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GREEN PAPER
on energy efficiency
or
doing more with less

TABLE OF CONTENTS

Introduction	4
A. Identifying the obstacles	12
1. The need to adopt specific measures to improve energy efficiency	13
1.1. Financial obstacles in the way of proper market reaction.....	13
1.2. The need for energy services.....	14
2. The need for action by public authorities.....	14
3. The external costs and the transparency of prices.....	14
4. Information and education: two underused tools	15
B. A European initiative	16
1. Action at Community level	17
1.1. Integrating energy in other Community policies	17
1.1.1. Research and technological development	17
1.1.2. Promoting best practices and technology.....	17
1.1.3. Establishing and promoting best practice at all levels through national action plans	17
1.1.4. Better use of taxation	18
1.1.5. Better targeted State aid	19
1.1.6. Opening up public purchasing	20
1.1.7. Finding European financing	20
1.2. Specific energy policy measures.....	21
1.2.1. Buildings	21
1.2.2. Domestic appliances.....	22
1.2.3. Limiting the fuel consumption of vehicles.....	23
1.2.4. Informing and protecting the consumer	24
2. National level	24
2.1. Regulation of network activities	25
2.2. Regulation of supply activities.....	25
2.3. Electricity generation	26
2.4. White certificates, a market-based instrument	28
3. Industry	28

4.	Transport	29
4.1.	Organising air traffic management.....	29
4.2.	Optimising traffic management.....	29
4.3.	Developing a market for clean vehicles	30
4.4.	Charging of infrastructure to induce changes in behaviour	30
4.5.	Tyres.....	31
4.6.	Aviation.....	31
5.	Regional and local levels	31
5.1.	Specific financing instruments	32
6.	A strategy open to the world	32
6.1.	Integrating energy efficiency in international cooperation	33
6.2.	Integrating energy efficiency in the neighbourhood policy and EU-Russia cooperation.....	34
6.3.	Integrating energy efficiency into development policy	34
6.4.	Reinforcing the role of international financing institutions	35
	CONCLUSION	36
	ANNEX 1	38
	ANNEX 2.....	46
	ANNEX 3.....	47
	ANNEX 4.....	48
	ANNEX 5.....	49

INTRODUCTION

Even without high and volatile oil prices, which have led to a downgrading of the prospects of economic growth in Europe, there would be very good reasons for the European Union to make a strong push towards a re-invigorated programme promoting energy efficiency at all levels of European society ⁽¹⁾:

- **Competitiveness and the Lisbon agenda.** According to numerous studies ⁽²⁾, the EU could save at least 20 % of its present energy consumption in a cost-effective manner, equivalent to EUR 60 billion per year, or the present combined energy consumption of Germany and Finland. Although considerable investment is needed to harness these potential savings, in terms of new energy-efficient equipment and energy services, Europe is a world-leader in this area and energy services are largely local in character. This means the creation of many new high-quality jobs in Europe. Indeed, on the basis of several studies ⁽³⁾, it could be estimated that such an initiative could potentially create directly and indirectly as many as a million new jobs in Europe. Furthermore, as the measures targeted in this initiative are only cost-effective energy-efficiency measures — ones that result in a net saving even once the necessary investment is taken into account — a successful energy-efficiency scheme means that some of the EUR 60 billion not spent on energy translates as a net saving, resulting in increased competitiveness and better living conditions for EU citizens. The same studies mentioned above conclude that an average EU household could save between EUR 200 and EUR 1 000 per year in a cost-effective manner, depending on its energy consumption.

An effective energy-efficiency policy could therefore make a major contribution to EU competitiveness and employment, which are central objectives of the Lisbon agenda. By addressing energy demand, this policy is part of the EU policies on energy supply including its efforts to promote renewable energies and is, as such, part of the set of priorities first outlined in the 2000 Green Paper ‘Towards a European strategy for the security of energy supply’. In addition, energy-efficiency equipment, services and technology are becoming increasingly important worldwide. If Europe maintains its prominent position in this area, resulting in the development and introduction of new energy-efficiency technologies in Europe first, this represents an important trade opportunity.

⁽¹⁾ See also Annex 1.

⁽²⁾ The mid-term potential for demand-side energy efficiency in the EU, Lechtenböhrer and Thomas, Wuppertal Institute, 2005: ‘Our recent policies and measures (P&M) scenario for the EU-25 sketches a so-called “ambitious strategy” in order to achieve substantial reductions of GHG-emissions until 2020. This strategy uses about 80 % of the currently available economic savings potentials. It is assumed though that decision-makers are better informed by active policies and measures and change their attitudes towards the best available technologies in case of energy efficiency. The results shown in the table make it clear that energy efficiency of the EU-25 economy will increase in this P&M scenario by 29 %.’ Explanatory memorandum to the proposed directive on energy end-use efficiency and energy services — COM(2003) 739. MURE Database Simulation 2000, SOS Italy; Economic evaluation of sectoral emissions reduction objectives for climate change, Blok and Joosen, ECOFYS, Utrecht, 2000; Energy efficiency indicators, ODYSSEE, ADEME, Paris, 2004; Powering profits: how companies turn energy efficiency into shareholder value, Green Business Letter, April 2005; Improving energy efficiency by 5% and more per year, K. Blok, to be published in *Journal of Industrial Ecology*; The potential for more efficient electricity use in Italy, F. Krause; The energy efficiency challenge, WWF, 2005; World energy assessment 2000 and 2004 update, UNDP website; European Council for an Energy Efficient Economy, *Proceedings* 2005 Summer study: Energy savings, What works and who delivers?, www.eceee.org

⁽³⁾ Rat für Nachhaltige Entwicklung, 2003, http://www.nachhaltigkeitsrat.de/service/download/publikationen/broschueren/Broschuere_Kohleempfehlung.pdf, Ecofys.

- **Environmental protection and the EU's Kyoto obligations.** Energy saving is without doubt the quickest, most effective and most cost-effective manner for reducing greenhouse gas emissions, as well as improving air quality, in particular in densely populated areas. It will therefore help Member States in meeting their Kyoto commitments. Secondly, it will constitute a major contribution to the longer term EU efforts in combating climate change through further emissions reductions, as part of a future post 2012 regime within the United Nations Framework Convention on Climate Change. Many developing countries fully recognise the essential role of energy efficiency in addressing these multiple challenges. Europe therefore needs to set an example in this respect, leading to the development of new policies, cooperation and technologies that can assist the developing world to address this challenge.
- **Security of supply.** By 2030, on the basis of present trends, the EU will be 90 % dependent on imports for its requirements of oil and 80 % dependent regarding gas. It is impossible to predict the price of oil and gas in 2020, particularly if demand from the developing world continues to increase as rapidly as today. As indicated on the 2 May 2005 in the context of the International Energy Agency's (IEA) ministerial meeting, energy efficiency is one of the key methods to deal with this challenge. Making a real effort to, at first, cap EU energy demand at present levels and subsequently reduce it, would represent an important contribution in developing a coherent and balanced policy to promote the security of energy supplies for the European Union.

This Green Paper therefore seeks to identify the bottlenecks presently preventing these cost-effective efficiencies from being captured — lack of appropriate incentives, lack of information, lack of available financing mechanisms for example.

The Green Paper then seeks to identify options how these bottlenecks can be overcome, suggesting a number of key actions that might be taken. Examples include:

- establishing annual energy-efficiency action plans at national level. Such plans might identify measures to be taken at national, regional and local levels and subsequently monitor their success both in terms of improving energy efficiency and their cost-effectiveness. The plans could be complemented by a 'benchmarking' and 'peer review' process at European level, so that Member States can easily learn from the successes and mistakes of others and to ensure the rapid spread of best practice throughout the EU;
- giving citizens better information, for example through better targeted publicity campaigns and improved product labelling;
- improving taxation, to ensure that the polluter really pays without, however, increasing overall tax levels;
- better targeting State aid where public support is justified, proportionate and necessary to provide an incentive to the efficient use of energy;
- using public procurement to 'kick-start' new energy efficient technologies, such as more energy efficient cars and IT equipment;

- using new or improved financing instruments, both at Community and national levels, to give incentives, but not aid, to both companies and householders to introduce cost-effective improvements;
- going further regarding buildings, where an existing Community directive applies, and possibly extending it to smaller premises in a manner that ensures cost-effectiveness and minimum additional bureaucracy;
- using the CARS 21 Commission initiative to speed up the development of a new generation of more fuel-efficient vehicles.

This Green Paper seeks to act as a catalyst, leading to a renewed energy-efficiency initiative at all levels of European society — EU, national, regional and local. In addition, this Green Paper seeks to make a significant contribution, by way of example and leadership, to kick-start an international effort to contribute to addressing climate change through energy efficiency. China presently uses more than five times as much energy as the EU to produce one unit of GDP, the USA uses approximately 50 % more than the EU ⁽⁴⁾. With exploding energy demand in particular in China and India, energy efficiency must be one of the key policies to try to reconcile, on the one hand, the increased energy needs of the developing world to power growth and improve living conditions for their citizens and, on the other hand, combat global warming. This Green Paper, and the momentum created in following it up, should put the EU at the forefront of efforts to make energy efficiency a global priority. Finally, high oil prices hit the poorest the hardest, particularly in ACP countries. Attention should be given during the follow-up to the Green Paper as to how technology which is developed in Europe can be used or adapted to meet the needs of these countries and how best it can be deployed.

The concrete examples cited above to meet this challenge, which are examined in more detail below, are not proposals; they are ideas for discussion. Nor are they exhaustive. Following the publication of this Green Paper, the Commission shall, until the end of this year, undertake an intensive public consultation.

To stimulate debate and effective input, the Commission puts forward the 25 non-exhaustive questions figuring below.

The Commission has decided to set up the ‘European Sustainable Energy Forum’. This forum, based on the models of the ‘Florence’ and ‘Madrid’ forums, which were used very successfully to develop consensus on how to proceed with energy market liberalisation, will bring together the Commission, Member States, the European Parliament, national energy regulators and representatives of European industry and NGO’s. It will meet twice a year. The first meeting, scheduled for October 2005, will discuss in depth this Green Paper.

However, in addition to consulting the Council, the European Parliament, industry and the NGO’s on the document, the Commission considers it vital to have a wide-ranging public consultation. All interested parties are welcome to put forward comments and suggestions in the following manners:

⁽⁴⁾ This comparison would change if we take into account the difference in the purchasing power of citizens. See Annex 1 for more details.

- by Internet, through the Commission's website at http://europa.eu.int/comm/energy/efficiency/index_en.htm;
- by contacting Mr Luc Werring of the Directorate-General for Energy and Transport of the European Commission (luc.werring@cec.eu.int);
- the Commission will involve each of its offices situated in EU cities. Information and possible events will be advertised on: http://europa.eu.int/comm/represent_en.htm;
- the Commission has a network of energy agencies, in many European cities. These agencies will be tasked with widely spreading information on the Green Paper and seeking comments.

Where the person submitting comments agrees, all submissions will be placed on the Commission's Internet site for consultation.

It is important that this Green Paper rapidly leads to concrete action. Thus, following the consultation process, the Commission believes that a concrete action plan should be drawn up in 2006, outlining the specific action to be taken at EU and national levels, accompanied by necessary cost-benefit analyses.

— **Questions for debate**

General remarks

The following questions seek to further analyse the options identified in this paper, in terms of their cost-effectiveness and their contribution to energy saving, to environmental protection, to job creation and to the reduction of imports of oil and gas.

In replying to these questions, the Commission would be grateful if as much detail as possible is provided on these specific issues, as well as the question of at which level the proposed measure could be best addressed: at international, EU, national, regional or local level? Furthermore, would the measure in question be best addressed through recommendations, voluntary measures, binding objectives or measures in legislative proposals? Finally, how could the measures under consideration be implemented in practice? What would be the timescale, the costs, and where a monitoring or similar function would be necessary, which body would be best placed to do this?

This will enable the Commission, in 2006, to reach solid, practical and implementable proposals in its action plan that will make a real difference.

In addition, one of the main objectives of the Green Paper and the consultation which follows it is to stimulate additional ideas that are not yet identified. Suggestions and examples, where possible giving the details mentioned above in terms, for example, of cost of implementation, benefits in terms of energy savings and ease of implementation would be welcomed by the Commission.

Questions regarding the options identified in the Green Paper

1. How could the Community and the Commission in particular, better stimulate European investment in energy-efficiency technologies? How could funds spent supporting research in this area be better targeted? (Section 1.1)
2. The emission trading mechanism is a key tool in developing a market-based response to meeting the goals of Kyoto and climate change. Could this policy be better harnessed to promote energy efficiency? If so, how? (Section 1.1)
3. In the context of the Lisbon strategy aiming to revitalise the European economy, what link should be made between economic competitiveness and a greater emphasis on energy efficiency? In this context, would it be useful to require each Member State to set annual energy-efficiency plans, and subsequently to benchmark the plans at community level to ensure a continued spread of best practice? Could such an approach be used internationally? If so, how? (Section 1.1.3)
4. Fiscal policy is an important way to encourage changes in behaviour and the use of new products that use less energy. Should such measures play a greater role in European energy-efficiency policy? If so, which sort of measures would be best suited to achieve this goal? How could they be implemented in a manner that does not result in an overall increase in the tax burden? How to really make the polluter pay? (Section 1.1.4)
5. Would it be possible to develop State aid rules that are more favourable to the environment, in particular by encouraging eco-innovation and productivity improvements? What form could these rules take? (Section 1.1.5)
6. Public authorities are often looked to for an example. Should legislation place specific obligations on public authorities, for example to apply in public buildings the measures that have been recommended at Community or national level? Could or should public authorities take account of energy efficiency in public procurement? Would this help build viable markets for certain products and new technologies? How could this be implemented in practice in a way that would promote the development of new technologies and provide incentives to industry to research new energy efficient products and processes? How could this be done in a manner that would save money for public authorities? As regards vehicles, please see question 20. (Section 1.1.6)
7. Energy-efficiency funds have in the past been used effectively. How can the experience be repeated and improved? Which measures can be adopted usefully at:
 - international level
 - EU level
 - national level
 - regional and local levels?(Section 1.1.7. See also question 22)

