Network of

European Environment and Sustainable Development Advisory Councils

Energy Efficiency –

Key Pillar for a Competitive, Secure and Sustainable Europe

Background Material

to the EEAC Statement and Annual Conference 2007

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Content

1 Introduction

(*Christian Hey, SRU)*

In 2006, when the EEAC energy working group started planning for the EEAC annual conference of this year, we knew, that energy efficiency is a strategic issue, but we could not anticipate its singular carrier on the EU Policy Agenda. It became an important issue in the European Commission Energy package from December 2006 and received full support by Heads of State during the Spring Summit 2007. Trend breaking targets for energy efficiency have meanwhile been agreed and the EU policy agenda is moving from principles to action. 2007 and the forthcoming years will be crucial for the many specific decisions on instruments and implementation measures which take the new agenda ahead. Europe has laid down the ground for organising a real energy efficiency revolution leading to a significant decline of consumption.

The rationale behind this new agenda is evident: Only by radically reducing demand Europe effectively can manage the environmental, social and economic conflicts linked to the supply of energy. Energy efficiency may also achieve win-win-win solutions: Both high and potentially very volatile energy prices and growing public concern about climate change are the drivers for an agenda which may bring about innovation, stronger competitiveness and environmental protection at the same time.

With its statement and its annual conference theme EEAC hence is heading for a dynamically moving target. The argument for energy efficiency has reached the minds, many instruments for energy efficiency are available or in the pipeline. The difficulty with the energy efficiency agenda however is, that there is no quick fix – no catch-all solution, which can be easily communicated. It is rather a puzzle of many little steps, which only in their sum can create the momentum for breaking the trend. Furthermore many very diverse actors must be addressed. It will not be sufficient to require producers to move to top performance levels of their products. It will also be important to motivate house-owners or consumers to change deeply rooted habits. All this is not only difficult to steer from the EU or national levels, it is also not easy to communicate politically. The trend-breaking innovation strategy needed, will also have losers, which are not willing or able to adjust to the new economic, cultural and regulatory environment to be created in the next years. Also many design questions for instruments and technicalities are still to be defined.

In its statement EEAC has elaborated the case for energy efficiency and addressed the different sectors, where action is needed. The statement is however only the iceberg of a much richer discussion which took place over the last year within the Energy Working Group. This debate was informed by a number of written contributions from members of the group.

We decided to make those papers also available to the participants of the Conference in order to broaden the common ground for the debate. The papers have been produced by members of the EEAC Energy Working Group and are fully in the individual responsibility of their respective authors. This may explain the one or the other overlap or inconsistency between the individual contributions. For the sake of enhancing discussion around the conference, we did not want to streamline the reader.

The reader closely follows the setting of the EEAC statement and of the annual conference. We start with a synopsis of the potential of Energy efficiency, based upon different scenarios and another synopsis of the rich work of the different Councils on that issue over recent years. This synopsis shows, there is lots of scope for trend-braking innovation.

We then look into the different sectors and instruments: energy, transport, buildings and products. Here we assess the different instruments: A fundamentally reformed emissions Trading System and a renewed energy taxation agenda will create the necessary overall incentives. However what also is needed is a renaissance of product related regulation, to drive designers towards the top runners. Furthermore incentives for the creation of the new markets are needed, where energy services are sold instead of energy products. Last not least consumers need to be mobilized to change their habits.

We hope the reader offers a deeper insight in the discussion on the decisions ahead. Eventually we will include the speakers contributions, the background papers and a report from this conference into a conference documentation.

Christian Hey

EEAC WG Energy Chair

September 2007

2 Energy Efficiency in Advisory Council Reports and Statements

(*Patrick Matschoss, SRU*)

The importance of energy efficiency was highlighted in various statements by several European environment and sustainable development advisory councils. It is consent among the councils that energy efficiency is a key component in climate policy.

The Royal Commission on Environmental Pollution (RCEP, UK) states that "sustained reductions in energy use are achievable, and should form an important part of the UK's response to the threat of climate change" (RCEP 2000, p. 122). The RCEP estimates that until 2012 cost-effective savings in end-use energy in the UK could amount to one quarter (w. r. t. 1998) compared to business-as-usual projections (RCEP 2000, p. 115). The Sustainable Development Commission (SDC, UK) considers "significant improvements in energy efficiency…a priority for action" in order to reach the UK's goal to cut CO_2 emissions by 60% by 2050 (SDC 2006, p. 2). The SDC expects half of the emission savings until 2020 to come from increased energy efficiency (SDC 2005a, p. 14) and considers energy efficiency "the cheapest and most effective way of fossil fuel consumption" (SDC 2005b, p. 38). In the same vein the German Advisory Council on the Environment (SRU) regards energy end-use efficiency as prerequisite to more ambitious emission reduction targets. Without improvements in energy end-use efficiency energy use would have been 50% higher and CO_2 emissions would have been 60% higher in large parts of the OECD between 1973 and 1998. Likewise, a number of studies attribute more than half of future emission reductions to improved energy efficiency (SRU 2005a, Tz. 11). Until 2050 end-use energy use could be reduced by between one third and roughly on half (SRU 2004, Tz. 43). The Swedish Environmental Advisory Council (MVB) highlights that energy intensities are falling due to improves energy efficiency and structural change with the largest improvements after the oil crises (MVB 2002). The German Council for Sustainable Development (RNE) highlights the economic potential to save 20% of German electricity consumption until 2020 (RNE 2003, p. 45). The German Advisory Council on Global Change (WBGU) calls for tripling global energy productivity by 2050 and points out that it is even feasible to reduce the necessary energy input per unit of energy service by 80-85% (WBGU 2003, pp. 84, 209). Likewise, the Federal Council for Sustainable Development (FCSD, Belgium) points to "considerable unexploited potential in the area of energy efficiency improvements" (FCSD 2004, p. 16). The National Sustainable Development Partnership (COMHAR, Ireland) highlights the importance to communicate energy efficiency within the national climate change strategy (COMHAR 2001). The Netherlands Council for Housing Spatial Planning and the Environment (VROM-Raad), too, considers energy efficiency a key factor (VROM-raad and Energieraad 2004, p. 16).

