EUROPEAN POLICY CENTRE

EPC WORKING PAPER No.29

Gain without pain: towards a more rational use of energy

Marie-Hélène Fandel and Fabian Zuleeg

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EUROPE'S POLITICAL ECONOMY PROGRAMME

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Foreword

by Jørgen Henningsen

Across Europe, the implications of our energy dependency for both climate change and European energy security have featured widely in the media and in political debate. But despite the energy savings' potential that could be realised through a more rational use of energy, for example by improving energy efficiency, insufficient attention has been paid to this aspect of policy. As a result, the EU is not moving fast enough in this direction.

To explore this issue in greater detail, the European Policy Centre set up a Task Force on the rational use of energy in February 2007, under the auspices of its Europe's Political Economy programme.

The Task Force was made up of representatives from a wide range of EPC member organisations,[1] including companies and NGOs, as well as from the EU institutions.

This EPC Working Paper reflects the outcome of the Task Force's discussions and all the recommendations it contains aim to meet three objectives simultaneously:

- to reduce CO_2 emissions;
- to reduce EU dependence on imported energy;
- to boost innovation and European competitiveness in green products and services.

This is in line with sustainable development principles: a policy designed to foster a more rational use of energy must strike the necessary balance between economic, social, environmental and energy-security goals. Policy recommendations must take into account the fact that positive change in one area might have a detrimental effect in another. The focus of the recommendations in this paper is on actions which would have a positive impact across all areas of sustainable development, or where a negative impact can easily be mitigated against.

The Task Force also focused on policies which can be implemented now. The technology already exists to make it possible to use energy much more rationally, but the take-up of that technology needs to be accelerated.

Furthermore, even without introducing these technologies, much more can be achieved by better management of energy.

But this does not mean that the EU has to resort to draconian measures. The recommendations contained in this paper focus on areas where there is a potential win-win situation; for example, where an upfront investment in energy-efficient technology can result in greater savings realised through reduced running costs.

Hence, moving towards a more rational use of energy does not require a significant reduction in our quality of life – rather this would enable us to continue enjoying the kind of lifestyles we are accustomed to, but without using as much energy as we do now.

The work of the Task Force does not claim to 'solve' Europe's energy problems. It is unlikely that the rational use of energy alone will reduce the level of CO_2 emissions that European leaders have committed themselves to achieve. But it would be a step in the right direction and, in many cases, a cost-effective one. It can thus have an important impact on our energy use in the very near future, making a contribution to meeting broader EU objectives.

Given the Task Force's focus on potential win-win solutions, these recommendations represent the very least the EU should do now. This would not only begin to address the Union's own use of energy, but would also signal to the rest of the world that the EU is willing to take a lead in this area.

This should not, however, be interpreted as a 'call for inaction' in other energy policy fields – in addition to promoting the rational use of energy, the Union has to continue developing and implementing wider energy policies, if it is serious about meeting the collective ambitious targets agreed at the Spring European Council in 2007.

Europe's politicians have given the EU institutions a crucial role in meeting these ambitious targets, and the Union's role in energy matters has been reinforced in the Lisbon Treaty. By acting decisively now to drive forward initiatives to promote the rational use of energy, the EU can collectively signal how seriously its policy-makers take their commitments.

This paper begins by setting out the background to the rational use of energy debate. It then describes what is meant by the 'rational use of energy' and

identifies the underlying obstacles and barriers which deter the public sector, business and consumers from implementing possible efficiency upgrades to achieve this goal. It explores the policy tools which could be used to encourage a greater take-up of existing technologies, the development of new ones and changes in behaviour. Finally, by applying these tools to specific sectors of the economy, it outlines a series of concrete policy recommendations in four specific areas: buildings, appliances, road transport and industry.

The Task Force's findings are intended to feed into the energy and climate change discussions at the Spring European Council on 13-14 March 2008 and beyond. The outcome of those discussions will be a crucial test of the EU's ability to address the issues of greatest concern to the European public, as it switches the focus from institutional reform to tackling the key challenges facing the Union following the signing of the Lisbon Treaty in December 2007. This paper is intended as a modest contribution to that debate.

Jørgen Henningsen chaired the EPC Task Force on Rational Use of Energy

Executive summary

Europe must reduce its dependency on energy to bring its level of CO_2 emissions down, curb its reliance on external energy supplies and boost Europe's competitiveness.

The European Union is already equipped with many policy instruments in the energy field and the Lisbon Treaty will extend its competences in this area, assuming it is successfully ratified. At the Spring 2007 EU Summit, Member States also committed themselves to taking the necessary measures to combat climate change and reduce Europe's dependency on external energy. Now the EU needs to turn those promises into actions.

There is a great deal that Europe can achieve by using energy more rationally and developing a competitive advantage in eco-innovation and green products. But the potential gains have not been fully exploited because there are numerous obstacles and barriers which prevent the public sector, business and consumers from tapping into that potential.

This Working Paper argues that these barriers can be overcome and identifies five policy tools which can be used to foster the rational use of energy and deliver significant progress in the short term:

1. *Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy*. This means ensuring that energy bills are paid in full by those who use the energy and that wasteful consumption is charged for additionally. Flat rates or all-inclusive charges for energy use in buildings should, for example, be discouraged.

2. *Incentives and standards which encourage the take-up of existing energy-efficient technologies.* These can play a key role in stimulating technological progress and the use of the best-available techniques. This means, for instance, using minimum standards to phase out inefficient appliances.

3. *Mechanisms which can turn long-term efficiency gains into upfront benefits.* Budget-neutral solutions already exist to make energy upgrades in buildings affordable for companies and public administrations without having to set aside specific funds. Such financing mechanisms should be promoted and adopted by a broader range of public sector organisations.

4. *Using the public sector as both a lever and an example.* The public sector can play a major role in promoting a more rational use of energy, not least because it can contribute to creating the critical mass required to make new technologies operational through its own activities and through its procurement of goods and services. Public sector organisations should therefore set ambitious targets for energy efficiency. The EU-Energy Star programme should, for example, be strengthened by extending the range of products it covers to include new technological devices used as office equipment.

5. *Providing the information needed for individuals and companies to make rational choices.* This means improving consumers' awareness of the amount of energy they are using and providing clear information about running costs in monetary and energy terms of specific buildings, appliances, or vehicles. Metering in buildings should be compulsory for all companies and individual households. In rented properties, energy consumption should always be identified separately from the rent and any other charges.

The recommendations contained in this paper are targeted at EU policy-makers, Member States, regions and public-sector bodies, as well as the private sector. Having identified the tools which can be used to promote rational use of energy, it then analyses four key sectors: buildings, appliances, road transport and industry – and considers how the tools outlined above can be applied in each case to deliver short-term win-win solutions.

A more rational use of energy can make a significant contribution to meeting Europe's energy challenges. It is also a way of achieving significant gains without pain; i.e. without requiring major changes in the way we live. However, action is needed now to make this possible and leadership will be required to make sure that energy efficiency not only remains at the top of the EU agenda but also that the policies required are implemented effectively to meet the commitments which have been made.

I. Towards a more energy-efficient Europe

Energy was at the heart of the foundation of European integration, which began with the coal and steel industries in the early 1950s. But since then, it has been a policy field where the possibilities for common action have been largely unexploited, apart from a short-lived period of activity in the early 1980s.

However, recently, the growing economic and political clout of emerging economies and the rising awareness of the man-made nature of climate change have pushed this issue to the top of the EU agenda.

The Union now faces two daunting challenges: its dependence on external energy supplies and the need to reduce CO_2 emissions to combat climate change. Both of these challenges will continue to increase in importance in the years to come.

The EU currently imports 50% of the energy it uses, according to the European Commission. Assuming current trends continue, this figure will rise to 70% within the next 20 to 30 years, with 90% of EU oil and about two-thirds of its gas being imported.[2]

The Union's economic stability will therefore be increasingly dependent on external suppliers' energy strategies and vulnerable to possible energy shocks. Given the growing scarcity of natural resources, energy prices are also likely to remain high and put an additional burden on Europe's competitiveness.

At the same time, the impact of energy use on CO_2 emissions, and thus on climate change, has raised significant environmental concerns. While the volume of CO_2 emissions in the EU is stable and its share of global emissions is falling (with China now the biggest emitter in terms of volume, according to the Netherlands Environmental Assessment Agency), Europe has both a historical responsibility for high emissions and a long-standing pledge to reduce them.

Since the informal European Council at Hampton Court in October 2005, EU Heads of State and Government have consistently expressed their joint commitment to tackle climate change and energy security.

Most recently, at the United Nations Framework Convention on Climate Change (UNFCCC) Conference in Bali in December 2007 – which aimed to

define a roadmap for a global agreement on fighting climate change post-2012, when the Kyoto Protocol expires – the EU pushed for eight key 'building blocks', including deeper mandatory absolute emissions' cuts by developed countries, and strengthening and extending the global carbon market.[3]

In March 2007, EU policy had already shifted to a higher gear, with EU leaders agreeing on a series of targets. These included commitments to reduce greenhouse gas emissions by 20% by 2020 compared to 1990 levels (and to increase this to 30% if non-EU countries committed themselves to similar ambitious targets); to increase the share of renewables in the overall EU energy mix from 7% now to 20% in 2020; and to ensure that in road transport, at least 10% of fuel comes from biofuels.[4]

There is, however, a long way to go. While these targets are theoretically binding, they will remain aspirations until EU policy-makers agree a plan to implement the necessary measures. Strong political will and leadership will be essential to move from words to deeds.

Key decisions have yet to be taken on who will be required to deliver what by 2020, how the targets will be reached, and what implementation measures and enforcement tools need to be developed at EU and Member-State level.

On 23 January 2008, the Commission unveiled an energy and climate change package which includes burden-sharing proposals, a Directive on renewables, a review of the European Emissions Trading Scheme (ETS), proposals on clean coal and carbon capture and storage (CCS), and new rules on state aid and the environment.

These proposals are controversial, but there is no doubt that a strong commitment from all sides to shoulder a share of the burden will be essential. Without this, Europe will become even more dependent on imported energy in future (making it more politically vulnerable) and the effects of climate change will continue to worsen. Political leadership does not mean simply making political declarations – it is much more about concrete delivery.