8. Energy efficiency in buildings is an area where important savings can be made. Which practical measures could be taken at EU, national, regional or local level to ensure that the existing Community buildings directive is a success in practice? Should the Community go further than the existing directive, for example extending it to smaller premises? If so, how could the appropriate balance be achieved between the need to generate energy-efficiency gains and the objective of limiting new administrative burdens to the minimum possible? (Section 1.2.1)
9. Giving incentives to improve the energy efficiency of rented accommodation is a difficult task because the owner of the building does not normally pay the energy bill and thus has no economic interest in investing in energy-efficiency improvements such as insulation or double glazing. How could this challenge be best addressed? (Section 1.2.1)
10. How can the impact of legislation on the performance of energy-consuming products for household use be reinforced? What are the best ways to encourage the production and consumption of these products? Could, for instance, present rules on labelling be improved? How could the EU kick-start research into and the subsequent production of the next generation of energy efficient products? What other measures could be taken at:
 - international level
 - EU level
 - national level
 - regional and local levels?(Section 1.2.2)
11. A major challenge is to ensure that the vehicle industry produces ever more energy efficient vehicles. How can this best be done? What measures should be taken to continue to improve energy efficiency in vehicles and at which level? To what extent should such measures be voluntary in nature and to what extent mandatory? (Section 1.2.3)
12. Public information campaigns on energy efficiency have shown success in certain Member States. What more could and should be done in this area at:
 - international level
 - EU level
 - national level
 - regional and local levels?(Section 1.2.4)
13. What can be done to improve the efficiency of electricity transmission and distribution? How to implement such initiatives in practice? What can be done to

improve the efficiency of fuel use in electricity production? How to further promote distributed generation and cogeneration? (Sections 2.1-2.3)

14. Encouraging electricity and gas providers to offer an energy service (i.e. agreeing to heat a house to an agreed temperature and to provide lighting services) rather than simply providing energy is a good way to promote energy efficiency. Under such arrangements the energy provider has an economic interest that the property is energy efficient and that necessary investments are made. Otherwise, electricity and gas companies have an economic interest that such investments are not made, because they sell more energy. How could such practices be promoted? Is a voluntary code or agreement necessary or adequate?
15. In a number of Member States, white (energy-efficiency) certificates have been or are being introduced. Should these be introduced at Community level? Is this necessary given the carbon trading mechanism? If they should be introduced, how could this be done with the least possible bureaucracy? How could they be linked with carbon trading mechanism? (Section 2.4)
16. Encouraging industry to take advantage of new technologies and equipment that generate cost-effective energy efficiencies represents one of the major challenges in this area. In addition to the carbon trading mechanism, what more could and should be done? How effective have been the steps taken so far through voluntary commitments, non-binding measures adopted by industry, or information campaigns? (Section 3)
17. A new balance between modes of transport — a major theme of the strategy set out in the White Paper that the Commission adopted in 2001 on a European transport policy for 2010 — is still a top priority. What more could be done to increase the market share of rail, maritime and inland waterway transport? (Section 4.2)
18. In order to improve energy efficiency, it is necessary to complete certain infrastructure projects from the trans-European transport network. How should the investments needed for infrastructure projects be developed, using what sources of financing? (Section 4.2)
19. Among the measures that could be adopted in the transport sector, which have the greatest potential? Should priority be given to technological innovations (tyres, engines...), particularly through standards defined jointly with the industry, or to regulatory measures such as a limit on fuel consumption of cars? (Sections 4.3-4.5)
20. Should public authorities (State, administrations, regional and local authorities) be obliged in their public procurement to buy a percentage of energy efficient vehicles for their fleets? If so, how could this be organised in a manner that is technology neutral (i.e. it does not result in distorting the market towards one particular technology)? (Section 4.3)
21. Infrastructure charging, notably paying to use roads, has started to be introduced in Europe. A first proposal was made in 2003 to strengthen the charging of professional road transport. Local congestion charges have now been introduced in some cities. What should be the next steps in infrastructure charging? How far should 'external costs' such as pollution, congestion and accidents be directly charged to those causing them in this manner? (Section 4.4)

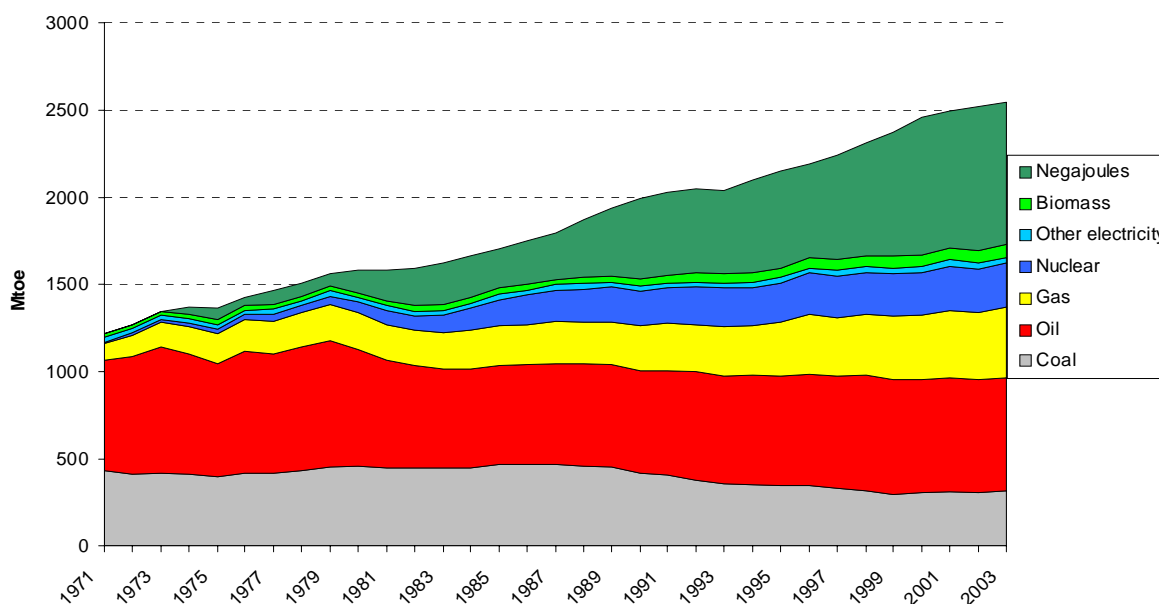
22. In certain Member States, local or regional energy-efficiency project financing schemes, managed by energy-efficiency companies, have proven very successful. Should this be extended. If so, how? (Section 5.1)
23. Should energy-efficiency issues be more integrated in the Union's relationships with third countries, especially its neighbours? If so, how? How can energy efficiency become a key part of the integration of regional markets? Is it necessary to encourage the international financial institutions to pay more attention to demand management issues in their technical and financial assistance to third countries? If so, what could be the most effective mechanisms or investments? (Section 6)
24. How could advances in energy-efficiency technology and processes in Europe be put to effective use in developing countries? (Section 6.3)
25. Should the Union negotiate tariff or non-tariff advantages within the World Trade Organisation (WTO) for energy efficient products and encourage other members of WTO to do the same? (Section 6)

A. IDENTIFYING THE OBSTACLES

The oil embargos at the beginning of the 1970s led countries of the EU to re-think their energy consumption to become less dependent on oil. Progress to this end in all Member States broke the hitherto inseparable link between growth in GDP and in energy demand already half-way through the 1970s. Energy intensity has come down by 40 % in Germany and Denmark, and in France it is 30 % less than what it was in the 1970s. This decoupling of GDP and energy demand is illustrated in the figure in Annex 3.

Fuel efficiency of cars dramatically increased ⁽⁵⁾. Awareness of the importance of rational energy use in buildings has given rise to better insulation. France, for instance embarked on an ambitious energy-savings programme, with the slogan ‘We don’t have oil, but we have ideas,’ accelerating the shift in electricity production from oil-fired power plants to nuclear reactors, and increasing taxes on diesel.

Development of the primary energy demand and of “negajoules” - EUR 25
(“negajoules” : energy savings calculated on the basis of 1971 energy intensity)



Source: Enerdata

The oil shocks were a short-term boost to quick energy-efficiency measures, but the absence of in-depth structural measures meant that demand could not be stabilised. In more recent years, the new energy price rise on world markets and especially oil prices, has stimulated renewed interest in demand management.

Effective action to bring down energy consumption substantially is impossible without first identifying the factors underlying waste in order to come to grips with them in future.

⁽⁵⁾ In contrast to the United States, where oil consumption initially fell but then ended up rising by a total of 16 % from 1973 to 2003, in France, despite some increase in recent years, oil use is still 10 % lower today than it was three decades ago and its energy intensity is 30 % lower than in 1973.

1. The need to adopt specific measures to improve energy efficiency

In theory, market forces would in time produce the most efficient outcome without interference. However, given the technical characteristics of the energy markets, there appears to be a need to promote and accompany such market induced change by improving energy efficiency more rapidly and thus reducing the demand for energy. Market forces will also continue to be essential when matching demand with supply.

The most important barrier to increased energy efficiency is a lack of information (on costs and availability of new technology; lack of information on costs of own energy consumption; lack of training of technicians on proper maintenance and the fact that these aspects are not properly taken into account by market participants). This can be a particular problem when making investments which are often long term. Investment decisions can also be influenced by the split-incentive problem (e.g. between the landlord (who installs the boiler) and the tenant (who pays the heating bill); or where a corporate investment budget is not coordinated with the energy budget. There can also be misleading prices (due to exclusion of externalities, lack of transparency). Technical barriers such as the lack of standardisation of energy-using equipment and components can also make it more difficult for new energy efficient technologies to have a rapid impact on the market. In the past, regulatory failures in the monopoly sectors created in some cases inadvertent consumption-incentives in energy tariff structures. The improvement in the regulatory regime in the EU and the introduction of more transparent market forces through liberalisation should address this concern, but the effects of previous investment decisions will be with us for many years.

1.1. *Financial obstacles in the way of proper market reaction*

The lack of information and training on the latest technologies and their economic and financial impact on the rate of return from investment, combined in some cases with an aversion to the risk associated with early adoption of new technologies and techniques, can encourage investors such as banks to continue to support outdated technology even when they are not the most efficient or offering the best return. The promoters of energy-saving technologies obviously need to make their case when seeking support from potential investors such as banks or venture capital funds. Energy service companies (ESCO`s) will also have a role to play here. Industry, investors, and consumers in general should also be encouraged to include the energy-saving alternative in their financial planning. Players should be made aware of the very positive cost-benefit ratio, and sometimes, very short pay-back periods — even less than a year in certain cases — for investments in energy efficiency. Simple tools could be developed for risk-assessment of projects such as life-cycle analysis handbooks and computer programmes and investment grade energy audits.

There is, moreover, a lack of access to adequate financial instruments supporting measures which bolster energy efficiency, such measures being predominantly small in scale. Experience shows that the traditional intermediaries, in particular banks, are often reluctant to support energy-efficiency projects. One avenue to explore is the idea of ‘global’ loans ⁽⁶⁾, where the funds are subsequently redistributed via an intermediary or a ‘clearing house’ with more technical and economic expertise in the field of energy efficiency. Another opportunity is the financing models based on shared savings currently used in some Member States, such as third-party financing and performance contracting.

⁽⁶⁾ The European Investment Bank, e.g., enters partnerships with intermediaries (usually national or local banks) to provide global loans, which are then loaned out through these intermediaries to finance smaller projects.

1.2. The need for energy services

The opening-up of markets has had a positive effect on energy efficiency. Competitive pressure has driven electricity companies to produce in the most efficient way, particularly through technology investments, (e.g. such as combined-cycle gas turbines).

The opening-up of markets has had an impact on electricity prices. Hence, for large industrial users, electricity prices fell in real terms by an average of 10–15 % between 1995 and 2005. However, more remains to be done to ensure real and effective competition in all areas of the EU. To this end, the Commission at the end of the year will adopt a full report on the state of the market, and has also recently launched a sectorial competition enquiry.

In themselves, falling prices for energy do not encourage either careful consumption or investments in energy efficiency. There are a number of companies that supply efficiency solutions and that are getting paid by the energy savings ('ESCO'). These companies still need policy support in the form of help for the dissemination of their activities, quality standards, and access to finance, as they are still in their infancy stage. The further development of the ESCO industry could greatly contribute to the implementation of many additional cost-effective projects, and can play an important role in bridging the gap between different actors on the energy and technology supply side and among energy consumers.

The Commission is well aware of the dilemma of increased consumption resulting from lower prices caused by the greater efficiency secured by the introduction of market forces. For this reason, in December 2003, it proposed a directive on energy end-use efficiency and services

2. The need for action by public authorities

Public authorities, national or European, have a role to play in compensating for inadequacies of the market. However, this is not always within their capacity. Several reasons explain this shortcoming.

Member States have recognised that more has to be done to ensure greater energy efficiency. They hesitate to commit themselves to the mandatory annual reduction in energy consumption by 1 % in the proposed directive on energy services.

Furthermore, State aid and tax measures are two tools which are often misused. State aid is granted not only in favour of energy efficiency but also for electricity generation using fuels which do not give the highest energy yield. There is also the effect of a plethora of disparate small subsidies which have only a very limited overall impact. The same is true for tax instruments. Levels of tax should in principle be eased on specific products with low energy consumption, and raised on those with high demand.

Finally, there is the need for continued, careful scrutiny of further mergers of companies in the energy and transport sectors, which can lead to increased scope for the abuse of market power, and not necessarily to greater energy efficiency.

3. The external costs and the transparency of prices

The current pricing system for energy products does not point consumers towards patterns of consumption which offer a more economical and rational use of energy.

Moreover, it does not take account of the relative energy value of products, nor of the environmental impact of their use. The current pricing system does not guarantee that external costs are included. Clearly, this is not an incentive to consume less, or to produce energy from more environmentally friendly sources. This problem is particularly acute in the transport sector. In the White Paper on transport ‘European transport policy for 2010: time to decide’, published in September 2001 ^(?), the Commission took the view that as long as the prices fail to reflect the entire social costs of transport, demand will continue to be artificially excessive. If appropriate infrastructure charging policies were applied, these inefficiencies would largely disappear.

The current pricing structure and low prices could even lead to higher consumption. There is a lack of effort to allow for consumers to understand the price of their consumption. A real-time metering system (so-called ‘smart meters’) could bring down consumption at times when the electricity price is high.

4. Information and education: two underused tools

While it is regarded as normal to launch public information campaigns to encourage people to drink less alcohol, less attention has hitherto been given to publicity campaigns on energy efficiency.

