto and Going Further: Europe should reduce energy consumption by at least 1% per year by boosting energy efficiency.*
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Greg Rosenquist, Michael McNeil, Maithili Iyer, Steve Meyers and Jim McMahon: *Energy Efficiency Standards for Residential and Commercial Equipment: Additional Opportunities*, Lawrence Berkeley National Laboratory, University of California, September 2004

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<http://www.fueleconomy.gov/feg/pngv.shtml>

TRIPLE BENEFIT FOR THE EU ECONOMY, SECURITY AND CLIMATE

Energy efficiency is truly 'low-hanging fruit' for politicians taking action to reduce greenhouse gas emissions. With comparatively small policy interventions the EU can create a triple benefit - for business, for energy security, and for the climate.

Essential climate policy targets of 60-80% emissions reduction are within reach. Moreover, the Energy Efficiency Challenge promotes a cleaner atmosphere, helps the European Union become less dependent on foreign energy sources and contributes to the EU's 'Lisbon strategy' of becoming the world's most competitive economy. A progressive standard for efficiency should become the core energy and climate policy in Europe.

THE EU COULD SET THE GLOBAL STANDARD
FOR **EFFICIENCY**



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The Energy Efficiency Challenge establishes energy efficiency at the heart of EU energy policy.

The EU should increase energy efficiency by 3% per year.

By accepting the challenge, the EU will set a global standard for efficiency.

It will increase energy security and competitiveness.

And it will combat climate change.

Join PowerSwitch!

You definitely don't have to be a power company to join PowerSwitch! Visit WWF's campaign website at www.panda.org/powerswitch to find out what you can do to protect our climate and our local environment.

Read about global warming and the effect it's having on our lives and our world.

Read about how some people are making a stand.

About how you can make a stand!



WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

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