More emphasis also needs to be placed on energy efficiency, building on the action plans agreed in 2006 and other EU energy efficiency measures detailed in the next section of this paper. Such measures could make a much

greater contribution to reaching the targets set at the March 2007 European Council than people have realised and, in many cases, without imposing a significant burden on societies,

The Commission also recently proposed binding legislation on CO_2 emissions from new cars. This proposal would require car manufacturers to cut average emissions from about 160 grammes of CO_2 per kilometre now to 130g/km by 2012 through vehicle-technology improvements. This proposal still needs to be adopted by the European Parliament and Council of Ministers, and has already stirred controversy, criticised by industry for penalising European manufacturers and by environmental organisations for not being ambitious enough.

The policy drivers for the rational use of energy in the EU

Energy is a cross-cutting policy issue in Europe which increasingly involves more of the Brussels' decision-making machinery. The EU's competences in the field of energy efficiency and environmental protection are significant but also complex – there is an overlap of roles and competences, in particular with the Member States.

Although energy as a policy issue was at the core of the birth of the EU, it was not given a specific chapter in the Union's founding Treaty of Rome nor in the successive Treaties. As a result EU energy policy has had to borrow its legal basis from different parts of the respective Treaties in force at the time, with legislative proposals normally presented as internal market or environmental measures.

This has generally worked well, but the fact that internal market legislation requires total harmonisation, while environmental legislation usually sets minimum standards makes the outcome quite complex. In most cases, the fact that competences are shared between the EU and individual Member States has also contributed to less ambitious results than expected – and required.

The EU Treaties[5] state that the Community's tasks include promoting a high level of protection and improving the quality of the environment (Article 2); sustainable development (Article 6), and contributing to the pursuit of "prudent and rational utilisation" of natural resources (Article 174).

In general, the EU already has the necessary competences to drive forward energy efficiency and, in most cases, it is a question of effective implementation.

However, there are also areas where EU powers are limited – for example, the Union does not have the ability to influence energy prices directly through taxation or to use fiscal incentives to encourage companies to introduce energy-efficiency measures.

Assuming it is successfully ratified, the Lisbon Treaty will extend the EU's competences in the energy field, albeit not in the fiscal area. Energy is now listed as one of the competences shared between the Union and the Member States, and a new Energy Title (Article 176 A) has been added to the EU Treaties, setting out four objectives for EU action in this field. These are to:

- ensure the functioning of the energy market;
- ensure security of energy supplies;
- promote energy efficiency and energy saving, and the development of new and renewable forms of energy;
- promote the interconnection of energy networks.[6]

Common EU actions on energy – and specifically on energy efficiency – are thus set to become explicit EU competences once the Treaty enters into force.

The Commission is responsible for proposing Community legislation, which can set targets and lay down minimum requirements in specific areas from an energy, industry or environmental standpoint. These proposals must then be agreed by the Council (i.e. Member States) and the European Parliament.

As the Guardian of the EU Treaties, the Commission is also responsible for checking that EU legislation is implemented properly in the Member States and, if necessary, referring alleged breaches of EU law to the European Court of Justice.

In addition, the EU increasingly acts as an international standard-setter: When the Union sets strict environmental or energy efficiency standards for its domestic market, it pushes global producers to adopt those standards for their global operations and therefore has a strong influence beyond the Union's borders.

Member States are responsible for financing and implementing EU policy in this field, but in some areas, they can go further by introducing stricter national standards or more stringent protection measures. They are also responsible for developing their own energy and energy-efficiency policies, funding schemes and legislation.

Local and regional authorities also have a role to play and, in several Member States, have some policy competences (three German cities have, for example, recently introduced 'environmental zones' to reduce fine particle emissions from traffic[7]) or even legislative powers (Scotland, for example, has competence for environmental legislation).

Energy efficiency

In addition to these broader measures and targets, energy efficiency is recognised as a key component in achieving wider energy objectives.

As early as 1992, the Energy Labelling Directive[8] established a framework for providing information about energy consumption on domestic appliances such as refrigerators, freezers, dishwashers and ovens. The aim was to encourage shoppers to buy more energy-efficient products by giving them the information they need to make informed choices.

From 2000 to 2006, a range of other legislation on energy efficiency was adopted. The key measures are described below:

- The 2002 EU Energy Performance of Buildings Directive (EPBD)[9] sets minimum efficiency requirements for the energy performance of large buildings, which the Commission estimates could reduce overall EU energy use by around 11%.[10] These include a system for calculating the integrated energy performance of buildings, minimum standards for new buildings and large existing buildings which undergo major renovations, energy-performance certificates for buildings, and regular inspections of boilers and air conditioning systems.

- The 2006 Energy End-Use Efficiency and Energy Services Directive aims to encourage energy efficiency through the development of a market for energy services and the delivery of energy-efficiency programmes. It covers most forms of energy sold to users, including transport fuels. The Directive requires Member States to achieve a minimum annual energy savings' target of 9% by 2016. In October 2007, the Commission launched infringement procedures against 12 Member States for failing to notify the EU of their national energy efficiency action plan by the agreed June 2007 deadline.[11]

- The Eco-Design Directive[12] lays down energy and environmental (ecodesign) requirements which energy-using products must meet in

order to be sold in the EU. These requirements also apply to imported products.

- Energy Star[13] is a voluntary labelling scheme for higher-efficiency equipment which originated in the United States and was adopted by the EU for office equipment.

- Eco-labelling,[14] which was introduced in 1992 and revised in 2000, is a voluntary scheme aimed at promoting products which have a reduced environmental impact over their lifecycle compared to other products in the same group.

In October 2006, an EU Action Plan for Energy Efficiency outlined a framework of policies and measures designed to achieve an estimated 20% energy saving by 2020. To reach this target, the Commission proposed more than 100 measures to be introduced at the European, national and local levels, including dynamic energy performance requirements for products, buildings and services to keep pace with technological advances; improving energy production, reducing transport's energy footprint; financing this market transformation; and changing consumer behaviour.

But it is clear that the plan – and energy efficiency more widely – can only be driven forward by generating the necessary momentum and through political leadership.

The Commission must continue to push the energy-efficiency agenda. Many recommendations of this paper are already being considered at EU level, but fast and decisive action is now required to move to implementation. Particular attention needs to be paid to implementation by Member States, to ensure that the introduction of measures is not delayed still further. More could also be done: the plan itself acknowledges that the potential for energy savings is greater than the measures it identifies, which would only achieve 13% of the required 20%.

Given the magnitude of the energy and environmental challenges facing the Union, the urgent need to act, and the inevitable delays associated with any action at the EU level, the EU must do more to boost energy efficiency and the rational use of energy than it has until now.

Eco-innovation and competitiveness

The rational use of energy is not just an essential component of the EU's response to the climate change and energy-security challenge. It also provides an opportunity for European businesses to be at the forefront of eco-innovation and to develop profitable green goods, services and processes.

A 1999 study by the consultancy ECOTEC suggested that the EU's eco-industries supplied around €183 billion of goods and services a year and accounted for more than two million[15] jobs in the EU-15. The study also concluded that Europe eco-industries were "a strong and diverse export sector, and a major global player alongside the USA and Japan", with a trade surplus in environmental products.[16]

It is safe to say that the importance of the sector has grown since then – and will become even more important in future, given the growing recognition of the importance of addressing environmental issues such as climate change. At the same time, resource constraints (high demand as well as shrinking and uncertain supplies) and higher energy prices will boost the global market for more energy-efficient goods and services.

Europe must ensure that it does not fall behind in including new, more energy-efficient technologies both in the goods it sells on the EU market and those it exports to the rest of the world, but rather takes the lead in these areas.

Europe's growing role as a global standard-setter increasingly means that if the EU imposes more stringent, and potentially costly-requirements on those operating within the Union, these will be duplicated by its main competitors. The single market can also encourage the rational use of energy by encouraging companies to use resources more efficiently and, through the creation of a level playing field, applying the same energy-efficiency standards across the EU.

The EU has recognised the importance of eco-innovation and the Seventh Framework Programme for Research and Development (FP7) identifies the environment (including climate change) as a key EU priority for collaborative research. Energy and climate change are also among the four key priority areas in the Lisbon Strategy. In a Progress Report published at the end of 2007, the Commission said: "The earliest gains can be made in the area of energy efficiency, where governments can play a pioneering role."[17]

The Commission's recent 'lead market' initiative, which aims to support European companies in markets where they are at the cutting edge, underlines this point. Four of the six markets it identifies are in the eco-innovation field: sustainable construction; bio-based products (renewable raw materials); recycling/waste management; and renewable/CO_2-neutral energy generation.[18]

This initiative is a crucial launch pad for generating increased demand for commercially viable eco-innovation and, if implemented decisively, has the potential to create the necessary market for energy-efficient products.[19] A greater focus on energy efficiency in identifying future lead markets would provide a helpful impetus for further development to foster the rational use of energy.

A key element in efforts to ensure that the EU can benefit from market opportunities in the eco-innovation sector is the take-up of innovations which promote a more rational use of energy. The following section sets out what we mean by 'rational use of energy' and identifies some of the key barriers which are currently preventing a wider take-up of innovations which promote it.

II. Why energy users behave 'irrationally'

Defining the term

To explain what is meant by the term 'rational use of energy', it is helpful to start by setting out what we are referring to when we talk about the 'irrational use of energy.'

Energy is used irrationally when it is wasted or used unnecessarily, i.e. when more energy is consumed than is needed to achieve the desired result. It also occurs when consumers use energy without thinking about the environmental and energy-security implications, leading to over-use.

Examples of waste and unnecessary use are widespread. They include, for example, the energy used by the stand-by facility on appliances or the lighting of empty buildings, and the loss of heat energy which is produced as part of another process (for example, in manufacturing) and could be put to other uses.

Over-use of energy can also occur in a variety of settings – for example, where households or businesses use inefficient heating and insulation and have little incentive to change as they are not charged directly for the amount of energy they use. Another example is when motorists drive cars which use a very high amount of energy for each kilometre travelled or drive in ways which increase energy consumption.

The aim of this paper is to identify measures which are cost-effective in promoting the rational use of energy; or ideally where, overall, using energy more rationally pays for itself. While there might be additional costs for a particular economic 'agent' – such as households, businesses or the public sector – and politicians have to decide openly who will pay any such additional costs, the overall impact should, at worst, be neutral. For example, the savings which are made through more efficient insulation should balance or outweigh the investment needed to make these improvements.

Furthermore, measures which affect public authorities, industry, business and consumers should not only be cost-effective but also proportionate. The most effective overall improvement is often realised when preference is given to the lowest-cost way of achieving this.

The rational use of energy has significant potential, and the Danish example demonstrates that economic growth need not necessarily be accompanied by ever-increasing energy demand.