Publicity campaigns providing clear information on how to make cost-effective energy savings, as well as providing stimulus for consumers to act, can be effective in changing perceptions and encouraging action. Action at three levels in this respect can be identified:

- information to citizens on issues such as how to reduce energy consumption in homes, through, for example, efficient lighting and heating and sensible purchasing decisions,
- information to industrial customers, and
- information to energy-efficiency experts and service providers to ensure that a network of such well-trained experts exists and functions well in all Member States.

It should not be difficult to convince consumers of the fact that by relatively simple measures, the average European household can save a significant amount in its spending, which is especially important for households spending a large share of their budget on energy.

Education and training can play a major role in strengthening a culture of energy efficiency. Examples could be certain aspects of civic education in some Member States or specific training courses to be set up on how to improve energy efficiency in enterprises. The European programmes in the field of education and training could contribute to spread good practices among Member States as well as encourage cooperation projects on these topics along the whole spectrum of lifelong learning.

Furthermore, national regulatory authorities have been created in all Member States with the opening-up of the energy markets to competition. Their role is to guarantee fair competition, but Community legislation equally provides that they shall oversee sustainable trends in energy consumption. This role of regulators should be strengthened in future.

^(?) http://europa.eu.int/comm/energy_transport/wp_en.html

The annual improvement in energy efficiency in the 1990's was 1.4 % per year, but this rate has declined since and is now stationary at 0.5 %, showing current efforts are proving insufficient.

B. A EUROPEAN INITIATIVE

Setting out an energy policy for the EU is a complex task. On the one hand, pending entry into force of the Treaty establishing a Constitution for Europe, the responsibility of the Union in this area is not clearly defined. For this reason, energy measures in Community policy have had to be adopted using other legal bases in the existing Treaties. On the other hand, energy is an area with a large number of players: governments, national regulators, large enterprises, local authorities, etc. Therefore, to mobilise all players and transform energy-efficiency policy over the long-term, a strong political message is essential.

Forceful action in the field of energy efficiency indeed requires a general structuring framework. It is the national, regional and local authorities, as well as industry, which will be responsible for implementing this framework, in line with the subsidiarity principle. Only a combination of measures at the various levels (EU, Member States, regions, local level, industry) will allow the whole potential to be exploited.

The EU will continue to develop market instruments as much as possible, particularly voluntary agreements with industry and information campaigns to increase consumer awareness. But whereas these instruments can prove highly effective, they cannot always be a substitute for adopting regulatory measures designed to correct market inadequacies and to provide proper signals for consumers when necessary.

According to available studies ⁽⁸⁾, the EU could save 20 % of its current energy use in a cost-effective manner. These studies indicate that around half of this could result from the full application of existing measures, notably Community directives already in force or tabled. This Green Paper seeks to launch a process to harness the potential in practice and to identify and subsequently implement as many cost-effective measures as possible, to achieve as much as 20 %. To do this, the Union must rapidly work towards a concrete action plan, which will be formulated after a widespread consultation of interested parties following this Green Paper, and, where necessary, after cost-benefit analyses. Such an action plan should mobilise all players: national governments, regions, municipalities, industries, and individuals — and cover all the energy producing and consuming sectors. In such an action plan, all types of cost-effective actions must be considered, including taxation, public subsidies, economic incentives, partnerships with industry, etc.

⁽⁸⁾ Explanatory memorandum to the proposed directive on energy end-use efficiency and energy services – COM(2003) 739. MURE Database Simulation 2000, SOS Italy; Economic evaluation of sectoral emissions reduction objectives for climate change, Blok and Joosen, ECOFYS, Utrecht, 2000; Energy efficiency indicators, ODYSSEE, ADEME, Paris, 2004; The mid-term potential for demand-side energy efficiency in the EU, Lechtenböhmer and Thomas, Wuppertal Institute, 2005; Powering profits: how companies turn energy efficiency into shareholder value, Green Business Letter, April 2005; Improving energy efficiency by 5% and more per year, K. Blok, to be published in *Journal of Industrial Ecology*; The potential for more efficient electricity use in Italy, F. Krause; The energy efficiency challenge, WWF, 2005; European Council for an Energy Efficient Economy, Proceedings 2005 Summer study: Energy savings, What works and who delivers?, www.eceee.org

1. Action at Community level

1.1. Integrating energy in other Community policies

Beyond those measures which can be proposed for improving sectoral energy efficiency, the EU and its Member States have ‘horizontal’ powers which are currently underutilised. The EU must therefore put energy efficiency at the centre of its concerns, with the tools that have proven their value in other policy areas.

1.1.1. Research and technological development

In this respect, it is important to mention the importance of research. Several promising end-use technologies still require R & D support. Community and industry investments in R & D for more energy-efficient emerging technologies will allow the EU to keep the technological leadership in this field and further improve energy efficiency beyond the 2020 horizon.

In particular, a number of concerns highlighted in this document (an increased share of renewable energy, the efficiency of fossil fuel-based power production, more efficient electricity networks, vehicle efficiency,...) can only be alleviated through efficient research and demonstration activities in connection with other regulatory and economy-based measures.

On 6 April 2005, the Commission adopted a proposal for the seventh framework programme for research and development. For energy, it is proposed to concentrate on a limited number of key priorities which reflect the policy priorities of the new Commission, among which are renewables for power generation and fuel production, clean coal technologies, smart energy networks and energy efficiency ⁽⁹⁾ within the main ‘cooperation programme’. The ‘clean safe car’ is a good example for which, on the energy side, demonstration projects for alternative motor fuels (biofuels) are planned.

Considerable research efforts are also being focused on power management for computer systems and energy ‘scavenging’ techniques where electronic devices draw their power from ambient sources such as the motion of the user, body heat or sunlight.

1.1.2. Promoting best practices and technology

The Commission has also proposed extending the programme ‘Intelligent Energy–Europe’ for the period 2007–13, and with a (greatly increased) budget of EUR 780 million. The programme will support a broad range of promotional activities and address non-technological barriers (legal, financial, institutional, cultural, social) in the fields of energy efficiency and renewable energy sources.

1.1.3. Establishing and promoting best practice at all levels through national action plans

The integrated guidelines for growth and employment, which as from 2005 bring together the main guidelines for the economic and employment policies of the Member States, will provide the EU and its Member States with a stable and coherent framework for implementing the priority actions identified by the European Council under the Lisbon

⁽⁹⁾ This includes topics such as fuel cells, distributed generation and smart energy networks, better efficiency of fossil power plants and co-firing and biofuels in transportation.

strategy. They will be the basis for national programmes which Member States will be required to implement.

These guidelines, adopted by the Commission on 12 April 2005 for the period 2005–08, point out that recent and forecasted trends for oil prices make action in favour of energy efficiency a priority. Delaying our efforts to face these challenges could increase the economic cost of the measures taken. To this end, the Member States should give priority to promotion of energy efficiency ‘in line with current European obligations’.

Member States should as appropriate give due consideration to the objective of improving energy efficiency in the context of their national action plans for growth and employment.

In this context, one of the key measures that will be considered during the consultation period following the adoption of this Green Paper is the possibility of agreeing that, for example on an annual basis, each Member State could adopt an energy-efficiency action plan, citing the specific measures that it has decided to undertake, either as a result of Community legislation or on its own initiative, to achieve a given target for energy efficiency in the year to come. Such a plan might be adopted on an annual basis, reviewing the success of the measures taken during the previous year, both in terms of energy savings and cost-effectiveness, and setting out new measures and, possibly a new target, for the subsequent period. These plans could be accompanied by a peer review process at Community level through a high level group on energy efficiency, as well as the Sustainable Energy Forum, followed by an annual benchmarking by the Commission. This review and benchmarking process would compare best practices with a view to their becoming widespread across the Community.

1.1.4. Better use of taxation

More than is the case today, the EU could promote tax measures that either encourage or discourage certain forms of behaviour. At the moment, Community tax policy still remains too often a simple tool at the service of budgets, without much coherence with the aims of other policies, and full of exceptions demanded by Member States for all manners of consideration. Nevertheless, it must be recognised that serious efforts have been made at Community level, as instanced by the adoption of Directive 2003/96/EC on energy taxation, which sets out a favourable context for cogeneration (CHP), development of renewables, rail and river transport, etc. Substantial proposals are on the Council’s table, especially regarding diesel fuel for business use. In-depth reform is also in progress as regards passenger vehicles.

The taxation of energy products, in the form of duties, falls under EU competence. This tool could be used to **move towards harmonising tax regimes, for example for supporting development of vehicles that use cleaner fuels and that are more energy-efficient.**

At Community level, the coherence of the whole area of vehicle taxation must be reviewed. A new framework should be considered allowing mechanisms to be introduced to be able to differentiate taxes — e.g. road and registration taxes — according to energy consumption, which will also allow the CO₂ emission level to be taken into account. It would encourage low consumption vehicles and penalise ‘gas guzzlers’. Such a policy, which can be designed so as not to have any budgetary impact on Member States, would make vehicle taxation ‘greener’ by encouraging purchase of low consumption vehicles. It would also help new markets to emerge for industry by speeding up the rate of vehicle replacement.

In 2002, the Commission presented a communication on vehicle taxation ⁽¹⁰⁾ containing a number of recommendations and future actions. On this basis, the Commission considers a proposal centring on two major objectives:

- improved functioning of the internal market in this area;
- restructuring of the tax base to include elements directly related to CO₂ emissions, particularly for highly-powered cars. This would imply parallel changes in both registration taxes and those levied when a car is first put on the road.

Further opportunities need to be analysed with a view to strengthening the positive impact of taxation of policies in favour of greater energy efficiency. In that context, the debate could focus on ideas such as:

- concentrating efforts as regards excise taxes on a few essential political areas (for instance, harmonise rates where substantial problems involving distortion of competition arise, use differentiated tax measures in order to promote renewables);
- bringing excise rates on energy products and electricity consumed in production activities closer together, but at the higher end of the scale, and introduce automatic indexing of all excise rates in order to avoid erosion by inflation;
- the tax treatment of transport, both as regards excises and VAT;
- the conditions for application of border trade adjustments;
- the tax treatment of inputs for heat production, in particular for large housing developments;
- rationalising tax exemptions and exceptions.

If it proves impossible to make progress due to the requirement for unanimous decision in the field of indirect taxation, enhanced cooperation in the field of energy efficiency could be envisaged as a last recourse. Enhanced cooperation, introduced by the Amsterdam Treaty, permits a group of Member States to deepen cooperation between them while leaving the door open for other Member States who may wish to join in later. Among the various conditions imposed by the Treaty, enhanced cooperation must not constitute an obstacle to trade between Member States nor distort competition. In this respect, it would not appear that such a group of Member States deciding together on measures designed to improve energy efficiency could do either of these things.

1.1.5. Better targeted State aid

State aid in favour of energy efficiency is approved by the Commission in accordance with the Community guidelines on State aid for environmental protection. The current ones expire at the end of 2007. **The revision of these guidelines, for which preparatory work must begin during 2005, will be the opportunity to put more stress on measures designed to encourage eco-innovation and productivity gains resulting from increased energy efficiency.**

⁽¹⁰⁾ COM(2002) 431.

This revision could also be the occasion to provide an exemption to notifying aid below a certain level, which would give a wider margin for manoeuvre to Member States to finance energy-efficiency measures.

1.1.6. Opening up public purchasing

Many technologies exist for improving energy efficiency. The problem is that, for some of new energy efficient technologies, the market is not significant enough to allow offsetting a greater development and production cost through increased numbers of sales.

Public procurement could constitute an incentive for achieving this objective. It accounts for some 16 % of the Union's GDP ⁽¹¹⁾. The number of vehicles purchased by public bodies has been estimated at 100 000 cars, 100 000 vans, 30 000 lorries and 15 000 buses each year in the EU-15 alone. **If the public authorities (States, administrations, local authorities) could collectively acquire less-polluting and more energy-efficient vehicles, this would clearly encourage motor manufacturers by helping to build up market credibility of these types of vehicles.** This topic is part of the discussions currently underway in the CARS 21 group. For example, if the urban local authorities, where pollution has exceeded a certain level, reserved 25 % of their purchases for cleaner and more efficient vehicles, this would represent nearly 60 000 vehicles each year.

Cars are just one example among many which could be mentioned. In general, the Commission is seeking to promote 'green' public procurement and to stimulate European public purchasers (at federal or regional/local levels) to include environmental criteria in their contracting ⁽¹²⁾. Purchasing by all public authorities should be concerned, by national authorities but also European institutions, because the latter should point the way by example and open up new markets for products which use less energy.

1.1.7. Finding European financing

Financing is one of the major problems to be resolved, bearing in mind that some industries claim that they currently expect a return on investment in about two years. Member States have already put in place different support mechanisms at national level, notably investment aid as well as fiscal reductions or exonerations. In order to increase the efficiency of these schemes and to gain the confidence of investors, it is important to consider establishing a more favourable framework for investments in this sector. This framework could be further strengthened if it was harmonised at Community level, implying notably the European Investment Bank (especially under the heading of 'risk facilities').

For the EU cohesion policy in the forthcoming programming period 2007–13, the Commission has suggested that the increased energy efficiency and the promotion of clean urban transport should constitute explicit targets for the activity of the European Regional Development Fund in both the convergence regions and in the regions that are running programmes for regional competitiveness.

Furthermore, the Commission has suggested opening up the Cohesion Fund in the current programming period, which originally was to be used only for transport and environmental projects, to other areas of importance such as sustainable development and environmental

⁽¹¹⁾ http://europa.eu.int/comm/internal_market/publicprocurement/studies_en.htm

⁽¹²⁾ <http://europa.eu.int/comm/environment/GPP>

benefits, which would include energy efficiency, clean urban transport and public transport. Such projects, however, need to be fully integrated into the regional development concepts and the Commission intends to provide further guidance on this aspect by Community strategic guidelines for the cohesion policy 2007–13 which will link cohesion policy more effectively to the Lisbon process. The importance and potential of the synergies between cohesion policy and energy efficiency is further underlined by the fact that a large part of the financial resources of the cohesion policy will be devoted to regions in the 10 new Member States where the potential for increasing energy efficiency is high.

1.2. *Specific energy policy measures*

1.2.1. *Buildings*

The implementation of the Directive on the energy performance of buildings (2002/91/EC), as from 2006, will permit a gain estimated at some 40 Mtoe (Megatons of oil equivalent) between now and 2020 ⁽¹³⁾. The Commission must therefore monitor the rigorous application of the directive.

It will be the task for the Commission to provide Member States with the necessary tools for developing the framework for an integrated calculation methodology of the energy performance of buildings. Around 30 European (CEN) standards have been developed. Member States have indicated that they will, on a voluntary basis, apply these standards. Should voluntary compliance with these standards not be forthcoming, or equivalence not proven, then mandatory standards should be considered in a future amended version of the buildings directive.