Denmark's economy has grown by more than 70% over the past two decades without an increase in the country's energy consumption.[20] This has been achieved by putting in place a series of measures such as mandatory building codes and labelling requirements for existing buildings; energy labels on appliances; voluntary agreements on energy efficiency in industry; energy-saving obligations for electricity, natural gas and district heating distribution companies; and taxes on energy (especially in households and the public sector).[21]

This policy has been so successful that Denmark is now aiming to reduce its overall energy consumption (excluding transport) by 2013.

Barriers and obstacles to the rational use of energy

If measures are cost-effective and contribute to a more rational use of energy, why are they not taken up? There are a variety of reasons why this might happen, such as consumer preferences, inertia or market failures. There are also natural limits to rational behaviour.

Achieving a more rational use of energy often means influencing individual choices. This is not only generally unpopular, but it can also be quite difficult if it involves persuading people to change their behaviour.

Small incremental changes, such as steady price increases, do not alter patterns of behaviour equally smoothly in the short term. Behaviour only tends to alter if these changes persist over time and they might not be sufficient to achieve broader energy policy objectives. At times, a very strong, sudden 'shock' can also move people from one behaviour pattern to another (for example, switching from driving cars to cycling).

Changing behaviour will not necessarily increase overall costs for the individual, as once new patterns of behaviour are established, the reduced use of energy might well lead to an overall saving. However, in the short term, introducing new measures can lead to high transition costs as people need time to adjust – and there is also a risk of overshooting the target.

To facilitate the introduction of innovations which can promote the rational use of energy, it may also be necessary to create 'critical mass' by encouraging demand for particular technologies. Once a sufficient level of critical mass is reached, the price of the technology will fall (as producers benefit from economies of scale) and the innovation will become more widely used if the price declines enough to make the technology widely affordable. (An example of this was the Spanish government's decision to make solar energy compulsory for all new buildings and when existing buildings undergo major renovations.)[22]

This is especially important where the innovation requires very significant investment at the outset, such as a new network or infrastructure.

Companies and individuals can often be at a disadvantage if they are among the first to invest in new energy-efficient technology. At an early stage, the technology is often more expensive and may be prone to teething problems. It may also be difficult for users to assess the precise impact of the technology on their energy use, as this will vary depending on patterns of behaviour and no comparisons will be immediately available. The negative effect of all this can be that everyone waits and the new technology is not adopted.

One of the general problems with environmental improvements is what economists call an 'externality' – where the cost of consuming a particular product does not reflect its wider environmental impact.

To achieve a more rational use of energy, it is also important to recognise that energy which is wasted or used at unnecessarily high levels is not generally priced differently than energy in general. Without these additional costs, there is often not enough of an incentive to use energy rationally.

This situation is aggravated by lack of information. Many consumers of energy or energy-intensive products and services are unaware of how much energy they are consuming, for example when the electricity used by individual households is not metered and paid for separately.

Even when consumers know how much energy they are using and are aware of the potential energy savings which could result from using more energy-efficient processes or technologies, it is still unclear what financial impact this might have 'down the line' because of uncertainty over future energy prices. Consumers might also be unaware of where and how to access these technologies, and what help and advice is available on how to take advantage of them.

Individual circumstances might also change: for example, through changes in transport usage or through a move from one rented premises (where investments have been made in energy efficiency) to another (where they have not). Individuals and, to a lesser extent, companies might also be limited by the funds available to invest in energy-efficiency measures, even when they are aware that this might bring longer-term gains.

In addition, consumers do not have ready access to information about the 'indirect' use of energy in the goods and services they consume, i.e. the amount of energy used during the production of specific goods. For example, information on the amount of energy going into the production and transportation of fruits and vegetables produced in Southern Europe and consumed in Northern Europe or those grown using energy-intensive agricultural techniques is not readily available to consumers.

For individuals and for companies in particular, the time frame over which savings will be made is also important and this tends to be shorter than for society as a whole. Society is generally concerned both about tackling current issues and problems and about the impact of current developments on future generations, as in the case of energy and climate change.

These differences in what is known in economic jargon as the 'discount rate' mean that companies and individuals are more likely to look for significant upfront energy-efficiency gains to justify any investment, whereas society as a whole would benefit more from the longer-term efficiency gains than the initial investment costs.

In addition, the benefits which accrue from the initial investment may not, in fact, go to the individual or company which made that investment if, for example, tools, machinery, vehicles or premises are sold to new owners or if a company or individual move from rented premises where they have made such an investment.

In cases where the energy user is not the person who pays the energy bill, there is also a significant risk that energy will not be used rationally. There is, for example, little incentive for individuals to reduce the energy use associated with business travel where the significant initial costs are met by their employer (for example, through the provision of a company car) and usage is fully reimbursed, regardless of energy-usage levels.

There is also an inbuilt inertia to introducing new technologies, resulting in long lead times to replace existing stock which is energy-inefficient, especially when it has a long lifespan.

When worn-out equipment needs to be replaced, companies will compare the merits of possible alternatives, including their energy efficiency. If the energy savings resulting from the new equipment outweigh the extra costs, companies will choose the energy-efficient alternative. However, when it comes to replacing equipment that is still functioning well, the situation is different: the energy savings must then outweigh the total price of the new equipment, leading to delays in the introduction of energy-efficient technologies. In most cases, replacing working equipment is also unlikely to be economically efficient.

Rented accommodation or offices pose particular problems, as the benefits of investing in making rented premises more energy efficient are not easily split between user and owner.

Investment is generally needed upfront and the investment impacts both on ongoing energy costs and the rental or capital value of the premises. In cases where energy is paid for on a flat-rate basis, there is little incentive for the user to reduce consumption. However, if the user pays in full for the energy he or she uses, the additional costs resulting from occupying energy-inefficient accommodation will be met by those renting the premises, so there is little incentive for the owner to invest in greater energy efficiency.

It also has to be recognised that there are limits to the extent to which individuals and, to a lesser extent, companies can be truly rational. Processing and acting on all of the information which is available to us in our daily lives is impossible, so we often resort to making decisions based on broad-brush judgements. Consumers might, for example, have formed opinions about certain products or services – "energy-efficient light bulbs create artificial-looking light"; "most household appliances do not use much energy"; or "cars with low emissions also have low performance" – which are hard to shift even if incorrect.

Individuals and, again to a lesser extent, companies might also not be sufficiently influenced by the price of excessive energy consumption, even when it reflects environmental costs. If the amount in question is very small

in relation to an individual consumer's income, changing behaviour might not bring sufficient cost advantages to warrant the effort (for example, switching to energy-efficient lighting).

The public sector might also not act entirely rationally in its use of energy. A more rational use of energy might only be an objective for some parts of the public sector, while others are more driven by simple cost considerations. At the local, regional, Member State or EU level, public organisations which do not consider a more rational use of energy as a priority may not devote enough time or resources to looking for examples of good practice to follow.

In addition, the public sector may not be fully aware of the extent to which it can act as an example to businesses and households, and thus fail to provide a lead in promoting the rational use of energy.

Furthermore, public-sector intervention can deter other economic agents, such as households or firms, from using energy rationally. Limitations on competition can have the effect of creating inefficiencies which in turn lead to higher energy use. For example, limiting cross-border competition for national transport markets can result in more 'empty-vehicle' (unloaded) journeys.

When attempting to address market failures, effective policy-making can be hindered by a lack of coordination across borders, within the EU and beyond. If additional measures impose an additional cost on an industry operating across the EU or in one EU country, it can shift economic activity away from this location without achieving the desired improvement overall. Similarly, new standards or additional charges can prevent effective market integration and competition if they are not introduced universally.

It should also be recognised that, in many cases, individual companies or sectors, and the governments in the countries where they are based, are unwilling to accept steps they consider too costly. While this is understandable, it must be recognised that the EU will have to take the lead in certain actions to achieve the necessary CO_2 reductions.

The following section considers how these obstacles and barriers can be overcome to promote a more rational use of energy, and identifies the tools needed to achieve this.

III. Five tools to promote rational behaviour

Given all the obstacles and barriers to a more rational use of energy identified in the previous section, what can be done to overcome them? The Task Force has identified five tools to achieve this:

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

Today's prices should reflect the environmental and energy impact of goods and services – a process known in economic jargon as 'internalising the externalities'. This implies that the price of goods and services being produced and sold today may be set differently from current market prices, to take into account future costs resulting from, for example, climate change and too great a dependency on external energy supplies.

This can only be done through political decisions, as politicians need to decide how to determine and include these future costs in today's prices.

In all cases, those who benefit from the use of energy should also be the ones who pay for it. However, to encourage a more rational use of energy, the price incentive has to be stronger than this. The price has to be especially sensitive to excessive or unnecessary usage and waste. This implies that usage over and above a certain level or the use of an inefficient technology should give rise to an extra 'waste' charge over and above the usual price of the energy itself.

Wherever possible, this charge should be paid 'upfront' to ensure that it is taken into account in purchasing decisions. However, ongoing charges related to usage levels are also important to ensure that there are sufficient incentives to restrict the ongoing use of energy.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

These can include fiscal incentives such as tax breaks but also loans, grants and co-financing. Clear and unbureaucratic incentives for individuals and

companies can often be a cost-effective way of achieving a more rational use of energy.

Introducing regulations or encouraging self-regulation can also boost the take-up of energy-efficient technology. In cases where inefficient technologies persist despite information being available about alternatives and strong price incentives to switch to them, the use of standards to phase out the most inefficient technology should be considered.

Technological standards can play a key role in stimulating technological progress and the use of the best available techniques if they are designed flexibly enough to adapt to changing technologies. They can also contribute to 'rewarding' technological performance and investments, especially since EU standards are increasingly being applied globally, as well as to eliminating sub-standard products over time.

However, to stimulate innovation effectively, standards must be dynamic and reflect the constant progress in technology. In addition, wherever possible, the method for setting standards which has the least impact on the functioning of markets should be used – self-regulation can, in specific cases, be a good alternative to traditional regulation.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

In many cases, investing in the technology needed to ensure a more rational use of energy makes good economic sense, but it can require significant upfront financial commitments – and there can be a long payback time in the form of lower energy bills. It would thus be advisable to develop and support mechanisms to ensure widespread access to loan and grant schemes for energy-efficiency measures.

Third-party financing for public organisations and businesses, where a third party (such as a financial services provider or energy systems company) provides the upfront investment and is then repaid from the energy-efficiency savings which accrue over time, can potentially create win-win situations.

For individual users, particular attention should be paid to situations where upfront investment in energy efficiency can have a long-term beneficial impact on those on low incomes. This could reduce energy usage and thus

social support costs for the public sector, while at the same time making low-income households better off.

4. Using the public sector as both a lever and an example.

The public sector can set an important example for both businesses and households to follow in promoting the rational use of energy – both in its own operations (for example, in the office buildings it occupies, as a landlord providing social housing or in reducing the use of private car transport by its employees for business travel) and in the wider economy, through its procurement of goods and services.

The public sector can also set an example for the private sector by demonstrating that new technologies can be introduced without interrupting normal working practices and can be cost efficient, drawing on good practice from across Europe. To ensure maximum credibility, the EU institutions should take the lead in this.

The public sector can create the critical mass required to make new technologies operational, especially where the introduction of such technology requires investment in a network or infrastructure, and particularly when it works together with private-sector suppliers and buyers, as well as supporting research and development in the field of eco-innovation. In addition, in areas where government rules create a barrier to the efficient operation of the market, the removal of such barriers can contribute to a more rational use of energy.

5. Providing the information needed for individuals and companies to make rational choices.

Increasing consumers' knowledge and awareness of the amount of energy they are using – and the impact this has – is an important part of efforts to change behaviour and could play a key role in achieving such changes, although it is only part of the answer.

This can be done by targeting both the 'direct' use of energy (through, for example, the compulsory introduction of metering) and its 'indirect' use in the production of consumer goods (through, for example, energy labelling). Users also need more information about the running costs, in energy and financial terms, of any consumer product and businesses

should provide more information about the energy costs of producing particular goods.

Who should act and what mechanisms can they use?

A number of the recommendations in this paper are aimed at EU policy-makers, with a view to introducing Union-wide provisions to foster the rational use of energy, or to remove provisions which distort the market and result in inefficient use of energy.

Others are aimed at the Member States, regions and other public-sector bodies, in cases where the key actions need to be taken at these levels.

The private sector has a key role to play, not only to realise its large energy savings' potential but also to harness eco-innovation as a driver for EU competitiveness in green technologies worldwide.

Households and individual consumers can also play an important role, not least in triggering changes in industrial practice as well as implementing the necessary attitude and behavioural changes to achieve a more rational use of energy.

Overall, there is a critical need for political commitment – and the EU level is best placed to secure that commitment and drive this policy forward. The Union should use all the tools available to it – including persuasion, coordination, the exchange of best practices, etc. – to do this.

It can provide a framework for fostering energy efficiency in a coherent manner across the EU as a whole, while at the same time making sure that the measures used to fulfil its ambitious energy and environment targets do not have a detrimental impact on EU competitiveness and the single market.

Having identified possible tools to bring about the necessary changes, the following section provides examples of what could be done in four specific sectors: buildings, appliances, road transport and industry.

IV. Applying the tools in key sectors

Buildings

Buildings account for the largest share of total EU energy consumption (42%) and produce about 35% of all greenhouse gas emissions.[23] The largest cost-savings potential lies in the residential (households) and commercial buildings sector – 27% and 30% respectively.[24]

Improving the energy performance of buildings across the EU as a whole is made more difficult by the differing conditions in individual Member States, which make one-size-fit-all measures and EU-wide standards relatively ineffective.

Firstly, climatic conditions and housing patterns differ widely across the Union. As a consequence, EU-wide legislation can only set general objectives and leave it up to the Member States to decide, according to national conditions, how best to achieve those objectives.

EU countries also have very different energy-performance 'histories', with buildings in the new Member States generally less energy-efficient than those in the EU-15 – a situation which the European Alliance of Companies for Energy Efficiency in Buildings (EUROACE) ascribes to "a legacy of inefficient, deteriorating buildings and heating systems".[25]

Furthermore, the energy savings' potential of old and new buildings is different. Minimum standards for new buildings are often stricter than those for existing buildings, yet their impact remains relatively limited: the renewal rate of existing building stock is estimated at 2% per year, so relatively few new buildings will be constructed by 2020.[26] It is important to ensure that new buildings are designed in accordance with the best energy-efficiency standards, but it is the existing building stock that needs to be upgraded to make a significant difference.

Another difficulty arises from the fact that buildings are occupied in different ways, with a large proportion used by tenants, which undermines the impact of energy-efficiency incentive mechanisms.

Tenants generally have very little influence over landlords' decisions on whether to improve the energy efficiency of buildings by installing wall insulation, double-glazing, thermostat valves, etc.; and landlords have very little incentive to make improvements if they do not benefit from the reduced energy use that results.

Finally, an almost EU-wide shortage of energy auditors, assessors and inspectors is currently making any comprehensive assessment of the energy performance of buildings in the Union difficult.

So what can be done, using the tools outlined in the previous section?

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

New technology which contributes to a more rational use of energy in buildings should be promoted. But unless the energy and environmental footprint of buildings is priced and reflected in purchasing decisions or usage costs, even existing energy efficient technology is unlikely to be used.

Recommendation:

- The electricity consumed in domestic or commercial buildings should be paid for by those who use it. Flat-rate or all-inclusive charges for energy consumption should be discouraged.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

Companies and individuals may be reluctant to invest in upgrading buildings if they deem that the return on their investment will be too slow. To tackle this problem, public authorities should provide incentives to make energy-efficiency improvements, such as avoiding the loss of energy through thermal insulation, upgrading heating, cooling, lighting and airing systems, and enhancing indoor air quality and ventilation. This would contribute to changing individual behaviours in the long term.

Although there is great potential in using existing technology more extensively, currently only a limited number of products which improve

energy efficiency are included in the revised Eco-Design Directive. This means energy-efficient and energy-inefficient products are often treated in the same way and compete on the same terms, even though they have different carbon and energy footprints.

Windows are a case in point. It is generally estimated that they account for 30% of the heat lost from buildings. However, only about half of the windows in the EU-15 are currently double-glazed, and progress has been even slower in Central and Eastern Europe.[27]

Recommendations:

- All products which improve the energy efficiency of buildings should be included within the scope of the Eco-Design Directive, including those which use energy (heating) as well as those which do not (such as windows) but have an important indirect impact on energy usage. Including them in the Directive would ensure that these products comply with minimum energy-efficiency standards.

- Public authorities should work together with the private sector to develop schemes offering loans on favourable terms (long-term, low-interest) to households to pay for energy efficiency upgrades. This type of financial instrument has already been used to provide loans for students, and could be applied to residential premises. Public co-financing of such schemes could also be offered.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

Third-party financing can make it possible to carry out energy upgrades without any upfront capital costs or special loans.

Energy services companies (ESCOs) are contracted to provide customised solutions for upgrading buildings ('retrofit'). Energy is saved through improvements to, for example, infrastructure, heating, ventilation or air-conditioning, and the subsequent savings are used to pay for the retrofit. As a result, the work is budget-neutral; i.e. owners do not have to set aside funding to pay for it or take out loans.

Energy-saving contracting schemes are usually used for large buildings where the energy bills are significant, and rarely for individual homeowners. But the

principles which underpin such schemes could be extended to householders, who are often reluctant to install double-glazing or wall insulation or switch from electricity to gas heating systems because the upfront investment is too high. Loan schemes of the type described above could be used to provide the necessary capital to perform the energy upgrades, with the subsequent savings on energy bills used to pay back the loan.

For low-income households, where a large share of disposable income is spent on energy bills, the problem is more acute. Some EU countries alleviate this by providing fuel allowances in winter, but this does nothing to achieve the necessary energy-efficiency improvements. It should be possible to convert such allowances into upfront investment in energy-efficiency measures, both reducing householders' energy bills and providing for a more rational use of resources in the long term.

Recommendation:

- Existing third-party financing mechanisms should be promoted and extended to the private sector, and adopted by a much broader range of public sector organisations, building on existing good-practice examples.

4. Using the public sector as both a lever and an example.

A large proportion of the existing building stock is publicly owned: about 30% in the EU-15[28] and between 5% and 20% in Central and Eastern Europe (where, after decades of high public ownership, the proportion of publicly-owned buildings has dropped). Nonetheless the potential impact of public sector measures remains high.

The public sector also covers 40% of the demand for the construction of new buildings across the EU.[29] To stimulate demand and foster European competitiveness in this sector, the European Commission recently identified sustainable construction as one of six priority areas in which public action will be taken to boost innovation, stimulate growth and create jobs.[30]

Energy-efficiency measures in the public sector are important because they can be introduced by public authorities without recourse to taxation or other indirect measures. If the public sector were to take a lead, it would also set an important example to be followed, not least if it can demonstrate that the cost of investments in energy-efficiency improvements can be recuperated quickly.

As outlined above, budget-neutral energy-saving schemes have already been used by public authorities, but their take-up has been relatively slow. Overall, this very much depends on the importance which Member States attach to energy efficiency and environmental targets. Lack of information is also a factor, as many public authorities seem unaware or uncertain about the benefits of energy-performance saving contracting.

The City of Berlin provides a good illustration of how effective energy-saving contracting is, particularly for the public sector.

The city was operating on a very tight budget and did not have sufficient resources to allocate any funding to modernising public buildings.

In 1997, it called upon the Berlin Energy Agency to develop and implement an Energy-Saving Partnership programme based on partnerships with energy service companies (ESCOs). The ESCOs were responsible for financing energy-efficiency upgrades (retrofit) of about 1,400 buildings over a period of 8-12 years.

The annual savings arising from the energy upgrades were used to finance the ESCOs' retrofit investments. The immediate impact was an annual reduction in CO_2 emissions of about 60,000 tons and annual financial savings of €10,000,000 in 1,400 buildings. The operation did not cost the City of Berlin a single euro.[31]

Recommendations:

- Public procurement rules for the public sector should take greater account of the economic benefits arising from energy-efficiency and environmental measures.

- All public sector organisations (including the European institutions) should set themselves ambitious targets for energy efficiency and achieve them through procurement and investment, with immediate effect for new buildings and under a phased programme for existing stock.

5. Providing the information needed for individuals and companies to make rational choices.

Clear information on the energy used by commercial and residential buildings is essential, not least so that occupiers know what level of energy use to expect. In particular, this information should be provided when requested by tenants or potential buyers.

Recommendation:

- Metering should be compulsory for all companies and individual households. In rented properties (private or commercial), energy consumption should always be identified separately from the rent and any other charges.

Appliances

The energy consumed by appliances accounts for an estimated 25% of all the energy used by households, and has been an important element of EU energy policy to date.

Lighting provides a useful illustration of untapped energy savings potential.