Article 7 of this directive requires the energy performance certification of buildings of more than 50 m² when they are constructed, sold or rented out. The certificates must be accompanied by recommendations for the cost-effective improvement of the building's energy performance. The Member States are responsible for facilitating the financing necessary for following up on these recommendations.

An option is to propose an extension of the directive in order to improve the energy performance of buildings when they are being renovated. The current directive only applies to buildings under renovation of more than 1 000 m². A study ⁽¹⁴⁾ arrived at the conclusion that the technical potential of this directive could be enormous if its rules were applied to all renovations. In economic terms, the biggest opportunity is in coupling measures for energy-efficiency improvement with retrofitting. This must not only be cost-effective, but also workable, and it remains to be discussed how this can be achieved in practice.

The Ecofys study, as mentioned in footnote 14, estimates that the net job effects of the existing and a possible new directive on buildings are important. With cost-effective gains conservatively estimated at more than 70 Mtoe, this sector alone could create at least 250 000 full time jobs. The gains in employment are for highly qualified personnel and for the building profession in general. The employment is mostly created at local level, in places where the changes to buildings have to be made.

⁽¹³⁾ See the explanatory memorandum of the directive.

⁽¹⁴⁾ Ecofys, DM 70067, 'Cost effective retrofit in buildings', 2005.

Around a third of the energy used by a building goes into lighting. Potential savings can run to 50 % or even more, as shown by several projects carried out under the framework of the 'European GreenLight Programme'. To realise this potential and to meet increasing demand, Europe could show the way by promoting the use and further development of more modern and intelligent lighting ⁽¹⁵⁾.

An energy-saving electric bulb uses five times less current than a standard one. Replacing bulbs can easily save EUR 100 annually for an average household.

1.2.2. Domestic appliances

Since 1992, a framework directive allows Member States to oblige the provision of information to consumers on the energy efficiency of a whole range of electrical appliances via labelling. During the last four years, the Commission has striven for an increase in the number of covered appliances. The Commission has to continue in this direction while involving industry in the definition of these consumer information activities.

This is an area where major improvements could be made with a combination of measures taken to inform the consumer on minimum efficiency levels and by voluntary agreements ⁽¹⁶⁾. However, a new approach has been proposed by the newly adopted directive on eco-design, setting requirements for eco-design applicable to consumer electrical appliances. The Council and the European Parliament have recently reached an agreement on this objective. One of the aims of the directive is to apply the requirements for energy efficiency while, at the same time, avoiding negative consequences of other aspects of the environment or other stages in the life cycle of the appliances.

To the extent that energy consumption has a significant impact on the environment, which is often the case for household appliances, it should now be possible to establish energy-efficiency requirements for a large range of appliances and applications. For example, the stand-by control for lighting, heating, cooling and electric motors ⁽¹⁷⁾. Special measures need to address the concerns over the the stand-by function. In fact, this type of energy waste is increasing all the time, because more and more appliances offer this feature. Whilst this was an early form of energy management for some appliances, it can also result in significant energy loss. Electricity used in stand-by mode can reach between 5 and 10 % of total electricity consumption in the residential sector ⁽¹⁸⁾. The technical development has now produced more efficient sleep modes than the ones currently used, and there is a strong need to encourage the rapid implementation of this technology.

The United States and Japan have already taken initiatives to reach a maximum consumption figure of one watt for several types of appliance. In Europe, and still in the context of the 'eco-design' directive, it is foreseen to:

- encourage and promote voluntary agreements;

⁽¹⁵⁾ Further savings could be achieved by the introduction of solid State LED (light emitting diodes)-based lighting for which estimates of reductions in Europe by 2015 are of the order of 40 GW of peak demand or two billion barrels of oil per year (ref: cited in Photonics for the 21st Century, VDI, 2005).

⁽¹⁶⁾ See Annex 2.

⁽¹⁷⁾ The directive has the potential to generate efficiency gains of at least 20 Mtoe, at the same time making European industry more competitive on a global scale.

⁽¹⁸⁾ Sources: IEA 'Things that go blip in the night', IEA 2005 'Saving electricity in a hurry', Fraunhofer Institute 'Study on options on a standby label for Federal Ministry of Economics and Labour, February 2005'.

- introduce, if necessary, implementing measures to reduce standby losses for certain groups of appliances ⁽¹⁹⁾;
- stimulate the development at international level of technologies and measures aiming to limit electricity loss in stand-by mode.

1.2.3. *Limiting the fuel consumption of vehicles*

The consumption in 2005 of private cars and motorcycles in the EU is around 170 Mtoe which is near to 10 % of our gross consumption.

Average consumption has improved over the last decade, but this improvement has been offset by the increase in the number of cars and car use, and there are now tendencies for heavier high performance cars that could lead to a further deterioration of the energy situation.

In order to limit this consumption, the Union has implemented until now voluntary agreements with the car industry and labelling of cars on energy efficiency.

In the framework of CARS 21, recommendations should be developed on how best to proceed. In deciding how and whether to proceed regarding this option, it needs to be defined how best the qualification as ‘clean’ and ‘efficient’ might be set, taking into account the need to promote the objective in a technology neutral and cost-effective manner, so that any initiative allows industry to develop the appropriate technology to meet the objective in question. Some of the measures to be discussed are as follows:

- With the automotive industry voluntary agreement, the EU’s aim is to reach an average CO₂ emission figure of 120 g/km for all new passenger cars marketed in the EU. This objective, adopted by the European Parliament and by the Council, is to be achieved by agreements committing European, Japanese, and Korean car manufacturers to reduce CO₂ emissions to 140 gm/km by 2008/09, to take steps aiming at the market to influence consumer choice towards lower fuel-consuming cars, and finally to improve the quality of consumer information on fuel consumption.

This means that the fleet of new passenger cars put on the market in 2008/09 will consume on average about 5.8 l petrol/100 km or 5.25 l diesel/100 km. This translates into a reduction of fuel consumption of around 25 % compared to 1998.

However, the trend for bigger size, weight and power poses a risk that the target will not be met. Reflection is necessary on how to move from 140 g/km in 2008/09 to 120 g/km in 2012. In this context, the Commission is aware of the great challenge associated with the achievement of the 120 g/km target. Reaching the 120 g/km target will not be possible without costs but it offers further benefits for consumers and society as a whole. For example, consumers will benefit from fuel savings and this benefit will increase with higher fuel prices.

- Car labelling: the European car labelling system obliges Member States to ensure that information on fuel consumption and CO₂ emissions of new private cars is available to consumers. This enables consumers to make an informed choice. The

⁽¹⁹⁾ As for ‘codes of conduct’ for power supplies and digital adaptors for televisions.

obligation entails the placing of a sticker with this information either on or nearby every new car being offered for sale. On the basis of reports on the implementation of the directive, the Commission is currently studying measures that could be proposed to improve its effectiveness.

It should be pointed out that for energy consuming products other than cars, apart from voluntary agreements and labelling provisions, minimum efficiency requirements are also imposed, but only where this is justified by the market conditions.

Experience with the European white-goods industry, which is the world leader as a result of best technology developed in accordance with minimum standards and a serious labelling programme, proves that in the longer term our car industry also could actually benefit, rather than suffer, from efficiency requirements in their home market.

1.2.4. Informing and protecting the consumer

This Green Paper has identified the shortcomings in information and training of consumers and the general public. Many of the actions to remedy this situation have to be taken at national, regional and local levels. The EU supports these initiatives, for example through the ManagEnergy Programme. ManagEnergy supports players at local and regional levels who work in the field of renewable energy sources and energy demand.

A broad public awareness campaign on sustainable energy across the EU, EEA countries and EU candidate countries has recently been launched: Sustainable Energy Europe 2005–08. It is designed to bring about a genuine change in behaviour by the main players concerned, so that they commit themselves to move towards efficient, clean and sustainable energy production and consumption schemes based on renewable energy sources and energy efficiency, including in transport. The new campaign is financed under the Intelligent Energy–Europe Programme, with a budget of EUR 3.6 million.

The campaign addresses all main sustainable energy sectors that contribute to the Community strategy on sustainable development and aims at fostering implementation of Community legislation on sustainable energy, as well as national and local measures, by supporting industry, energy agencies, associations and consumers' activities ⁽²⁰⁾.

Informing the public is the first goal, informing and training those working in the energy sector the second. When designing buildings, architects need to have enough knowledge about the latest technologies to make energy-savings possible. The same goes for heating system installers who have to advise their clients. These actions could be initiated at European level, but obviously have to be taken up and carried out by national, regional and local authorities.

In addition, under the second electricity directive, the Member States must ensure that consumers benefit from so-called universal service, in other words that they have the right to be supplied on their territory with electricity of a given quality, and at reasonable, transparent, and easily comparable prices. Consumers must also be able to change supplier under non-

⁽²⁰⁾ The campaign will support promotional activities by the main stakeholders, such as national governments, regions, municipalities, energy agencies, energy production but also energy service companies, utilities, industrial manufacturers, building developers, agricultural and forest industry, consumer, industry, and farming associations, financial institutions, domestic and foreign trade associations, NGOs and development cooperation institutions. Other initiatives of this type should be launched in future.

discriminatory conditions. Furthermore, the same directive requires electricity companies to inform their actual and potential clients regarding the energy mix in their generation portfolio.

2. National level

The national level is in many ways more appropriate for putting measures to encourage energy efficiency into effect. National authorities' actions will reinforce Community efforts which would not be as effective on their own in the long term. National authorities should be encouraged to use the large range of measures available to them, through regulators, better control of the electricity supply chain, introduction of certification mechanism and optimisation of road transport. It should be remembered that there are excellent good practice examples to be found in every Member State which deserve to be made widespread.

2.1. Regulation of network activities

The transport of electricity involves losses of up to 10 % of the electricity produced (up to 2 % by transmission, 8 % in distribution). In many cases, cost-effective measures can be taken to significantly reduce these figures. However, transmission or distribution system operators may not always have the incentive to undertake the necessary investments to make the savings. As the efficiencies result in reduced losses, this will normally mean a reduction in transmission fees, and in a system of regulated third-party access, a loss of money for the company making the investment. Therefore, unless a system of incentive-based regulation is provided for in this respect — i.e. transmission and distribution system operators being able to retain an appropriate proportion of the net efficiency gains resulting from the improvement — the necessary investments are unlikely to be made.

The transport network operators could include their practices for loss management (information transparency measures and compensating energy purchasing conditions) in their commitment programme drawn up in pursuance of Directive 2003/54/EC. The European Regulators' Group for gas and electricity might be invited to propose guidelines on good regulatory practice for transmission and distribution tariff regulation and energy efficiency. These guidelines might start from the principle that transmission and distribution system operators should be placed under a positive obligation to carry out all investments that are cost-beneficial (i.e. will result in a net reduction of tariffs), and be permitted to retain a fair proportion of the resulting net benefits. Moreover, the group of network regulators and the other players concerned could look into the possibility of an energy efficiency certificate system.

2.2. Regulation of supply activities

In December 2003, the Commission proposed a directive on energy efficiency in end-use and energy services. This directive will oblige distributors and suppliers of energy to offer consumers not only electricity, gas or oil products, but to diversify by also offering consumers the opportunity to opt for energy services. These would comprise an integrated package, such as thermal and lighting comfort, and warm water production in building, transport, and so forth. Price competition between energy service suppliers will lead to a reduction in the quantity of energy consumed by these services, since the cost of the energy would normally be a large part (sometimes the most important one) of the total cost of the service. Offering this kind of integrated service allows market forces to play an important role in improving energy efficiency at the point of supply of the energy services.

The current pricing structure for energy products could be re-examined, as it does not encourage consumers towards more rational use. Promotion of lower consumption at peak times and in times of shortage could also be an issue for consideration. This would imply that regulators at national level promote metering to enable users to be informed of their consumption in real time.

2.3. *Electricity generation*

With energy ‘waste’ levels in the process of electricity generation running at 66 %, this sector possesses great potential. Using standard technology, only between 25 and 60 % of the fuel used is converted into electrical power. Combined-cycle gas turbines (‘CCGT’) are among the most efficient plant now available as compared with the old thermal solid fuel ones, some of which were commissioned in the 1950’s.

Liberalisation and stringent emission standards have brought significant benefits in terms of fuel efficiency to European electricity generation. Many old inefficient and surplus plants have been taken off the market and in most cases, it is the more fuel-efficient CCGT technology (efficiency ranging between 50 and 60 %) which is preferred as replacement.

With predicted growth of 1.5 % per year, Eurelectric — the European association representing the electricity industry — projects that around 520 GW of new generation capacity must be installed up to 2030 in the EU-15. This means huge investment costs running into billions of euro.

Therefore, the EU is presented with a unique opportunity to radically improve fuel efficiency across its electricity generation capacity. The EU emissions trading system is an effective means to incite electricity producers to reduce emissions and improve efficiency in the most cost-effective way. The Commission is planning a review of the system in mid 2006. Through the establishment of the national allocation plan and the creation of an overall scarcity in the market, Member States can continue to use the EU ETS as an instrument to incentivise more efficient power production.

Some major issues will require careful consideration in the context of developing the energy-efficiency action plan for 2006:

- **to ensure that only the most fuel-efficient (CCGT) technology for electricity production is being used in Europe.** The most efficient technology currently available has a yield close to 60 %, and is mostly manufactured by European companies. However, competitors from other parts of the world now also offer CCGT technology, with lower up-front investment costs, but with significantly lower fuel efficiency of around 40 %. It needs to be considered what action might be taken to ensure that our generation in the EU is highly energy efficient.
- **promotion of distributed generation.** The biggest waste in the electricity supply chain (generation — transmission, distribution — supply) is the unused heat which escapes in the form of steam, mostly by heating the water needed for cooling in the generation process. The supply chain is still largely characterised by central generation of electricity in large power plants, followed by costly transport of the electricity to final consumers via cables. This transport generates further losses, mainly in distribution. Thus, centralised generation has advantages in the shape of economies of scale, but also wastes energy.

The current investment needs in electricity generation could be used to Europe's advantage if it was to use the opportunity to facilitate a shift in electricity generation away from the big power stations to cleaner and more efficient distributed and on-site generation. Distributed generation is normally much closer to useful outlets also for the heat which is lost in conventional generation, so increasing heat recovery opportunities, which dramatically improves fuel efficiency. This change will be a gradual process which can be facilitated at national level by using the right incentives for industry.