Greenpeace estimates that switching to energy-efficient light bulbs (Compact Fluorescent Light bulbs – CFL) in the EU could save about 32 million tons of CO_2 per year, and close down 25 medium-sized power plants.[32] Electronics giant Philips is even more optimistic, estimating that the savings potential amounts to €14 billion in electricity costs per year,[33] 59 million tons of CO_2 emissions a year, 200 million barrels of oil-equivalent a year and the output of more than 67 power plants.[34]

Despite the magnitude of these potential savings, progress to date has been slow and remains hampered by a number of obstacles.

The upfront cost of energy-efficient light bulbs is significantly higher than the cost of traditional ones, and consumers remain doubtful about the energy savings to be made by switching. Bad experiences with first-generation Compact Fluorescent Light Bulbs (CLFs), which were introduced in the 1980s and often produced an artificial-looking light, have also discouraged shoppers from trying the newer versions. As a result, consumers have generally opted to continue using the incandescent light bulbs which have dominated the household market since the 1960s.

Many are calling for a ban on conventional light bulbs; most recently Ireland, which has announced legislation banning the sale of normal incandescent light bulbs from 2009. However, although many Member States have announced or promised to switch to energy-efficient light bulbs, words have as yet not been followed by deeds.

Why? The main problem is that national bans would conflict with EU mutual recognition rules governing the internal market and, unless exceptions are made for environmentally progressive measures, such bans would be illegal. Even granting environmental waivers would not be a 'silver bullet', as they risk fragmenting the internal market.

Although the take-up of energy-efficient appliances has increased, this has not occurred on a massive scale and experts have predicted that the amount of energy used by households will increase by 2% a year.[35] Part of this rise stems from the increasing use of office equipment such as computers at home, which EU-Energy Star estimates will account for 8.9% of the electricity bill of the average EU household by 2010.[36]

So what can be done, using the tools outlined in this paper?

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

The recommendations detailed in the buildings section, which would ensure that households and business are charged according to their energy use, would also have an impact on the rational use of energy with regard to appliances.

Higher charges for appliances which use more energy than necessary would, in principle, be desirable. However, the task of pricing appliances according to their environmental and energy footprint is challenging and the level of bureaucracy required would make this costly to implement.

The principle might also not be as applicable as in other sectors (buildings and transport in particular) given the wide variety of appliances on the market, and the fact that their CO_2 and energy footprint varies according to size and format. Therefore there is no system for pricing appliances which could be appropriate and cost-effective.

A more effective approach is the setting of efficiency standards for appliances. The current status, and scope for improvement, in such standards and incentives will be analysed in the following section.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

In the early 1990s, the EU Energy Labelling Directive (92/75/CEE)[37] introduced the first EU-wide requirements to provide information on the energy efficiency of appliances on labels. Household appliances covered by the Directive include refrigerators, freezers, washing machines, dryers, dishwashers, ovens, water heaters, lighting sources and air conditioning equipment.

The energy labels are the same across the EU and rate the energy efficiency of the appliance on a scale of efficiency categories going from A to G (with A being the most efficient). To reflect technological advances, A+ and A++ categories were added for freezers and refrigerators at a later stage.

However, over the past two decades, as more appliances have moved up the efficiency ladder, the gap between the energy performance of different products within the most efficient Category (A) has widened. As a result, it is difficult for consumers to assess whether a product is at the top or bottom of this category.

This penalises manufacturers which have invested in energy-efficiency technology but do not reap the full rewards of doing so because of the lack of a clear differentiation between products. It also penalises consumers, who are unclear about the actual efficiency of appliances in Category A.

To be fully effective, energy-efficiency standards also need to cover a more comprehensive range of appliances. The current standards for household appliances and office equipment only cover a fraction of existing products and do not, for example, include most electronic consumer goods (computers, televisions etc.), which currently account for 11% of domestic electricity consumption in the EU.[38]

Recommendations:

- 'Best-performer' standards (Eco-Design Directive etc.) should replace static energy-efficiency standards in order to ensure that inefficient goods are gradually phased out.

- Concrete measures are needed quickly to ensure that the Eco-Design Directive covers all energy-using products such as light bulbs (CFLs), computers and televisions.

- Fiscal incentives should be developed to speed up the take-up of energy efficient appliances.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

The high upfront price of energy-efficient appliances is an important deterrent which has slowed their take-up. Mechanisms are needed to

provide the necessary funding, particularly for lower-income households, where the purchase cost appears to be too high despite the long-term benefits of buying energy-efficient appliances.

In cases where appliances are not used by those who have bought them (for example, they are bought by landlords but used by tenants), incentives need to be provided for property owners to buy efficient appliances.

Recommendations:

- Incentives to buy energy-efficient appliances should be provided to low-income households in the form of energy grants.

- Public authorities should ensure that new appliances installed in social housing comply with the highest energy-efficiency standards.

4. Using the public sector as both a lever and an example.

The public sector can become a model for the rational use of energy in appliances.

Firstly, through the procurement of goods and services, the public sector can contribute to building the critical mass necessary to make new technologies operational. It can take a lead and provide examples of how to prevent energy being wasted, and play a key role in show-casing technologies to reduce the waste resulting from, for example, lights being left on in public office buildings at night and leaving appliances in standby mode.

Recommendations:

- EU-Energy Star should be strengthened by extending the range of products it covers to include new technological devices used as 'office equipment'; and, in particular, energy-efficient light bulbs.

- Existing technology such as metering and sensors should be used to combat energy waste and to demonstrate to the private sector that these ICT devices can be installed without causing disruption (for example, energy-efficient standby modes do not necessarily create problems for server updates; office lights can be automatically turned off without disturbing office work).

- Green procurement should be in place in the public sector to encourage the take-up of energy-efficient appliances and phase out energy-inefficient ones.

5. Providing the information needed for individuals and companies to make rational choices.

There are natural limits to the capacity of users to process all the existing information on energy efficiency. But increasing their knowledge and awareness of the amount of energy they are consuming is an important element in changing behaviour and ultimately achieving more rational levels of energy usage.

It is widely recognised that energy-efficiency labelling, and in particular the EU Labelling Directive, have successfully contributed to increasing the take-up of efficient appliances over the past decade. Rising energy prices have also contributed to stimulating the demand for energy-efficient appliances. The impact has been particularly strong on the 'white goods' sector, including dishwashers, washing machines and refrigerators, where only a small percentage of sales are now in the low-efficiency Category C (below 10% in 2004-05). For other goods, the take-up has been slower (only 47% of freezers and electric ovens were from category A, A+ or A++ in 2004-05).[39]

But there are some important limits to the effectiveness of labelling in Europe. Firstly, its impact varies from country to country: it is estimated that in the late 1990s, labels influenced about 56% of white goods' purchasing decisions in Denmark but only 4% of sales in Greece.[40]

Secondly, critics claim that European household appliances "have outgrown the existing energy label".[41] CECED, a European association of appliance manufacturers, argues that technology-rating categories are not updated frequently enough. As a result, European consumers are buying more Category A products, but the categories are based on outdated standards. Existing labelling schemes also only cover a limited share of household products.

Finally the lack of uniformity in providing energy savings' information across EU Member States and across retailers and outlets (i.e. big or small retailers; shop or Internet sales) appears to have discouraged the take-up of energy-efficient appliances.

Recommendations:

- More and better information should be provided about the energy efficiency of products throughout their 'lifecycle'. Where possible, the economic gains arising from energy efficiency should be expressed in terms of cash savings and communicated at the point of sale.

- Incentives should be created for retailers to provide consumers with information about the energy efficiency of appliances.

Road transport

The transport sector accounts for approximately 20% of total primary[42] energy consumption in the EU, with fossil fuels – mainly oil – accounting for almost all of this (98%). This makes the transport sector particularly vulnerable to oil price fluctuations as well as making it difficult for the sector to meet the 'decarbonisation' challenge.

Road transport is not the only part of the transport sector which needs to improve its performance in this area. For example, while air transport accounts for a smaller share of overall energy consumption and CO_2 emissions than road transport, its share is rapidly rising, with a 67% increase in the energy used by air transport over the past decade.[43]

However, there are many specific issues which make air transport very different from road transport – particularly the rise of low-cost transportation and the inclusion of air transport in the European Emissions Trading Scheme (ETS). It remains to be seen whether the latter will successfully contribute to sustainable development.

The road transport sector still accounts for more than 80% of energy consumption in the transport sector as a whole. This section thus focuses specifically on passenger cars and trucks. While inter-modality is an important element in the rational use of energy in transport, this is not addressed explicitly in this paper as it has previously been covered in an EPC Working Paper on sustainable mobility in Europe.[44] The Task Force also refrained from addressing the issue of biofuels, as their short-term, wide-scale potential application remains uncertain.

Despite its dependence on fossil fuel, and soaring oil prices,[45] energy consumption in road transport increased by 27% between 1990 and 2004,[46] with the number of cars increasing by 40% to roughly one car per two EU inhabitants.[47] Transport also appears to be the only sector where greenhouse gas emissions increased markedly between 1990 and 2004, up 26%.[48] There is thus still significant scope to achieve CO_2 emission reductions by, for example, using energy-efficient technologies.

What lies behind the increase in road transport? Mobility is an essential component of EU integration, economic growth and welfare, and as European economies and *per capita* income grows, the transport needs and

demands of industry, businesses and consumers increase too. The problem is exacerbated by the fact that market failures such as lack of information, as well as government intervention, can hinder the rational use of energy in the road transport sector.

Gaps in the internal market for transport, for instance, are a significant hindrance to realising the potential energy efficiency gains to be derived from technological progress in transport logistics, which are crucial not only to ensure that transport operators pick up freight across the EU but also to limit congestion and fuel consumption, and therefore reduce CO_2 emissions.

The impact of *cabotage* operations (with trucks from one Member State collecting and delivering goods in another) varies from country to country. It depends on how much access Member States give foreign operators and this is not always fully in line with the principle of free movement of goods and services enshrined in the EU Treaties.[49]

Some EU rules also limit the potential scope of *cabotage* operations, for example by restricting to three the number of *cabotage* operations which can be carried out within a seven-day period after a loaded truck enters the host country. Furthermore, if *cabotage* can only begin after the goods carried on the incoming journey have been delivered, this limits the potential scope for energy efficiency in the field of transport logistics.[50]

Rational use of energy is also an issue for private vehicle users. The recent surge in oil prices has raised consumer awareness of energy scarcity. But old habits die hard and there does not seem to have been a dramatic shift towards smaller, energy-efficient cars. Even if individuals change their purchasing choices in light of permanently higher petrol prices, it takes time for any changes to work themselves through the system as the existing stock of cars is not affected.

In a recent *Eurobarometer Survey*, only two out of ten Europeans questioned said they would use their car "a lot less often" if the price of unleaded fuel/diesel reached €2 per litre.[51] The recent oil price increases might have a greater impact on behaviour if they persist, but consumers lack information about future oil costs. For the moment, it seems that most consumers have accepted the increasing costs without changing their behaviour significantly.

So what can be done, using the tools outlined in this paper?

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

To limit unnecessary road transport or the use of energy-inefficient transport modes, the cost of driving should be priced to reflect both its environmental and energy footprint. This would act as a deterrent to wasteful 'behaviour' – for example, making unnecessary journeys by car or driving energy-guzzling vehicles. It would also encourage the take-up of energy-efficient technologies.

In many Member States, company cars account for up to 50% of annual sales of new cars.[52] These are often offered to employees as benefits and many businesses also fully reimburse driving costs. Such incentives discourage a more rational use of energy: because users do not directly pay for the energy they use, or are reimbursed in full no matter how much energy they consume or how many kilometres they drive, they have little incentive to pay attention to the energy and environmental impact of motoring.

Recommendations:

- Employee benefits which encourage driving, such as company cars and full reimbursement of mileage, should be converted into incentives to change individual behaviour such as public transport subsidies or monetary benefits, based on the estimated cost of energy-efficient driving. It would then be up to the individual to decide whether to stay below or go beyond this allowance, which would encourage them to make more rational motoring decisions; i.e. to make fewer journeys and drive in a more energy-efficient way to save money.

- Companies should ensure that company cars are energy-efficient. This would both reduce CO_2 emissions and could potentially contribute to cost savings for businesses, which could be particularly significant for small- and medium-sized enterprises.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

Energy-efficiency standards have evolved in line with the development of the car industry and technological improvements in passenger cars. But since the 1970s' oil shocks, they have also been driven by increased consumer

concerns over fuel prices. More recently, environmental and health considerations have encouraged the development of more energy-efficient technologies and standards.

More recently, the EU sought to achieve cuts in CO_2 emissions through a voluntary accord (ACEA agreement) setting standards for emissions per company fleet. However, the European Commission raised concerns that some car manufacturers would not meet the targets within the agreed time frame and subsequently, proposed binding legislation to address this issue in December 2007.

This proposal has prompted an EU-wide debate over how and by how much CO_2 emissions from passenger cars should be reduced. Some argue that the proposal is less ambitious than previous EU initiatives (130g of CO_2 per kilometre by 2012 compared with 120g by 2005 or, at the latest, by 2010 proposed in 1995 Council Conclusions). However, the Commission estimates that this will translate into an overall 19% reduction in CO_2 emissions and make the EU a world leader in fuel-efficient cars.[53]

As well as improving the energy-efficiency of passenger cars, other incentives should be developed within a broader and more comprehensive strategy for road transport, in particular to facilitate the free movement of goods and services across all EU Member States. National or EU measures at times put limits on *cabotage* operations and inhibit the efficient working of the internal market, which can result in more waste and congestion and, ultimately, less energy efficiency and more CO_2 emissions.

Recommendations:

- While the Commission proposal paves the way for significant potential energy savings, the best-performing cost-effective fuel-efficiency technology by segment on the market should become the benchmark in the long term to ensure constant upgrading of vehicle efficiency in line with technological developments. A progressive charge could be levied proportionate to how far the vehicle is from the benchmark. Some of this would be charged upfront so consumers take it into account when buying vehicles, with the remainder levied annually to reflect the ongoing costs.

- Incentives and research funding should be used to boost the development and use of ICT solutions and, in particular, logistics technologies to combat congestion. These include traffic monitoring, flexible working hours to reduce traffic at peak hours, and reducing business journeys through, for example, teleconferencing.

- Where *cabotage* restrictions result in inefficient use of energy in cross-border freight transport, these restrictions should be removed. Protecting health and safety must remain an essential consideration, but should not be misused to shield national transport markets. In general, health and safety measures should focus on mechanisms which do not impact negatively on transport efficiency.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

When companies buy vehicles for commercial use, they tend to look for a relatively short-term return on their upfront investment and are unlikely to contemplate replacing existing working vehicles with more energy-efficient ones unless offered sufficient incentives to do so.

Recommendation:

- For users of large fleets of vehicles, financial instruments should be put in place to provide solutions for the upfront investment in energy-efficient vehicles. For individual users, some Member States are already promoting low-interest loans for buying energy-efficient cars. Such practices could be expanded across the EU.

4. Using the public sector as both a lever and an example.

The public sector plays an important role in setting an example in the transport sector, and there are several levers it can use to promote a more rational use of energy.

Firstly, through procurement, the public sector can contribute to building the critical mass necessary to make energy-efficient technologies marketable. This could be done by, for example, encouraging the purchase of energy-efficient buses and therefore the take-up of 'clean' technologies. Public procurement can also be used to set environmental standards for vehicles used in sectors which are often exempted from energy and environmental standards. In

addition, public-private partnerships (PPP) could help develop critical mass and launch specific technological innovations.

Public authorities can also influence the energy efficiency of car fleets beyond the public sector by setting energy and environmental standards when authorising private operators. Some cities, for example, have rules governing what kind of taxis can be used and how they can be used.

The public sector can also use its urban transport strategies to encourage the rational use of energy. For example, encouraging 'high occupancy' lanes (lanes which can only be used by cars with more than one occupant), only allowing delivery vehicles which meet energy efficiency standards to use priority lanes, or encouraging the use of logistics solutions to reduce the number of inner city deliveries, can all contribute to a more rational use of energy.

Finally, the public sector can influence the individual behaviour of its employees by, for example, promoting flexible working to reduce congestion at peak hours or limiting the use of cars by not providing parking facilities, as and when appropriate.

Recommendations:

- The public sector should make energy efficiency an integral part of procurement policy.

- It should also contribute to creating the critical mass necessary to accelerate the take-up of technologies fostering the rational use of energy.

5. Providing the information needed for individuals and companies to make rational choices.

Companies, businesses, public authorities and individuals tend to heavily 'discount' the future cost savings from fuel economy, and there is scope for improving the information provided to them on the real cost of road transport. *The King Review of low-carbon cars* indicates that, on average, consumers apply a very high discount rate (60%) and are looking to recoup any additional cost of buying the vehicle through savings on fuel costs within 18 months[54]

According to the British motorists' association the RAC, consumers also appear to underestimate the costs of running their car by 50%.[55] These costs

not only include fuel but also depreciation, repairs, wear and tear, and servicing, which together are estimated to cost twice as much as the fuel used by the driver. Insurance and road tax also need to be added to get a true picture of the overall costs.

Eco-driving can significantly reduce the environmental and energy impact of driving, so it is important to make motorists aware of the impact of speed, loads, tyre pressure, etc. on the cost of driving. Information on fuel efficiency is also very important, as it allows consumers to compare cars within the same category. To this end, the Commission recently invited manufacturers to sign an EU Code of Good Practice on car marketing and advertising.

Recommendations:

- More complete information should be provided to users on all the lifetime costs of a vehicle and the potential savings to be made through eco-driving.

- Harmonised EU-wide labelling on energy efficiency should be introduced.

Industry

This paper focuses on the use of energy, rather than on the energy production and distribution sector itself. Maximising the efficiency of electricity generation and determining the right mix of energy sources while, at the same time, minimising the environmental and energy-security impact, is clearly an important part of overall energy policy. However, the focus of the Task Force's work has been on the rational *use* of energy.

Since the oil shocks of the 1970s and early 1980s, the rational use of energy in industry has been one of the key elements of energy policy. At EU level, this has been addressed through the Integrated Pollution Prevention and Control Directive (IPPC) and is also an important aspect of the EU Emissions Trading Scheme (ETS). More recently, the Energy Services Directive and the Co-Generation Directive have pushed in the same direction.

It is, however, important to recognise that EU economies have changed fundamentally in recent years and will continue to do so. The contribution of industry[56] (which encompasses the traditional manufacturing sector) to the EU economy has been shrinking and now stands at just over 20%, with business activities and financial services contributing more than 25%, and trade, transport and communication almost 22%. Even other services – including public sector services such as health and education as well as community, personal and social services – contribute a higher share, at 22.5%.[57]

This means that in total, the service sector now accounts for some 70% of all economic activity in Europe. While manufacturing, and especially the manufacture of high value-added products, is still an important sector, especially in countries like Germany, the EU-wide economy increasingly relies on the services sector.

So what does this imply for the rational use of energy? First and foremost, it is clear that manufacturing processes account for only part of the energy used in the private sector, with services and logistics consuming an increasingly large share.

In this kind of economic activity, the energy usage will be similar to that described in previous chapters – for appliances (especially business appliances such as computers), buildings (such as office buildings), and

transport (freight and also use of company cars). More attention needs to be paid to this issue in the private sector: good-practice examples and the recommendations from previous chapters apply to the commercial users of appliances, buildings and transport.

The shift away from manufacturing has also been accompanied by an increasingly knowledge-intensive economy. Very little 'traditional' manufacturing (which relies on a cost advantage arising from bulk production) remains within the EU. There has also been a shift to increasingly human capital-intensive services and manufacturing, which require a high level of skills.

To achieve a more rational use of energy in this sector, consideration will have to be given to individual behaviours and how incentives can be created at the individual employee level.

Building on past progress

Within industry, much has already been done to enhance energy efficiency over the last few decades. In contrast to the oil shocks of the 1970s and early 1980s which triggered large-scale recessions, EU economies have demonstrated a surprising resilience in the face of recent sky-rocketing oil prices. In addition to the changing nature of economic activity and more diverse energy sources, some economists, such as Olivier Blanchard at MIT, have argued that industry's increasingly rational use of energy might be one of the key factors contributing to this resilience.[58]

So, despite industry's declining share of economic activity, it can still contribute significantly to achieving a more rational use of energy: in 2005, it accounted for more than a quarter of final energy consumption and more than 15% of CO_2 emissions in the EU.[59]

The increasingly sophisticated manufacturing that remains in Europe should be able to take a more sophisticated approach to energy use and climate considerations. Under any circumstances, given current energy prices, rational use of energy will create a win-win situation.

Industry can also potentially benefit from producing more energy-efficient products, both for the EU market and increasingly for international exports. The manufacture of energy-efficient products is a niche market, in which

there are good opportunities to position green products at a premium. With high energy prices and a limited supply of resources, energy-efficient products can have the edge over those which do not take energy usage into account.