The second electricity directive, 2003/54/EC, already contains an incentive for Member States and national regulatory authorities to promote distributed generation by taking account of its benefits for the transmission and distribution networks in the form of long-term avoided investment costs. Furthermore, Member States are obliged to ensure that authorisation procedures for this type of generation take account of its small-scale nature and therefore potentially limited impact. Streamlining and reduction of the regulatory load of authorisation procedures for distributed generation is therefore required: national authorities, regulators and local and regional authorities need to make this happen. The Commission will see to it that the measures provided for by the directive are enforced. In any event, to conform to the Community rules on freedom of establishment and of provision of services, authorisation procedures for energy production must be based on objective and non-discriminatory criteria, made known in advance to the undertakings concerned, so as to ensure that the discretionary power of the national authorities shall not be used in an arbitrary fashion. The nature and scope of public service obligations to be imposed by a system of administrative authorisations must be made clear in advance to such undertakings. In cases where the number of available permits for a particular activity is subject to a limit, the validity of the permit must not exceed the time necessary to write off the investment and to allow for equitable payback on the capital. Furthermore, any person affected by a restrictive measure based on such a derogation must have the opportunity to enter an appeal.

- **Cogeneration** also offers a substantial potential gain in efficiency. To date, only around 13 % of the electricity consumed in the EU is generated using this technology. The Member States have to implement the directive promoting the use of high-efficiency cogeneration by February 2006. They should ensure that the best possible use is made of this technology. In addition, they could stimulate further progress in developing cogeneration technologies not only in respect of energy efficiency and fuel flexibility but also with the aim of reducing construction costs. Member States could equally further explore and develop cogeneration technologies which can increase the use of renewable sources.
- Most Member States of the EU-25 have district heating systems, and especially in the new ones in central Europe with transition economies. This is a very common means of providing heat, especially to households. District heating, if managed well, can be environmentally friendly. It is estimated that even those district heating and cogeneration facilities, including industrial applications, already existing, may save 3–4 % in primary energy use as compared with separate production.

However, the main problem to be solved is how to finance the upgrading of old systems. To this end, the financial institutions such as the European Investment Bank need to be further mobilised to enable financing for energy-efficiency measures in

district heating. Finally, it needs to be determined how to support the **Improvement in the energy yield of coal-fired plants beyond 50 % as soon as possible**. Community-supported research is likely to play an important role.

2.4. *White certificates, a market-based instrument*

Policies based on incentives have the disadvantage that they don't always galvanise market forces towards the most cost-effective solution. White certificate systems have been partially implemented in Italy and the United Kingdom, are under preparation in France, and are being considered in the Netherlands. These are systems where suppliers or distributors are obliged to undertake energy-efficiency measures for final users. Certificates corroborate the amount saved, giving both energy value and lifetime. Such certificates can, in principle, be exchanged and traded. If the contracted parties cannot then submit their allocated share of certificates, they can be required to pay fines that may exceed the estimated market value.

Modelling work carried out under the 'White and Green' SAVE project has concluded that by introduction of this system in the tertiary and services sector, savings of 15 % can be obtained at zero cost, and that when 'externalities' such as the environment consequences are taken into account this saving potential would go up to 35 %. The Commission is currently preparing for the possible creation of an EU-wide scheme for white certificates, in order to allow real trade in energy efficiency between Member States. A measurement system for this purpose is expected to be developed under the current Commission proposal for a directive on energy end-use and energy services.

3. **Industry**

Industry has already moved in the direction of energy efficiency. Furthermore, driven by economic incentives, it is to be expected that industry will make additional significant improvements in its processes and the machines it uses (electric motors, compressors, etc.) European and national legislation impacts on the energy consumption of industry, and in that connection industry itself must take the necessary measures to fulfil the cap on greenhouse gas emissions imposed by the national allocation plans as foreseen in the emissions trading directive. It is in this respect that energy efficiency is a necessary tool. In addition, the Commission is currently preparing a general BREF ⁽²¹⁾ on energy efficiency in the context of the IPPC directive ⁽²²⁾ that will provide information which can be used for developing best practice for energy systems that are used in a large number of industrial processes (motor systems, pump systems, approaches to energy efficiency, etc.).

A large number of voluntary agreements in industrial sectors have already been taken (for instance in the paper industry, the horticultural sector and the chemical industry). Such voluntary agreements by industry reinforce energy-efficiency measures. Among these examples, one can quote:

- United Kingdom: the 'Energy-efficiency commitment' (2002–05) obliges electricity and gas suppliers to achieve targets for installing energy-efficiency measures in households. This programme has proven to be extremely cost-effective in reducing energy consumption and has been extended from 2005 to 2008.

⁽²¹⁾ BAT (Best available technology) reference documents.

⁽²²⁾ Directive 96/61/EC concerning integrated pollution prevention and control.

- The Netherlands: thanks to the tradition of voluntary agreements with industry, the Netherlands has become one of the best performing economies in the world in terms of energy efficiency. In July 1999, the Dutch government signed a benchmarking agreement on energy efficiency with industry ⁽²³⁾. In return for a commitment by industry to reach the absolute top in energy efficiency by 2012, the government agreed to refrain from imposing additional national energy-efficiency measures. The first review of measures taken and planned by these companies indicated that they will save 82 000 TJ in 2012 (2 Mtoe), thus avoiding emissions of around 5.7 million tonnes of CO₂.

In addition, two voluntary environmental programmes, the Community eco-label award scheme ⁽²⁴⁾ and the Community eco-management and audit scheme (EMAS) ⁽²⁵⁾ could also contribute to enhanced energy efficiency. The eco-label can be awarded to consumer products under the condition that they comply with a set of environmental performance criteria, considering the whole life cycle of the product. Energy-efficiency requirements are part of these criteria, in particular concerning product groups such as tourist accommodation and campsites.

Under EMAS, organisations must engage in the continuous improvement of their environmental performance. Here too, energy efficiency is part of this improvement and has to be addressed in the environmental review and the environmental statements to be performed under the scheme.

4. Transport

4.1. Organising air- traffic management

An ambitious plan to reorganise European airspace was launched under the ‘Single Sky’ initiative. In particular, it provides for the development of a single Europe-wide system for air-traffic control. This project, which will give rise to a large industrial initiative to be known as ‘SESAME’, will lead to substantial savings (around 6 to 12 %) of kerosene aviation fuel, simply by reducing air congestion around Europe’s airports.

4.2. Optimising traffic management

Intelligent transport systems such as navigation systems, congestion charging and cooperative driver assistance are being developed which can increase the safety and energy efficiency and driving behaviour. Notably, the exploitation of the satellite navigation system following the programme ‘GALILEO’ by 2008 will open the door to a new generation of applications and services in various fields. Transport will be the user par excellence of this radio navigation system by satellite. The satellite navigation system will offer reliable and precise positioning systems for cars and will enable information systems to be developed for road users and assistance to drivers. In aviation, it will assist at different stages of the flight. In the maritime field, it will be used on the high seas as well as for coastal navigation. The development of the satellite navigation system will thus also help development of sustainable transport, thanks to traffic flow optimisation in road transport, aviation, maritime and rail transport. By pushing back the limits of infrastructure saturation, it will diminish the exorbitant costs of congestion

⁽²³⁾ Companies representing around 90% of industrial energy demand have signed up to the agreement.

⁽²⁴⁾ Regulation (EC) No 1980/2000.

⁽²⁵⁾ Regulation (EC) No 761/2001.

and will help to reduce energy consumption and underpin better protection of the environment.

The promotion of intermodality is another measure that will contribute to substantial energy-savings. Alternatives to road transport have already been encouraged by a number of measures, notably the creation of a Community programme — MARCO POLO — dedicated to stimulation of alternative solutions: rail, inland and maritime navigation for short distances. The Commission proposed a budget of EUR 740 million for this programme in July 2004 under the financial perspectives for 2007–13. Numerous industrial projects have already benefited from its programme: the ‘Kombiverkehr’ project which served to introduce a multimodal train-ferry service between Italy and Sweden, ‘Lokomotiv’, which has linked Germany and Italy by intermodal rail services run by private rail companies, ‘Oy Langh Ship’, which introduced an intermodal service combining maritime, rail and river transport between Finland and central Europe, etc.

4.3. Developing a market for clean vehicles

Community research programmes have invested large budgets in the development of electric vehicles, in testing those running on alternative fuels such as natural gas, as well as in advancing longer-term prospects for technologies such as fuel cells and hydrogen. The seventh framework programme for research and development will continue such support.

Possible options that are being discussed, amongst others, in the context of CARS 21 are

- de-taxing clean vehicles;
- as mentioned above, placing an obligation on public administrations to spend a part of their vehicle-purchasing budget on clean vehicles;
- cities to introduce restricted access to central areas for polluting and high fuel-consuming vehicles, either by tolls or actual prohibition;
- specific certification and technical standards for clean vehicles.

Such measures could prove to be more efficient than direct aid to industry and contribute furthermore to technological development in European industry. This is no small benefit in a globalising economy.

4.4. Charging of infrastructure to induce changes in behaviour

Half of all road transport fuel is burnt in built-up areas, despite the fact that half of all journeys in such areas are less than five kilometres in length.

The Union has already embarked on a road-pricing policy for heavy goods vehicles on the trans-European road network. Future satellite location techniques, based on the satellite navigation system following the programme ‘GALILEO’, will make it easier to put road charging systems in place without causing long queues at entry points to the charging zones.

The Community directive on air quality obliges the most polluted large conurbations to draw up plans for combating air pollution. In most cases, this has meant either radical restriction on polluting transport in city centres, or else charges which are sufficiently differentiated to take account of the emission and consumption levels of individual vehicles. In the consultation

period following the adoption of this Green Paper, the question of the need and effectiveness of such schemes needs to be considered.

The experience of London since introducing ‘congestion charging’ in 2003 has been that fuel consumption has gone down by 20 % and CO₂ emissions by 19 % in the charging zone. For its part, the city of Madrid has installed a system for rapid transit for buses and cars with a minimum of two passengers on a section of 20 kilometres of the A6 highway into the city. The Commission is making an effort by means of its intelligent energy programme to promote these best practices on a larger scale.

However, it should be noted that the exchange of best practices is rather limited. One could question if and how such good examples of best practices can be generalised and expanded throughout the EU.

4.5. Tyres

Friction between tyres and the road accounts for up to 20 % of a vehicle’s consumption. Properly performing tyres can reduce the latter by 5 % and sales of such tyres should be encouraged not only on new cars but also for subsequent replacements

Better pressure checks also lead to lower consumption. Estimates suggest that between 45 and 70 % of vehicles are driven with at least one tyre below the prescribed pressure, which causes 4 % over-consumption, not to mention the increased risk of accidents. So why not consider developing systems to encourage service stations to better inform and assist drivers as regards tyre checks? Another option would be to consider a voluntary agreement with industry to install tyre pressure sensors on the dashboard of cars.

In addition to the substantial gains to be made by using the right tyres at the right pressure, an average driver can easily save EUR 100 on the annual fuel bill by driving in a more ecological way ⁽²⁶⁾.

4.6. Aviation

The Commission plans shortly to present a communication on climate change and aviation. The communication will focus, in particular, on the use of economic instruments (such as fuel taxation, emissions charges or emissions trading) which would promote energy-efficiency and greenhouse gas reductions in the sector.

5. Regional and local levels

Many measures can be taken at regional and local levels, close to the citizen. Action on energy efficiency will only produce all its potential gains if operations to be undertaken at Community and national levels are reflected locally. The EU has already taken numerous initiatives in this area. An example is the CIVITAS programme, launched in 2000, which has helped 36 European cities with urban mobility projects. Support programmes have also been put in place to encourage public and private investment in rational energy use (pilot actions, creation of local agency networks, etc.). Indeed the Union has recently adopted a new programme called ‘Intelligent Energy – Europe’ which brings all these actions under one roof thus strengthening the synergies between them.

⁽²⁶⁾ International Energy Agency ‘Saving oil in a hurry’, 2005.

Furthermore, the specific activities for energy efficiency that are integrated into the operational development programmes for the EU cohesion policy, notably in those regions lagging behind in development, give the regions strong instruments which could be used for a wide range of different projects. Support for increased energy efficiency of public buildings, investments in clean urban transport, support to SME's in improving their energy efficiency as well as related research and development are options to be mentioned. When this potential for energy efficiency is mobilised, one has, however, to respect the specific provisions of cohesion policy programming, partnership and management.

As already mentioned, it should also be discussed how to find solutions for the growing problems caused by city centre congestion. City transport is above all a matter for local and national authorities, the EU should contribute to find solutions in the face of the deterioration in the quality of life which this problem causes, and which goes hand-in-hand with a truly enormous waste of energy. Local authorities have an important role to play by providing and promoting sustainable construction in their cities, in particular in relation to energy efficient buildings. Then again, there is the eternal problem of financing. Regulatory measures are certainly needed, but we must also be able to back them up with investments. Currently available financing products as developed by banks are not always suitable for the small scale of many energy-efficiency projects, whereas the aggregate benefit such smaller projects can provide as a whole is substantial.

5.1. Specific financing instruments

There is a huge 'win-win' potential for investments in small-scale sustainable energy projects throughout Europe. They will often be highly feasible, especially when including the aspects of energy security and environmental benefits. But financing of such projects, especially in the less developed regions of Europe, needs 'facilitation' to happen. Financial instruments could be devised along the lines of the clearinghouse facilities used in other sectors. These would include project preparation facilities and risk management funds.

But given the small scale and dispersed nature of the projects to be funded, it would seem that action is in any event best initiated at local or regional level.

It may be appropriate that local and regional authorities should take the lead in setting up an EU working group with stakeholders, involving financing institutions like the European Investment Bank and other commercial banks, regional funds, and Member States' representatives. They could develop proposals as soon as possible on how to rearrange existing financing mechanisms, including focused organisation of clearinghouse-type instruments, to review the investment potential in small-scale sustainable energy projects, and consider ways to overcome barriers to investment, including the role of energy companies, recovery of energy bill savings, pricing, etc.

Funds to support the projects for the improvement of energy efficiency have been very successful in many Member States, and it should be considered how best practices in this area can be repeated and improved.

6. A strategy open to the world

The energy-efficiency performance of countries varies widely. The EU and Japan are for instance three to four times more energy-efficient in terms of energy intensity than the countries of the former Soviet Union or the Middle East.