However, industry generally considers investing in energy efficiency in the same way as other investments and looks for a relatively rapid pay-back. There is thus still considerable unexploited potential to increase the use of energy-efficient technologies beyond those which pay for themselves within a very short time frame.

What can be done?

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

The EU's main instrument with regard to energy prices is the Emissions Trading Scheme (ETS), launched in 2005. While establishing the ETS was a useful and necessary step to price carbon emissions, given the scheme's initial failure to produce the desired emissions' reductions, there is still a great deal of room for improvement overall.

In January 2008, the European Commission published a proposal designed to improve implementation of the ETS and to it more flexible to adapt to changing circumstances (for example, changing emission targets).

A reformed ETS has the potential to support a more rational use of energy and achieve three key objectives simultaneously: reducing emissions, reducing external energy dependency and encouraging eco-innovation.

To do this, energy use in the private sector needs to be addressed in a comprehensive and consistent way, with all sectors, not just manufacturing, paying in full for the energy they consume, whether it is used directly in manufacturing processes or indirectly in logistics, business travel, office buildings or the use of appliances such as computers. This would also reflect the increasingly complex nature of modern manufacturing companies, which have many functions besides manufacturing, including logistics, research, administration, marketing, etc.

However, this does not mean that all of industry should be treated in exactly the same way. It is important to recognise that higher energy prices have a different impact on different type of companies.

Raising the cost of energy might have the desired effect of reducing energy use without a detrimental impact on economic activity for most companies. However, higher energy costs could well put energy-intensive industries at a competitive disadvantage against global competitors and result in a shift of production to outside the EU (which would result in a more inefficient use of energy overall).

Recommendations:

- Global standards should be pursued for energy-intensive industries, and some industries will need to be treated differently from others in any charging scheme.

- For those industries which are not included in any such charging scheme, energy auditing could be much more widely applied. This should give sufficiently priority to the value of energy savings in a broader context, including CO_2 emissions and security of supply.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

In many cases, energy and heat consumption can be improved when new manufacturing facilities are being designed, for example, by finding ways to re-use heat which is a side product of manufacturing processes.

Public authorities could do more to support the co-location of different processes on the same premises and integrated energy-management systems; for example, by supporting industry parks where energy management is built into the design. Proposals which include a more rational use of energy (including re-using waste energy) could be favoured in planning processes.

The most significant energy-saving potential in industry comes from improving the energy use of motors and the systems in which they operate. Between 60% and 65% of all electrical energy used by industry is converted back into mechanical energy in induction motors[60] and the technology exists

to improve their energy efficiency significantly, as well as improving the use of energy in the system as a whole by, for example, introducing variable speed drives (like the gears in a car).

A recent paper by BUSINESSEUROPE[61] on energy efficiency notes that "huge energy savings can be achieved by combining motors with variable-speed drives, which regulate the speed of a motor to the needs of the process it is running. … [But] despite the scale of the potential savings, less than 10% of motors worldwide are combined with a variable speed drive."

While replacing motors which are still working would not be feasible, as this would mean scrapping valuable working machinery and create significant additional costs for industry, new motors could become more efficient in the near future.

Recommendations:

- In designing ETS schemes, the new structure of European industry should be taken into account and the focus should be on achieving three objectives simultaneously: reducing emissions, reducing external energy dependency and encouraging eco-innovation.

- There should be a consistent standard across the EU for energy use by motors, using a 'whole systems' approach to measure energy use and covering all sectors and companies. Over time, the most inefficient motors and systems should be phased out as new purchases/investments are made.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

Like households, industry tends to look for a fast return on its investments, which may not be best for society as a whole in the long term. In industries which tend to rely on long-term energy contracts (to ensure security of supply and smooth out the impact of energy price fluctuations), there is potential for government, energy providers and industry to work together in designing public-private partnerships to provide loans (equivalent to the lump-sum energy savings over the life-time of the contract) to be used for upfront investments in energy efficiency, which are repaid through a higher energy price.

Recommendation:

- The public sector should – alone or in public-private partnerships – develop schemes to fund energy-efficiency upgrades, reimbursing funding from the money companies save in energy costs.

4. Using the public sector as both a lever and an example.

The public sector is not generally involved in manufacturing but, like the services sector, it is a user of energy in its own right. As such it can provide an example to the private sector in reducing the indirect use of energy associated with business activity, such as business travel, transport logistics, commuting to and from work, office appliances and building and construction activity, as set out in previous chapters of this paper.

The public sector could also support stronger industrial standards for energy use and efficiency, for example though the ISO certification process, and by channelling its research and development funding into technologies which improve the energy-efficiency of industrial processes and products.

While there is already a strong focus on eco-innovation and energy at EU level (for example, in the Seventh Framework Programme (FP7) and the Lead Market Initiative), more needs to be done to ensure that this is consistently pursued at Member State level.

Finally, while a range of support mechanisms are available for firms to introduce energy-efficiency measures in Member States, the current framework does not provide for coherent, easy access to this support, which should aim to improve competitiveness by reducing long-term running costs arising from energy inefficiencies.

Recommendations:

- The public sector should provide examples of best practice in rational use of energy, and should work with industry to raise industrial standards (such as the ISOs) to provide further incentives for more rational use of energy.

- Research and innovation funding at Member State and EU level should support practical applications which improve the energy efficiency of processes and products in industry as a priority.

- Starting with the EU regional funds, supplemented by national schemes, there should be easier access to co-financing for energy efficiency measures. State aids and other subsidies (where compatible with the current EU framework) could also be made contingent on companies' energy-efficiency improvement plans.

5. Providing the information needed for individuals and companies to make rational choices.

To understand industry's impact on energy fully, it is crucial for consumers and the wider public, including policy-makers, to be aware of how much energy is used within a particular business. Industries should disclose information on energy use and 'responsible energy use' should be promoted in a similar way to 'corporate social responsibility'.

The Carbon Disclosure Project (CDP)[62] is an example of good practice which could be built on. Through shareholder and investor pressure, the CDP is ensuring that the implications of climate change for shareholder value and commercial operations are taken into account in setting standards for carbon disclosure methodology. The CDP website now claims to be "the largest repository of corporate greenhouse gas emissions' data in the world".

Recommendation:

- Building on the CDP's methodology, the EU should work with industry associations to establish good-practice guidelines for carbon disclosure and encourage self-regulation mechanisms.

V. Conclusions

The work of the EPC Task Force has shown that there is still a great deal of scope to achieve a more rational use of energy in the EU.

Applying the tools outlined in this paper and implementing the specific recommendations it contains would do much to reduce the unnecessary and wasteful use of energy in appliances, buildings, industry and road transport.

This would create win-win situations for households, businesses and the public sector, as well as for society as a whole, and would contribute to achieving three key EU objectives:

- to reduce CO_2 emissions;
- to reduce external energy dependency; and
- to encourage eco-innovation and competitiveness.

However, this requires political will, leadership and momentum, spearheaded by the EU institutions.

Much attention is currently focused on issues such as the Emissions Trading Scheme (ETS) and the structure of the energy market, particularly in relation to the supply of electricity. But there also needs to be a strong focus on realising the significant potential – in the short to medium term – of energy efficiency and the rational use of energy across all parts of the economy. The rational use of energy can produce results quickly if we act now.

There are, however, already worrying signs at the Member State level that the implementation of the energy-efficiency tools which already exist is patchy. There seems little impetus to drive forward a more ambitious agenda and the EU institutions need to exert pressure on the Member States to do more.

Not only do current tools need to be implemented in full, but the Union also needs to develop further instruments to achieve a more rational use of energy. The EU has to act to overcome national vested interests and to ensure that action is taken which is not only fair and proportionate for individual countries and sectors but also ambitious enough to meet the Union's commitments. It must ensure that Member States go beyond paying

lip service to these commitments. The action plans drawn up by national governments must contain concrete commitments as well as setting out exactly what policy tools will be used to achieve them.

At the EU level, there needs to be continued focus on energy efficiency as one of its main priorities within the broader energy policy framework. Achieving ambitious energy-efficiency goals over the next decade – a critical component of a wider programme aimed at meeting the EU's ambitious CO_2 targets – should be a key part of the debate at the European Council in March 2008. As part of this debate, it should be considered whether the EU needs further instruments to deal with energy questions, such as certain fiscal powers.

The rational use of energy on its own is not the answer to the EU's dependency on foreign energy or its responsibilities regarding climate change. But equally, it is difficult to see how the EU will be able to meet these targets without a significant and sustained improvement in energy efficiency.

The rational use of energy can also have another crucial advantage, in that it does not require us to sacrifice our current standards of living in order to reduce energy consumption. The reduced 'life time' energy costs, the competitive advantage arising from eco-innovation, and offering energy-efficient products, provided by the rational use of energy can result in a win-win situation.

By developing a set of tools to achieve this, the EPC Task Force has attempted to demonstrate that there are ways available to overcome the current barriers which limit the rational use of energy. These tools, when applied consistently across the economy, could deliver a step change in the way energy is used, by creating disincentives for wasteful and inefficient usage and by creating incentives for good practice.

In summary, the five tools identified by the Task Force to drive the rational use of energy are:

1. Pricing which ensures that energy costs are paid by those who benefit from its use and reflects all the costs involved, with higher charges for wasted energy.

2. Incentives and standards which encourage the take-up of existing energy-efficient technologies.

3. Mechanisms which can turn long-term efficiency gains into upfront benefits.

4. Using the public sector as both a lever and an example.

5. Providing the information needed for individuals and companies to make rational choices.

So how can these tools be operationalised to make sure that the EU uses energy more rationally in buildings, appliances, road transport and industry? The preceding chapters contain a number of specific recommendations designed to contribute to the rational use of energy.

By applying the tools and implementing the recommendations contained in this paper, the EU as whole can make a significant step towards meeting its energy targets and ensure that, at the very least, energy is not wasted or used inefficiently.

It would also demonstrate that the Union is serious about meeting its energy commitments. If the EU cannot achieve a more rational use of energy in a situation where there is significant potential for businesses, households, the public sector and society as whole to benefit, this would undermine the credibility of its ambitious wider energy agenda.

It is often said that there is no gain without pain. This is one of the exceptions to that rule: there is a great deal to be gained without hampering Europe's economic growth or requiring a change in its citizens' lifestyles. It is an opportunity which must not be missed.

Annex: Rational Use of Energy Task Force membership

This Working Paper reflects the discussions which took place within the EPC's Task Force on the Rational Use of Energy. Final responsibility for the content of this paper rests with the authors. The EPC would like to thank all the members of the Task Force very much for the time and energy they devoted to this work. The Task Force members were:

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Stefano Vescovi	Swiss Mission to the European Union
Maja Wessels	Honeywell
Rachel Winks	The Boeing Company

Endnotes

1. A list of task force members can be found in the Annex to this paper.
2. European Commission: Green Paper, 'Towards a European strategy for the security of energy supply', COM(2000)769, 29 November 2000.
3. European Commission Press Release, 'Climate change: Bali Conference must launch negotiations and fix 'roadmap' for new UN agreement', IP/07/1773, 30 October 2007. http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1773&format=HTML&aged=0%3Cuage=EN&guiLanguage=en
4. Since the March summit in 2007, much controversy has surrounded the biofuels target, leading the EU to reconsider. Some of the side effects of increased biofuels' production could be rising food prices and deforestation.
5. Official Journal of the EU: 'Consolidated versions of the Treaty on European Union and of the Treaty establishing the European Community', C321 E/1, 19 December 2006. http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/ce321/ce32120061229en00010331.pdf
6. Official Journal of the EU: 'Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community', 13 December 2007. http://bookshop.europa.eu/eubookshop/FileCache/PUBPDF/FXAC07306ENC/FXAC07306ENC_002.pdf
7. BBC News *Germans tighten car exhaust rules*, 1 January 2008. http://news.bbc.co.uk/2/hi/europe/7166770.stm
8. Council Directive 92/75/EEC, 22 September 1992.
9. Directive of the European Parliament and the Council on 'Energy Performance of Buildings', 2002/91/EC, 16 December 2002. www.buildingsplatform.org/cms/index.php?id=8
10. Ibid.
11. The EU members involved in these proceedings are Belgium, Estonia, France, Greece, Hungary, Latvia, Luxembourg, Malta, Portugal, Slovakia, Slovenia and Sweden.
12. Directive of the European Parliament and Council establishing a framework for the setting of ecodesign requirements for energy-using products, 2005/32/EC, 6 July 2005. Amending Council Directive 92/42/EEC and Directives of the European Parliament and of the Council, 96/57/EC and 2000/55/EC.

13 Regulation of the European Parliament and the Council on a Community energy-efficiency labelling programme for office equipment, 2422/2001, 6 November 2001.

14. Regulation of the European Parliament and the Council on a revised Community eco-label award scheme, 1980/2000, 17 July 2000.
15. Full-time equivalent.
16. ECOTEC (2002) *Analysis of the EU Eco-Industries, their Employment and Export Potential.* http://ec.europa.eu/environment/enveco/industry_employment/pdf/ecotec_exec_sum.pdf
17. European Commission: 'Strategic report on the renewed Lisbon strategy for growth and jobs: launching the new cycle' (2008-2010), COM(2007)803 final, 11 December 2007. http://ec.europa.eu/growthandjobs/pdf/european-dimension-200712-annual-progress-report/200712-annual-report_en.pdf
18. European Commission DG Entreprise and Industry's 'Lead Market Initiative for Europe', 2008. http://ec.europa.eu/enterprise/leadmarket/leadmarket.htm
19. F. Zuleeg, J. Green, C.B. Schubert (2007) 'Cultivating a market for innovation in Europe', *EPC Policy Brief.* www.epc.eu/TEWN/pdf/659840296_Cultivating%20a%20market%20for%20innovation%20in%20Europe.pdf
20. Danish Ministry of the Enviroment (2007) *The Danish Example – towards a Climate Friendly Economy.* www.ambottawa.um.dk/en/servicemenu/News/TheDanishExample-towardsaClimate FriendlyEconomy.htm
21. Danish Energy Authority (2005) *Constant Primary Energy Consumption in 25 Years.* www.ambottawa.um.dk/NR/rdonlyres/31F1870B-4754-4AC8-8EB7-23F89BC87E89/0/constantenergy.pdf
22. According to ESTIF, the new Spanish Technical Buildings Code (CTE) was adopted in March 2006, and its solar thermal section entered into force on 29 September 2006. The CTE goes far beyond the minimal level of implementation of the EC Directive on the Energy Performance of Buildings and includes an obligation to

cover 30-70% of the Domestic Hot Water (DHW) demand with solar thermal energy, to be applied in all new buildings and those undergoing major renovation and/or changes of use. www.estif.org/262.0.html

23. European Commission: 'Coordinated action to accelerate the development of innovative markets of high value for Europe – the Lead Markets Initiative', MEMO/08/5, 7 January 2008.
24. European Commission: 'Action Plan for Energy Efficiency: Realising the Potential', COM(2006)545, 19 October 2006, p.5.
25. Rod Janssen *Towards Energy Efficient Buildings in Europe*, July 2005. www.euroace.org/EuroACE%20documents/050731%20Towards%20Energy%20Efficient%20Buildings%20in%20Europe%20(Jul%2005%20update).pdf p. 34
26. Ecobuildings website at: www.ecobuildings.info/DEMOHOUSE_Introduction.html
27. Europe Economics and Fraunhofer-ISI with BSR Sustainability and FfE *Impact assessment study on a possible extension, tightening or simplification of the framework directive 92/75 EEC on energy labelling of household appliances*, 19 October 2007, p.35.
28. The European Alliance of Companies for Energy Efficiency in Buildings (2004) *Sustainable Refurbishment of High-Rise Residential Buildings and Restructuring of Surrounding Areas*, Figure 2 'Ownership of housing stock'. www.euroace.org/highrise/oppsandbarrs_political.htm
29. European Commission DG Enterprise and Industry: 'Sustainable construction, An integrated life-cycle-oriented approach'. http://ec.europa.eu/enterprise/leadmarket/sustainable_construction.htm
30. Ibid. The construction market accounts for 10% of GDP and 7% of the workforce. Buildings account for 42% of total EU final energy consumption and produce about 35% of all greenhouse emissions. More than 50% of all materials extracted from earth are transformed into construction materials and products.
31. New York Climate Summit (2007) *An innovative energy efficiency program that costs building owners zero, drives down CO_2, and generates immediate savings.* www.nycclimatesummit.com/casestudies/energy/energy_berlin.html
32. www.greenpeace.org/international/campaigns/climate-change/solutions/energy_efficiency/lightbulbs-q-and-a
33. 20% savings at €10 cts/KWh.
34. Presentation made by Craig Burchell, Vice-President Royal Philips Electronics at EPC Rational Use of Energy Task Force, 8 March 2007.
35. Op. cit. Europe Economics and Fraunhofer-ISI with BSR Sustainability and FfE.
36. Energy Star *EU figures, Residential sector and Tertiary sector.* www.eu-energystar.org/en/en_012p.shtml#residential
37. Council Directive 92/75/EEC, 22 September 1992.
38. Op. cit. Energy Star *EU figures, Residential sector and Tertiary sector.*
39. Op. cit. Europe Economics and Fraunhofer-ISI with BSR Sustainability and FfE. Paolo Bertoldi and Bogdan Atanasiu (2007) *Electricity consumption and efficiency trends in the enlarged European Union – Status Report 2006*, EUR22753ENT, Institute for Environment and Sustainability. http://sunbird.jrc.it/energyefficiency/pdf/EnEff%20Report%202006.pdf
40. Ibid, page 17 quoting P. Shiellerup, J. Winward, B. Boardman, *Cool Labels*, 1998.
41. CECED (2007) *Beyond A – A new energy labelling scheme.* www.sustenergy.org/tpl/page.cfm?pageName=press_releases
42. Sources of energy before they have been transformed (for instance oil is the primary energy for gasoline).
43. Eurostat *Panorama of Transport*, 2007 Edition. ww.eustatistics.gov.uk/publications/publicationlist/Panorama_of_Transport_Statistical_overview_of_transport_in_the_European_Union.asp
44. EPC Transport Task Force (2005) '12 Prescriptions for a European Sustainable Mobility Policy', *EPC Working Paper* No.16.
45. WTRG (2006) *Crude Oil Prices* at: www.wtrg.com/oil_graphs/oilprice1970.gif, and Energy Information Administration (2006): Annual Oil Market Chronology. www.eia.doe.gov/cabs/AOMC/Overview.html
46. Op. cit. Eurostat *Panorama of Transport*, 2007 Edition, p.144.
47. Ibid. p.161, in 'Evolution of total greenhouse gas emission by transport mode, EU-25, 1990-2004'.
48. Ibid.
49. International Road Transport Union 'Position on the European Commission Proposal for a regulation on Access to the Road Haulage Market', 31 October 2007, p.2.
50. Ibid.

51. Special Eurobarometer Suvey (2006): 'Attitudes towards Energy', 247/ Wave 64.2. http://ec.europa.eu/public_opinion/archives/ebs/ebs_247_en.pdf
52. European Federation for Transport and Environment (2005) *Making car taxes work for the environment.* www.transportenvironment.org/docs/Positionpapers/2005/2005_12_car_taxation.pdf
53. European Commission (2007): 'Commission proposal to limit the CO_2 emissions from cars to help fight climate change, reduce fuel costs and increase European competitiveness.' http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1965
54. HM Treasury (2007) *The King Review of low-carbon cars Part I: the potential for* CO_2 *reduction.* www.hm-treasury.gov.uk/media/9/5/pbr_csr07_king840.pdf
55. RAC (2004) *Motoring.* www.rac.co.uk/web/knowhow/owning_a_car/rac_report_on_motoring_2004/summary
56. As measured by the contribution of industry to EU Gross Value Added (GVA) (2005 figures).
57. Eurostat: 'Yearbook 2006-07.' http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-CD-06-001-06/EN/KS-CD-06-001-06-EN.PDF
58. Olivier J. Blanchard and Jordi Gali (2007) 'The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so Different from the 1970s?', *MIT Department of Economics Working Paper* No.07-21. http://ssrn.com/abstract=1008395
59. European Commission (2007): 'Energy Pocket Book 2007'. http://ec.europa.eu/dgs/energy_transport/figures/pocketbook/doc/2007/2007_energy_en.pdf
60. Institution of Engineering & Technology *Standards for Energy Efficient Motors, An Opportunity for Large Scale Energy and Emissions Savings.* http://www.theiet.org/factfiles/energy/iet-motors.cfm
61. BUSINESSEUROPE (2007) *Reconciling Growth and Climate Protection.* http://212.3.246.117/Common/GetFile.asp?DocID=19775&logonname=guest&mfd=off www.businesseurope.eu/Content/Default.asp?
62. Carbon Disclosure Project. http://cdproject.net/whatiscdp.asp

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