Energy efficiency already forms part of the international cooperation activities of the EU with its partners, including industrial partners (such as the United States), countries in transition (such as Russia), and developing countries (such as China and India). Furthermore, energy-efficiency projects, albeit limited in size, are part of the lending portfolio of international and European financing institutions. However, huge scope remains for much closer and vigorous cooperation on energy efficiency with the majority of countries.

The principal reasons for strengthening energy-efficiency cooperation with third countries are closely linked to the geopolitical and strategic interests of the EU and the business opportunities arising from the EU's leading role in this area. In particular, Europe could be actively engaged in establishing and adopting standards on energy efficiency that can be internationally compatible. A further reason is the contribution energy efficiency can make to economic and social development.

The recent increase in oil prices highlighted the impact of increased energy demand resulting from rapid growth in energy consumption in a number of countries, including China. Given the scarcity of energy resources and the limited spare production capacity, especially for hydrocarbons, it is obvious that energy-importing countries increasingly become competitors for the same energy resources, for example in Russia, the Middle East and the Caspian region.

Therefore, energy efficiency is an issue in the interest of all energy importing countries, including the Union, and should be integrated into their global strategy for security of energy supply.

From a climate perspective, the recent communication on climate change has highlighted the importance of broad participation as an essential element of a mid- and long-term strategy. Cooperation with developed, and in particular, developing countries could be a useful tool for engaging countries in climate action, while providing local benefits for insurance in terms of air quality and energy security, which are key concerns for a large number of developing countries. As the energy sector has to provide the lion's share of the reduction targets, global climate change mitigation depends greatly on increased use of energy efficiency, renewable energy and other cleaner energy technologies in all countries. Due to the fact that the EU, since the first energy crisis in the early 1970's, has put in place coherent policies and programmes for energy-efficiency promotion, the EU's energy-efficiency manufacturing industry is now well placed to make the most of new opportunities and to gain new markets in third countries. European industry is at the forefront in technology, and occupies the strategic high ground in the global competition on energy-efficiency technology in most sectors, including turbines, combined heat and power and district heating technologies, household appliances and building materials. Renewed efforts for an international drive on energy efficiency could play a key role in consolidating the European industry's role as world leader in this field and could contribute to boosting Europe's competitive edge in the energy sector.

The export potential for energy efficient products and services has not been systematically assessed, but it is estimated that the business opportunities deriving from stronger efforts on energy efficiency are not less significant than those related to renewable energy. The Chinese market, for example, is expected to develop rapidly in accordance with the long and medium-term energy conservation plan drawn up by the National Development and Reform Commission, according to which residential and public buildings are supposed to halve their energy consumption during the 11th five-year plan (2006–10) as compared with current levels. In this context, it should be mentioned that the EU construction industry has the world

leadership in low-energy consumption buildings and by further updating the requirements in the EU, the export of this know-how will give new opportunities to our industry.

6.1. Integrating energy efficiency in international cooperation

The first part of increased international cooperation on this issue will consist of working with the EU's industrial partners, particularly the OECD countries within the International Energy Agency (IEA), to establish energy-efficiency plans. As developing countries are now able to join the implementing agreement of IEA, they could be encouraged to participate in these fora.

This international forum could, for instance, be the starting point for launching the idea of taking better account of external effects of the aviation sector on the environment.

European trade policy can assist in the cause of energy efficiency, for instance by negotiating favourable tariff treatment for goods on the basis of their energy-efficiency performance. This was proposed in WTO context by the European Commission in February 2005 ⁽²⁷⁾. This policy furthers the Doha Development Programme. At Doha, ministers agreed to negotiations on the reduction, or even elimination, of tariff and non-tariff barriers to environmental goods and services to further sustainable development.

Finally, the EU should renew its efforts to arrive at a common understanding with industrialised third countries, in particular the United States, to the effect that serious efforts to improve global energy efficiency are indispensable; the recommendations contained in the recent consensus report from the US National Commission on Energy Policy ⁽²⁸⁾, which forcefully addresses demand-side policies, may be a positive starting point for such a renewed EU-US dialogue on energy efficiency.

6.2. Integrating energy efficiency in the neighbourhood policy and EU-Russia cooperation

Energy efficiency is also, as its second feature, part of the EU's neighbourhood policy. The Commission will ensure that it continues to feature in the action plans for this policy.

Furthermore, the Commission is currently negotiating a treaty establishing an Energy Community with the countries of south-east Europe. It has equally initiated cooperation actions in the Caspian and Mediterranean regions. The potential in these countries is significant but, as yet, largely unexploited. They are conscious of the fact that their steep increase in energy consumption not only causes environmental and public health problems, but will equally serve as a brake to economic development, sooner rather than later.

A third feature must be to promote energy efficiency in the process of energy cooperation with Russia which has emerged since the year 2000. Russia is becoming increasingly conscious of the need to improve its energy efficiency.

⁽²⁷⁾ WTO submission TN/TE/W/47 of 17 February 2005.

⁽²⁸⁾ 'Ending the energy stalemate: a bipartisan strategy to meet America's energy challenges'.

6.3. *Integrating energy efficiency into development policy*

European development policy is the fourth feature of increased international cooperation. The EU energy initiative launched at the WSSD in Johannesburg in 2002 sets the political framework for EU cooperation with developing countries on energy issues, where energy efficiency is, of course, an important component. The need to ensure coherence of EU policies with development objectives was underlined in the recent communication on policy coherence for development, in which energy was one of the 11 policies specifically highlighted. With their comparatively weak economies, developing countries are extremely vulnerable to increases in energy prices. In countries of sub-Saharan Africa, increased oil prices can have a significantly stronger negative impact than on OECD countries. At the same time, developing countries often face high losses in power production, transmission and distribution as well as in transportation and different end-uses of energy. In addition, up to 95 % of the population depends on the use of traditional biomass for cooking and heating that is used with low-energy efficiency and creates health problems. In the island States of the Pacific and Caribbean, the high price of imported oil is exacerbated by the small markets and long transportation distances. The potential for increased energy efficiency for economic and social development in developing countries is significant and should be given more attention in the cooperation with these countries.

European *development* policy can and should help take these issues into account. Action can support capacity building, awareness raising, policy development, as well as deployment of efficient applications and end-use technologies.

Finally, European *environment* policy should help develop the capacity to value efficient projects implemented in these countries through climate change mechanisms such as the CDM.

6.4. *Reinforcing the role of international financing institutions*

Lastly, **as a fifth feature, the EU and the Member States must incite the IFI's (international financing institutions) to give more attention to energy-efficiency measures in their future financial and technical assistance operations to third countries.** Ways and means need to be explored on how international financial institutions can integrate energy-efficiency considerations in all major investment projects. The upcoming evaluation of the energy policy of the European Bank for Reconstruction and Development (EBRD) will be a good opportunity to raise this point. The fact that promotion of energy efficiency often passes through support for micro-projects should not be an argument for these institutions not to engage themselves fully. Global lending facilities should be developed, and there is a need for more lending through intermediaries, for example national agencies.

CONCLUSION

This Green Paper aims at identifying options and at opening a wide-ranging discussion on how to realise the cost-effective savings and to start the process towards rapidly establishing a concrete action plan, involving action at Community, national, regional, local and international levels and at the level of industry and of individual consumers, to harness the identified potential energy-efficiency savings.

Implementation of this framework will involve all actors. Firstly the national, regional and local public authorities, to be supported by local energy agencies, which will take care of dissemination of best practices, right through to the general public. Industry is another partner which should be brought on board to drive forward this policy. Energy efficiency also constitutes opportunities for industry to develop new technologies for export. Discussions should also be opened with financial institutions in order to increase their investments in energy efficiency in the future. Without investments, many measures will not take place. In particular, financing tools have to be devised which are more suitable for smaller projects.

An energy-efficiency initiative has wider implications than for energy policy alone. It constitutes a major contribution to reduction of our energy dependency on third countries, in a setting of high and volatile oil prices. This initiative will also contribute to the attainment of the Lisbon strategy goals, aiming to relaunch the European economy, and to the fight against climate change.

The key to promoting energy efficiency is to give Member States, regions, citizens, and industry the incentives and tools necessary to go forward to the necessary action and investments to achieve energy savings with a positive cost-benefit ratio. This can be done without any lowering of comfort levels or of the standard of living. It simply means to avoid wasting energy when simple steps can be taken to reduce consumption. According to studies carried out by the Commission ⁽²⁹⁾, the following table gives a general indication of the potential cost-effective savings in the different sectors that could be harnessed. Whilst only indicative, they represent a picture of the opportunities that this Green Paper seeks to exploit.

Potential savings in Mtoe	2020 Rigorous implementation of adopted measures	2020+ Implementation of additional measures
Buildings: heating/cooling	41	70
Electrical appliances	15	35
Industry	16	30
Transport	45	90
CHP	40	60
Other energy transformation, etc.	33	75
Total energy savings	190	360

This Green Paper therefore is a starting point from which to launch the debate and to prompt new ideas, whether these come from industry, public authorities, consumer groups or

⁽²⁹⁾ See i.a. 'European energy and transport – Scenarios on key drivers', Ecofys studies etc.

consumers themselves. This consultation process has already begun. To prepare this Green Paper, a high level group composed of representatives of all Member States was put in place and met in April 2005. It has already confirmed that progress can only be made if the EU takes a proactive approach, and concrete targets are adopted. Additionally, the Commission is creating a Sustainable Energy Forum, which will include representatives not only of Member States but also of all those interest groups which must be considered as partners in order to make sure that the energy-efficiency drive shall succeed.

The initiatives to be launched by the EU must be made known and implemented at national, regional and local levels. Obviously, consumers themselves will also have to be mobilised in order to develop and spread habits which will incorporate more energy efficiency in everyday life.

Of course, ideas are required in order to achieve the whole potential for energy savings, but also a good method for putting them into practice across the EU. If, following the debate on the Green Paper, it is decided to set overall binding targets and ensure a minimum of harmonisation, the so-called 'Community method' must be used. Under this, the Commission, armed with its right of initiative confirmed by the Treaty, makes proposals which are discussed and adopted by the European Parliament and the Council of Ministers. The Community method has been the keystone for the success of the EU. Furthermore, energy efficiency is included in the integrated guidelines under the Lisbon process. It is therefore part of the new economic governance structure. As was done in the 2000 Green Paper on the security of energy supply, the Commission now puts down a number of questions in order to set out a structure for public debate, and facilitate putting the results to good use.

In December 2005, the Commission will lay a first analysis of the results of the public debate to be launched on this Green Paper on energy efficiency before the Council of Ministers. The report will be accompanied by an action plan containing the practical action which will be proposed as from 2006.

ANNEX 1

Energy efficiency: the need for action

The 25 Member States of the EU currently consume around 1 725 Mtoe (Megatons of oil equivalent) of energy per year. This has a high price tag in the region of EUR 500 billion, or **more than EUR 1000 per person per year**. Of this EUR 500 billion, about one half falls on the trade bill of the EU (around EUR 240 billion). Energy is expensive. It is also beginning to be scarce. According to many experts, known oil reserves are only enough to cover today's needs for about 40 years.

However, in Europe, a large proportion of this energy continues to be wasted, whether by inefficient equipment or through lack of awareness of energy users. This represents a cost with no benefit, whether the waste occurs at the point of production or use. This enormous loss of capital could be put to other uses, including developing new energy-efficient practices, technologies and investments.

Energy consumption is also a major contributor to climate change, which is the cause of increasing concern over recent years. Energy is the source of 4/5 (78 %) of total greenhouse gas emissions in the EU. Of these, the transport sector contributes around one third.

The cost-effective saving of energy means, for the EU, lower dependence on imports from third countries, greater respect for the environment and reduced costs for the EU economy at a time of trailing competitiveness. Reducing energy needs is hence a policy objective which would contribute to the objectives of the Lisbon agenda by boosting the European economy and creating new jobs. **Energy-efficiency policy also brings significant savings on household energy bills and thus has a direct impact on the everyday lives of all European citizens.**

The role of public authorities, particularly the EU, is to make individuals and their political representatives aware of the urgency of improving energy efficiency. It is imperative for the environment, for the economy and for our health.

Improving energy efficiency is a broad term. In this Green Paper it covers firstly, a better use of energy through improvements in energy efficiency, and, secondly, energy saving through changes in behaviour.

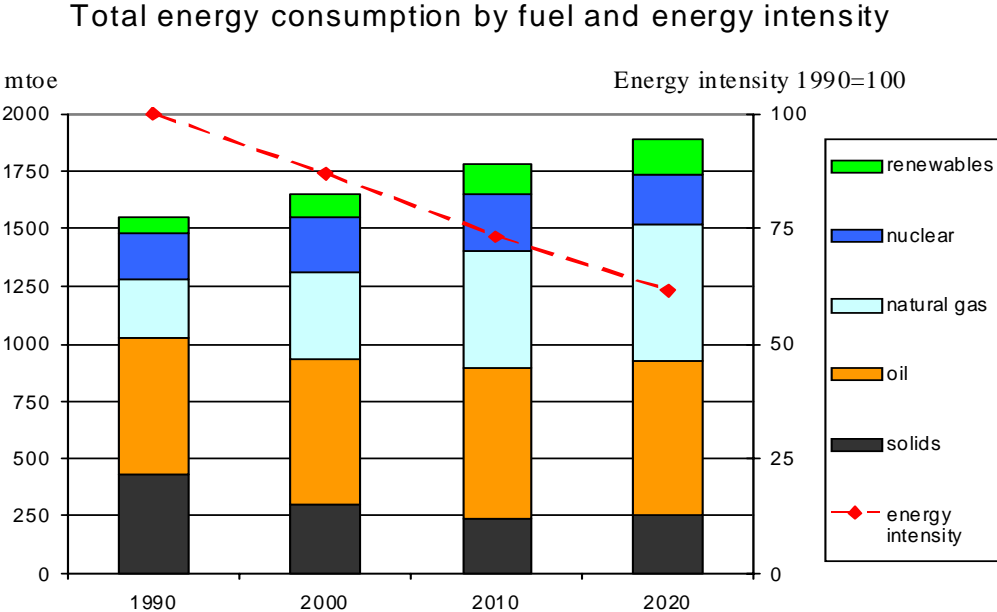
- Energy efficiency essentially depends on the technologies used. Improving energy efficiency hence means using the best technologies to consume less, whether at the final consumption or energy-production stage. This means, for example, replacing an old household boiler with a new one which consumes one-third less; or putting in place systems which avoid the energy consumption of standby mode on numerous household appliances (TV, electric oven, etc.); or using light bulbs which, for the same brightness, use less energy thanks to new technologies.
- Energy saving in the overall sense also derives from a change in consumer behaviour. This means, for example, a policy of making public transport more attractive and thereby encouraging car users to take the bus or train instead; or educating people on how to reduce heat losses from their house, notably through correct use of thermostats.

This Green Paper intends to open a discussion on how the EU promotes an overall policy in order to encourage the more widespread use of new technology to improve energy efficiency and to stimulate a change in European consumer behaviour.

Research is particularly vital to further improvements of the energy-efficiency potential which will continue to grow as economies develop further. Research and development in the area of energy efficiency as carried out under the framework programmes and under the Intelligent Energy for European programme thus complement policy in this field and work towards the same goals: less fossil fuel use, better jobs created in the European Union and higher added value for the European economy.

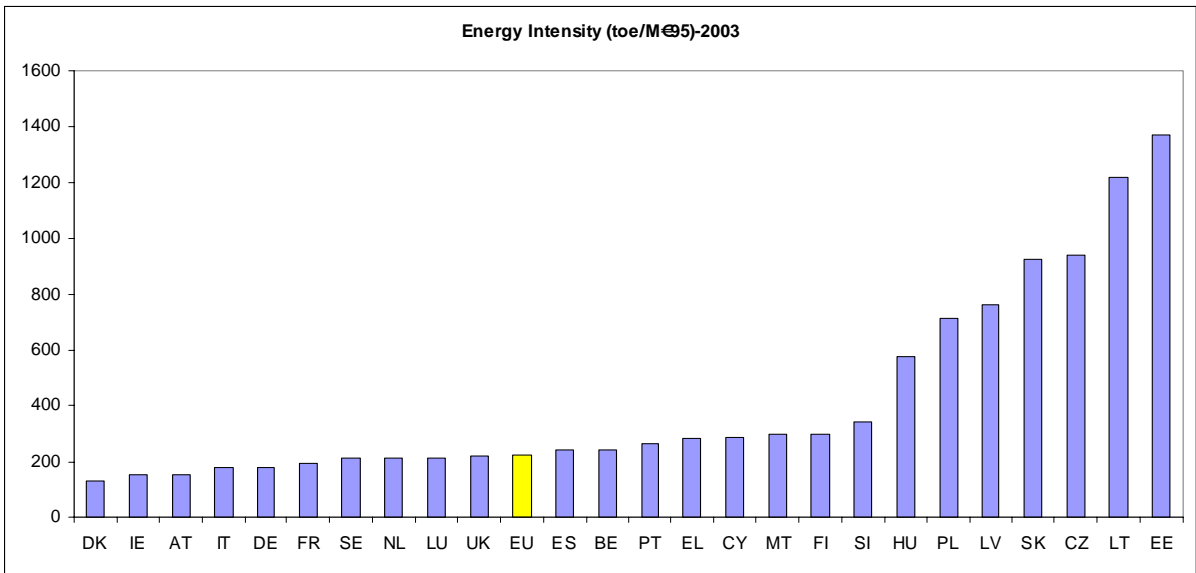
1. Fossil fuels dominate in Europe’s energy consumption

From the early 1970s until 2002, energy consumption in the EU-25 rose by almost 40 % — or 1 % per year — while GDP doubled, growing at an average rate of 2.4 % per year. Energy intensity, the ratio of GDP to energy consumption, therefore decreased by a third. However, since 2000, the improvement in energy intensity has been less substantial, reaching only 1 % over two years (see Annex 3).

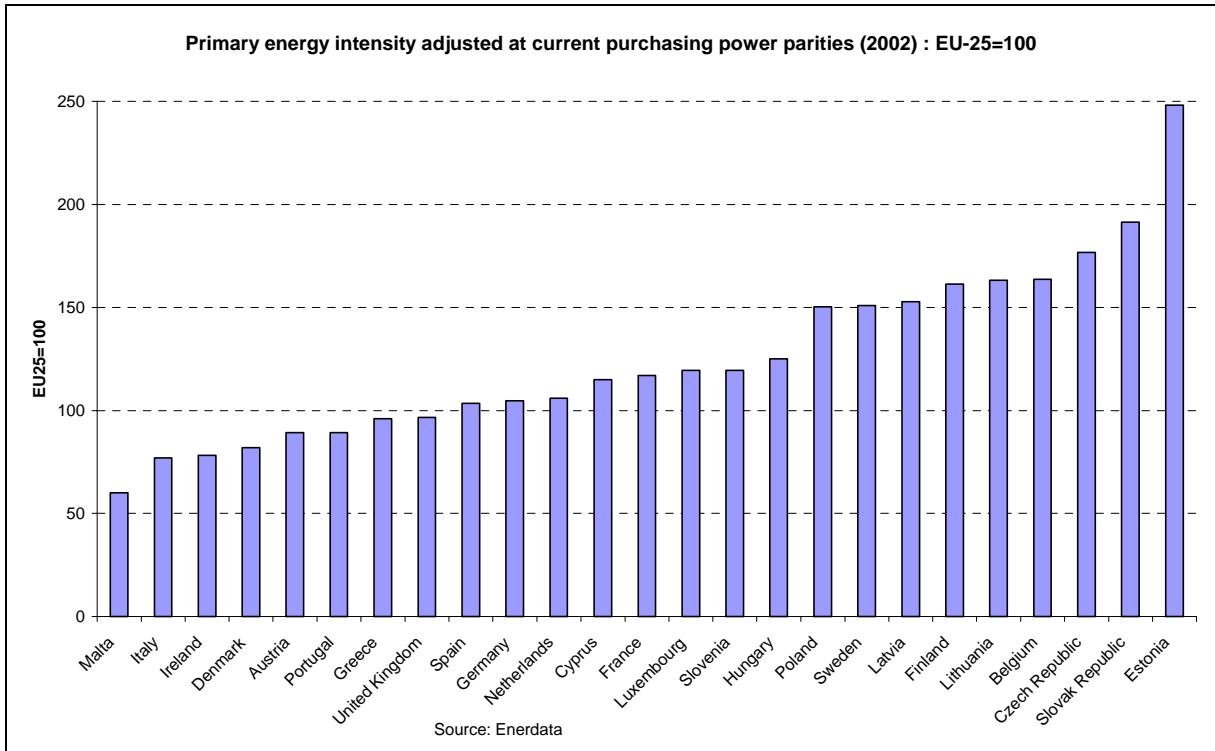


This Community average does not reflect the considerable differences between Member States caused by the differing economic structures (e.g. more or less energy intensive industry), the national currency exchange rate compared to the euro and the level of energy efficiency that, by and large, is obviously much better in the EU-15.

The following diagram demonstrates the great potential for improvements in most new Member States.



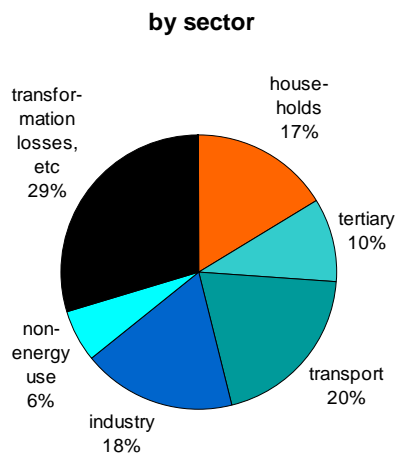
In the following diagram, this comparison is corrected for the differences in the purchasing power of incomes in the Member States.



If the current trend continues, gross energy demand could increase by 10 % by 2020. Growth in electricity demand could also reach 1.5 % per year. **Today's consumption in the EU could reach 1 900 Mtoe within 15 years (2020), compared with 1 725 Mtoe in 2005 ⁽³⁰⁾.**

⁽³⁰⁾ These predictions are made under the assumption of an average growth of GDP as foreseen to be 2.4 % per year.

Gross energy consumption EU25 (1725 mtoe) in 2005 – see annex 1



Meanwhile energy demand continues to increase in the EU, while its hydrocarbon production slows down. Thus, oil production reached a maximum in 1999 with 170 Mtoe; and it should decrease to 85 Mtoe by 2030 ⁽³¹⁾. The contribution of renewable energies remains relatively low — 6 % in 2000 and between 8 and 10 % of the total consumption in 2010 and the expected decrease in production of nuclear electricity predicts a fall of around 240 Mtoe. This means that domestic primary production could fall to 660 Mtoe in 2030, whereas it still represents 900 Mtoe in 2005.

2. The benefits of increased energy efficiency for the European economy

The absence of convincing action to thwart the trends towards increased energy consumption also has a negative effect on the efforts of the EU in the context of **the Lisbon strategy**, which aims to make the economy of the Union the most competitive in the world.

Higher oil prices impact negatively on GDP growth. A lesser dependency on oil would thus benefit the economy immediately. But even without higher oil prices, there are sound economic reasons to make a strong push towards more efficient use of energy in Europe. In this context, a discussion should be launched on how EU business and citizens could make a financial gain in the short, medium and long term by, for example, installing new energy-efficiency equipment or refurbishing buildings. Furthermore, as energy efficiency requires services and technology in an area where Europe is a world leader, an effective energy policy means that instead of paying for imported hydrocarbons, new, quality jobs are created in the EU.

⁽³¹⁾ EU-25 baseline scenario. 'European energy and transport – Scenarios on key drivers'.

According to estimations made by the German Council for Sustainable Development ⁽³²⁾, **more than 2 000 full-time jobs could be created for each million tonnes of oil equivalent that will be saved as a result of measures and/or investments specially taken to improve energy efficiency as compared to investing in energy production.** This is shown to be the case in calculations done in several other studies on the subject. It should be noted here that this figure does not include jobs created as a result of increased exports of European technologies, but does include job losses due to the lower demand of energy (see Annex 5).

The economic potential of energy efficiency depends both on technological developments and on current and forecast energy prices. Consumers will benefit from energy-efficiency measures when the cost-benefit ratio is positive. The general economy could also benefit thanks to transfers of the resources saved to other economic activities. Research is also at the centre of progress in energy efficiency, and is one of the two main goals of the Lisbon strategy to revitalise the European economy, together with job creation, to which it is also directly linked.

Furthermore, the European Union is one of the world economic zones best placed to help developing economies reduce their own energy intensity and render their economic growth more sustainable ⁽³³⁾, thanks to its exports of state-of-the-art technology.

3. Energy use — a cause of environmental damage

Growth in consumption has a direct impact on the deterioration of the environment and on climate change. Air quality is a major environmental concern for the EU. The Commission is currently elaborating the EU Clean Air Programme (CAFE), where the harmful effects of ozone and especially particulates are revealed for human health, the ecosystems and agricultural crops ⁽³⁴⁾. This situation will be improved by 2020 in the first place by the implementation of current emission standards, but increased energy efficiency could equally improve air quality dramatically by avoiding burning of fossil fuels. Effects of reduced energy consumption have been estimated in environmental models ⁽³⁵⁾ to be in the order of thousands of avoided premature deaths and billions of euro.

Burning fossil fuels cause greenhouse gas emissions. CO₂ emissions, rather than evening out, could, if prevailing trends persist, actually exceed 1990 levels by 14 % by 2030 under a 'business as usual scenario'. At the current rate of increase of energy consumption, the tensions between our pattern of energy demand — 80 % based on fossil fuels — and the struggle to advance a sustainable environment could be felt most strongly from 2012 onwards.

In its recent communication on climate change ⁽³⁶⁾, the Commission concluded that 50 % of future reductions of greenhouse gas emissions would be achieved by improved energy efficiency.

All Member States are committed to developing forms of energy, which do not emit greenhouse gases: 'green' electricity, biofuels, etc. They have already developed plans for

⁽³²⁾ Rat für Nachhaltige Entwicklung, 2003, http://www.nachhaltigkeitsrat.de/service/download/publikationen/broschueren/Broschuere_Kohleempfehlung.pdf

⁽³³⁾ UNDP, World Energy Assessment 2000, and update of 2004, <http://www.undp.org/energy>

⁽³⁴⁾ For example in 2000, three million life years were lost in the EU due to particulate concentrations in the air we breathe. This is equivalent to about 288 000 premature deaths.

⁽³⁵⁾ Study made for the CAFÉ.

⁽³⁶⁾ COM(2005) 35. The communication stresses the importance of energy efficiency for reaching greenhouse gas-emission levels which are compatible with maintaining the climate. It is estimated that 50 % of the necessary reduction, i.e. to achieve a level of such gases in the air of 550 ppm, could come from greater energy efficiency.

energy savings in certain sectors. However, Europe has still not demonstrated its ability to reduce current trends or its capacity to reverse the spiralling growth in energy consumption.

4. The international response

Energy concerns were for a long time merely a matter of satisfying demand by supply-side policies. It was only in the year 2000 that the European Commission's Green Paper on energy supply security put forward a clear strategy based on demand management. The Green Paper on security of supply proposed a clear strategy anchored in demand. The Green Paper came to the conclusion that the EU had just too little room for manoeuvre on energy supply and that it was in the area of energy demand that it could act. So the Commission has started a first series of regulatory acts in the field of energy efficiency, notably the directive on the energy performance of buildings and the cogeneration directive.

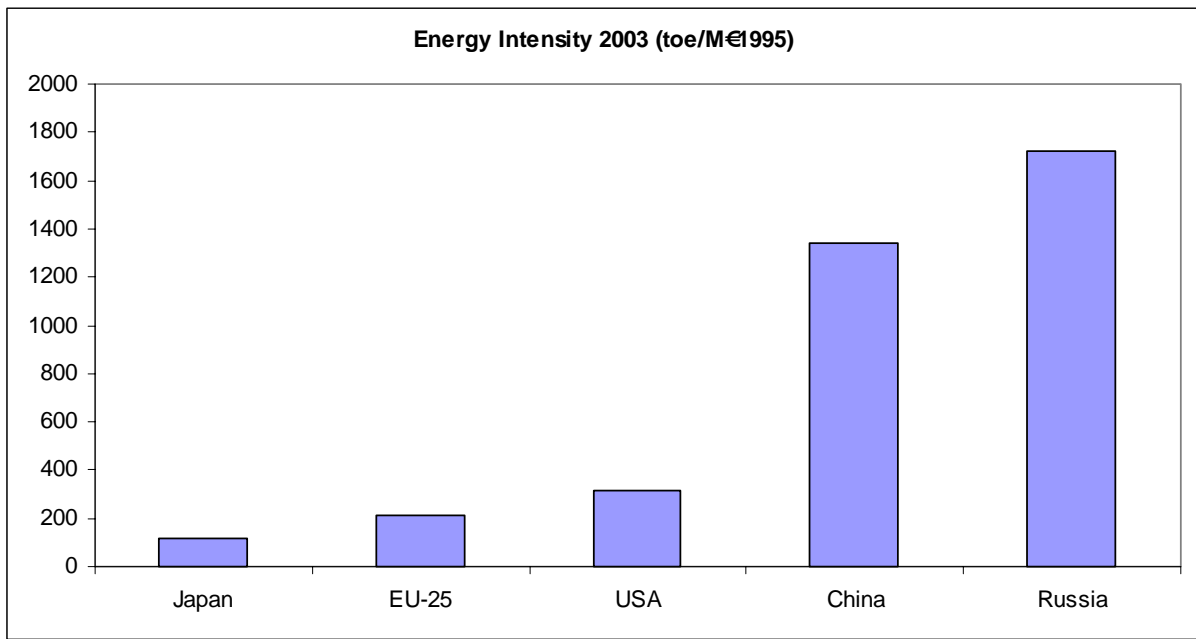
The same can be said regarding the international intergovernmental organisations like the International Energy Agency (IEA) which have very recently started to consider energy efficiency as a priority, pushed by record oil prices. Bilaterally, there has not been a proper energy dialogue either between producing and consuming countries. Such a structured and lasting dialogue would have enabled the introduction of a minimum of transparency in the market and would have contributed to stable prices. The partnership with Russia launched in 2000 and the upcoming relaunch of the dialogue with OPEC will allow for this gap in the energy policy of the Union gradually to be overcome.

This new awareness is also reinforced by the international economic effect of the strong economic growth in certain countries — China, Brazil, and India — which has led to energy consumption racing ahead. However, it must be stated that these countries are conscious of the fact that they have to reduce their energy intensity, if only because these growth rates in energy consumption can put their economies at risk.

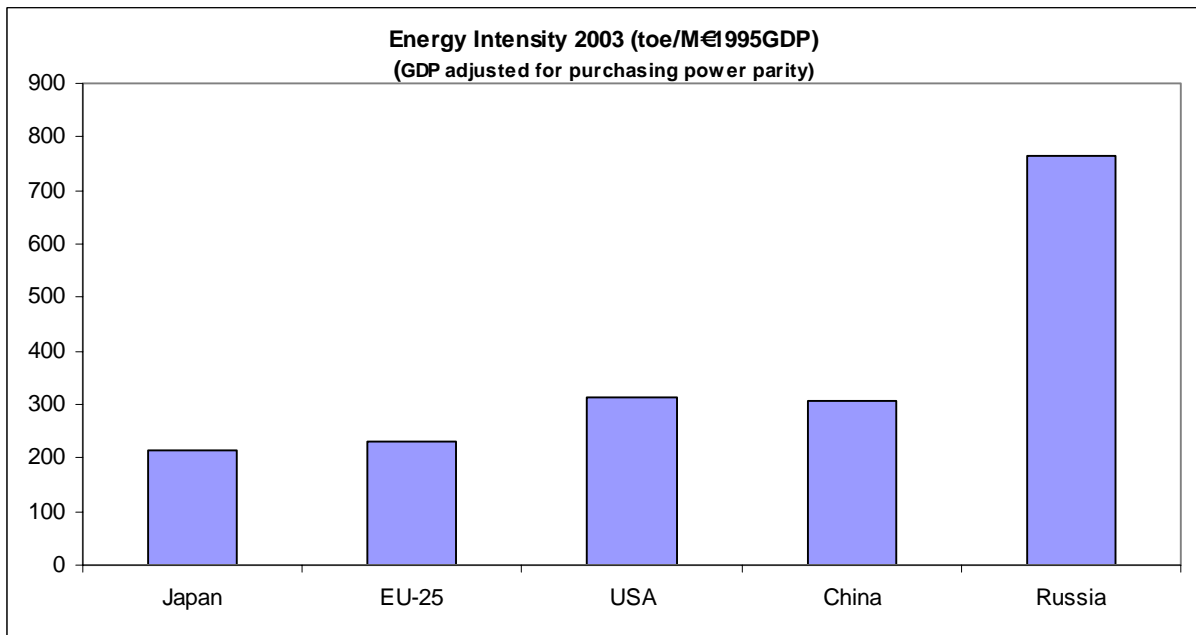
Moreover, there is also a lack of a structured dialogue between consumer countries, whereas this could lead to a demand-based strategy at world level, and would help them to become less dependent on fossil fuels, thus reducing the negative impact of their consumption on the environment.

The following graph shows the big differences in energy intensity between the large zones of consumption in 2003 ⁽³⁷⁾:

⁽³⁷⁾ Although other less energy-efficient regions are at the moment more competitive than the EU, this is not a reason why the EU should not increase its energy efficiency and thus its own competitiveness.



In the following diagram, this comparison is corrected for the differences in the purchasing power of the incomes of these economic areas.



source Enerdata

5. Opening the debate on an ambitious goal for the EU

Without proactive measures to avoid a further drift of energy consumption, all these preoccupations linked to the security of supply, European competitiveness, climate change and atmospheric pollution will only get worse. The EU cannot allow such negative predictions to come true.

This Green Paper on energy efficiency envisages to launch the debate on how the EU could achieve a **reduction of the energy consumption of the EU by 20 % compared to the projections for 2020 on a cost-effective basis.**

With today's most advanced technology, it is certainly possible to save around 20 % of the energy consumption of the Member States of the EU. Total consumption is currently around 1 725 Mtoe. Estimations indicate that, if current trends continue, consumption will reach 1 900 Mtoe in 2020. The objective is thus to arrive, thanks to energy savings of 20 % at the consumption level of 1990, i.e. 1 520 Mtoe.

This would mean that rigorous implementation of all measures taken after 2001, for instance the directives on the energy performance of buildings and on combined heat and power generation, combined with new measures, could lead to annual savings of an average of 1.5 % per year, which in turn would allow the EU-25 to return to its 1990 consumption ⁽³⁸⁾.

⁽³⁸⁾ This is calculated on the basis of existing EU predictions on GDP development, indicating a yearly growth of 2.4 %, see 'European energy and transport – Scenarios on key drivers', Commission, 2004.

ANNEX 2

Electricity consumption savings and trends in the residential sector EU-15 (sources: Wai 2004, Kem 2004) ⁽³⁹⁾

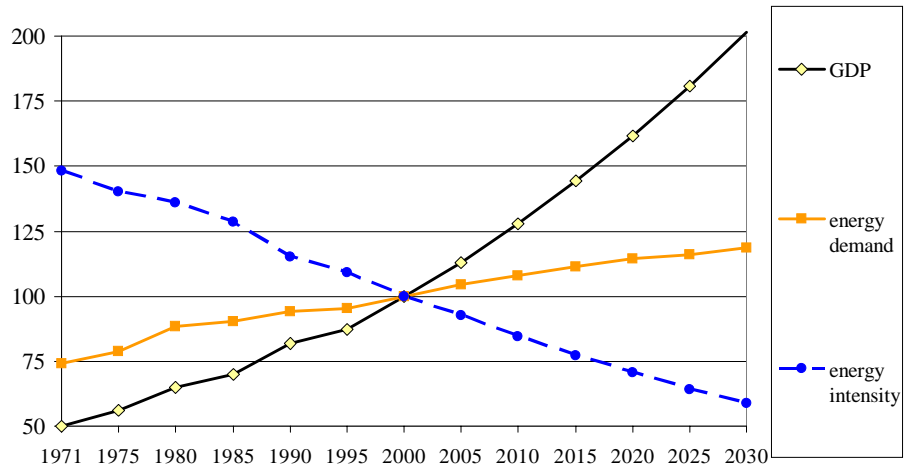
	Electricity savings achieved in the period 1992–2003 [TWh/year]	Consumption in 2003 [TWh/year]	Consumption in 2010 (with current policies) [TWh/year]	Consumption in 2010 Available potential to 2010 (with additional policies) [TWh/year]
Washing machines	10–11	26	23	14
Refrigerators and freezers	12–13	103	96	80
Electric ovens	-	17	17	15.5
Standby	1–2	44	66	46
Lighting	1–5	85	94	79
Dryers	-	13.8	15	12
DESWH ⁽⁴⁰⁾	-	67	66	64
Air conditioners		5.8	8.4	6.9
Dishwashers	0.5	16.2	16.5	15.7
Total	24.5–31.5	377.8	401.9	333.1

⁽³⁹⁾ Status report 2004, Joint Research Center IES.

⁽⁴⁰⁾ Domestic electric storage water heaters (DESWH), the saving potential indicated is only related to the reduction of the thermal standby losses due to thicker insulation. Additional saving will come from control strategy (thermostat and timer). Larger electricity saving will be achieved by introducing solar thermal panels.

ANNEX 3

EU-25: long-term development of GDP, energy demand and energy intensity (baseline) : 2000 = 100



Average decrease of energy intensity is 1.6 % per year

ANNEX 4

Final energy demand

2002	Buildings (residential and tertiary)		Industry		Transport		All final demand sectors	
	Mtoe	% of final demand	Mtoe	% of final demand	Mtoe	% of final demand	Mtoe	% of final demand
Solid fuels	12.2	1.1	38.7	3.6	0.0	0.0	50.9	4.7
Oil	96.8	8.9	46.9	4.3	331.5	30.6	475.2	43.9
Gas	155.6	14.4	105.4	9.7	0.4	0.0	261.5	24.2
Electricity (incl.14 % from RES)	121.3	11.2	91.2	8.4	6.0	0.6	218.5	20.2
Derived heat	22.8	2.1	7.5	0.7	0.0	0.0	30.3	2.8
Renewables	29.0	2.7	16.2	1.5	1.0	0.1	46.2	4.3
Total	437.8	40.4	306.0	28.3	338.9	31.3	1 082.6	100.0

ANNEX 5

The employment effects of energy-efficiency improvements

Investments in cost-effective energy-efficiency improvement will almost always have a positive impact on employment ⁽⁴¹⁾. In all cases, the number of jobs created is greater than those created from comparable alternative investments, including investments for the extraction, transformation and distribution of energy ⁽⁴²⁾.

The strong employment impact deriving from energy-efficiency investments is due to the combined result of two separate effects. One effect is the so-called ‘re-deployment effect’ of energy savings investment. This effect is due to the indirect effects of reinvesting the financial savings generated by energy-efficiency measures. It accounts for fully two-thirds of the total impact on employment ⁽⁴³⁾. The other effect is the direct effect of such investments and comes from the labour required to implement the original energy-efficiency investment. A good example of this is investments such as retrofitting of existing buildings. Many such investments have the added advantage of being labour-intensive, of having impacts that are felt locally and regionally and of having a relatively low import content. This demand for labour often includes unskilled labour as well as semi-skilled and highly trained craftsmen, making it a versatile instrument for reaching regional policy objectives.

Many other direct investments in energy efficiency, such as energy-efficient process lines in industry, the installation of energy-efficient boilers, improved building maintenance service will generate as much or more employment per invested euro than comparable alternatives such as road, bridge and energy transmission infrastructural investments.

Numerous studies have been carried out to compare the relative employment-creating effects of energy-efficiency investment with alternative investments. One such study identified 12–16 job-years of direct employment created for every USD 1 million invested in energy efficiency, compared with only 4.1 job-years for an investment in a coal-fired power plant and only 4.5 job-years for a nuclear power plant. That is to say, energy end-use efficiency investments create three to four times the number of jobs created by comparable energy supply investments ⁽⁴⁴⁾.

It has also been commonly thought that power plant construction has a very large impact on the local economy. This impression arises from viewing the impact in a local area where construction expenditures and employment are highly concentrated. For the region as a whole, however, the impact is not nearly as large as that of a comparable energy-efficiency improvement programme. In addition, because of the large share of capital investment required for energy production facilities, the total cost of producing a kWh of electricity is about twice the cost of saving a kWh.

Some jobs are actually lost due to increased environmental regulation and market deregulation in the energy sector. The opening of the electricity and gas markets, for example, has led to job losses in the short term, mainly because increased competition has forced rationalisation of energy production/generation, transmission and distribution facilities. These

⁽⁴¹⁾ ‘National and local employment impacts of energy efficiency investment programmes’, 2000. SAVE study, ACE, UK.

⁽⁴²⁾ ‘Employment effects of electric energy conservation’, 2002. Charles River Associates.

⁽⁴³⁾ Ibid.

⁽⁴⁴⁾ Ibid.

net job losses do not take account of the redeployment effects of lower electricity prices for big industrial users. It is clear, however, that if increased investments in energy efficiency are coordinated with environmental legislation and market liberalisation, net employment gains can still be achieved ⁽⁴⁵⁾.

There are many estimates on the possible number of jobs that can be created in the EU through increased energy efficiency. These estimates vary greatly, according to the size, length and types of investments that are made. A rough calculation based on the value of the energy saved from an energy-efficiency increase of 1 % per year for a 10-year period, shows that this could lead to over 2 000 000 man-years of employment if these investments are undertaken, for example, under proper conditions in the buildings retrofitting sector ⁽⁴⁶⁾. These estimates are corroborated by other studies ⁽⁴⁷⁾. The large savings potential and the fact that the buildings sector is responsible for 40 % of EU final energy consumption, make energy-efficiency investments in this sector particularly interesting. The increased possibility to finance some of these investments from the Structural Funds and the possibility for Member States to apply reduced VAT and other taxes and charges can add to this interest ⁽⁴⁸⁾.

It should also be mentioned in this context that new requirements in Member States for the certification of the energy performance of buildings are expected to impact very positively on employment in the buildings sector. At the same time, this requirement will provide information and advice on future cost-effective energy-efficiency investments, many of which should be undertaken. The requirement for the inspection of heating and air-conditioning systems is also expected to increase employment. Although EU-level estimates of the direct employment effects of these requirements are not yet available, indications are that Member States together will need around 30 000 new experts for certification and inspection when national legislation has been fully entered.

⁽⁴⁵⁾ European Parliament study of 2004.

⁽⁴⁶⁾ SAVE study.

⁽⁴⁷⁾ UNDP, World Energy Assessment, p. 185. Rat für Nachhaltige Entwicklung: 'Perspectives for coal in a sustainable energy industry', October 2003.

⁽⁴⁸⁾ It is estimated that lowering income taxes and employer charges while raising them compensatorily on energy could create half a million new jobs in Denmark.