Concerning the building sector the RCEP points to an economic potential of roughly one third for the medium term (RCEP 2000, p. 99). For the longer term the MVB suggested a vision "energy-efficient Sweden 2050" and points to the fact that energy consumption could be reduced by 50% during that time in the existing building stock as well as in new buildings. Energy saving potentials are even higher due to the existence of so-called "passive houses" that require no heating system at all (MVB 2004, p. 11, 16). Likewise, the RNE points to the fact that energy standards mandatory in new buildings require energy use of 80-90% less than energy consumption of building erected in the 1970's. In the same vein the economic potential in housing is considered to be roughly 50-60% by the RNE (2004, p. 43) and SDC (2005a).

In road transport the SDC recommends a 50% cut in emissions through a combination of technical and behavioural change (SDC 2005a, p.23). The SRU regards increased energy efficiency of conventional car engines as a high priority to reduce CO_2 emissions. As an interim goal new cars should not emit more than 100 g CO_2/100 km by 2012 (SRU 2005a, p. 6). The SRU proposes a mandatory emissions trading scheme that holds car makers responsible for their respective car fleet emissions. This would ensure the introduction of energy efficient cars on a sufficient scale (SRU 2005b, section 4.2). As an additional incentive directed at the consumer, the SRU proposes not to base vehicle taxation on CO_2 emissions instead on engine capacity as is the case in Germany (SRU 2005b, section 4.3). The MVB suggest a vision of a "transport-efficient Sweden by 2050" with at least 50% less transport-related GHG emissions (from 1990 levels) by that year. Economic policy instruments and physical planning are said to have the greatest potential in the long term (MVB 2006). Comhar stresses the need to incentivise the energy efficient retrofitting of the building stock (COMHAR 2002, p. 19).

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3 Economic Potential and Contribution of EE (*Patrick Matschoss, SRU*)

1. Economic Potential and Contribution of EE

1.1 Definition

There is a cascade of definitions on the potential of energy efficiency (THOMAS 2006, pp. 7-8). The *theoretical potential* is the largest and describes the potential of technologies that do not yet exist but are conceivable according to today's scientific and engineering knowledge. Of that, the *technical potential* knowledge is the part that may be tapped by existing best available technologies (BAT). The *economic potential*, in turn, represents those technologies with a superior cost-benefit ratio within the current economic framework (in its widest definition including external effects). The economic or cost efficient potential is estimated by calculating life cycle costs that include purchase cost and e.g. energy cost over the life time. Finally, the *expected potential* additionally takes into account barriers and other constraints. The theoretical and technical potentials are dynamic as knowledge and technologies progress (R&D, learning curve). For market actors to tap the economic potential it is necessary that they receive the relevant information (price signals and other) and that transaction costs are low. This is often hindered by market failures and barriers and gives rise to the existence of so-called low/no/negative-cost or win-win potentials. Energy efficiency policy tries to tap those potentials (see background paper on overall policy mix).

1.2 Goal of the action plan on energy efficiency

The European Commissions action plan on energy efficiency aims at further reducing the European energy intensity beyond the current trend in order to lower absolute energy demand compared to the baseline level. The European Union's GDP is projected to rise at a rate of 2.3% pa. However, energy demand is projected to grow "only" by 0.5% pa. This is due to a projected decline in energy intensity by -1.8% pa because of structural changes of the economy, autonomous improvements and previous policies (before the energy service directive). The energy service directive and the Green Book on energy efficiency with its subsequent action plan together aim at a reduction of another -1.5% pa improvement of energy intensity (-0.7% pa and -0.8% pa respectively) leading to a total reduction in energy intensity of -3.3% pa. This, in turn, is projected to lead to an absolute reduction of energy demand at a rate of -1% pa resulting in 20% extra savings until 2020 (EUROPEAN COMMISSION 2006).

1.3 Past trend and future projections

In the 1990's energy intensity improvements ranged around -1.5% pa in the EU-25 with faster improvement in the New Member States than in Western Europe and a general slowdown during the 1990's and thereafter. That is, in this decade the EU-25 achieves only a rate of 1.1% pa (MANTZOS und CAPROS 2006c, p. 40). Different studies provide different numbers: energy intensity improvements calculated by the IEA for Western Europe of the 1990's are generally less favourable, ranging around -0.8% pa for the 1990's (IEA 2004, p. 210). However, for 2000-2005, the European Commission, too, calculates with a rate of only -0.6% pa due to sluggish growth (personal communication).

For the future (until 2030) the current baseline scenario of the European Commission's main analytical tool for forecasting energy and emission trends projects an annual decline of energy intensity of -1.5% taking into account policies that are implemented by the end of 2004. However, this scenario assumes that current (i.e. 2005) oil prices of 55$/bbl fall to 45$/bbl in 2010 before rising again to 58$/bbl in 2030 (all in 2005 US$) (MANTZOS und CAPROS 2006c, p. 19).

Further scenarios try to show effects of further measures to overcome barriers and unlock low-cost potentials: Assuming "soaring" oil prices of 62$/bbl in 2010 and 99$/bbl in 2030 due to stronger growth of world GDP only leads to slight improvements of energy intensity beyond the baseline in the sense that in 2030 the value is around 3% lower (un-weighted average, annual rates not given) for EU-25 (MANTZOS und CAPROS 2006b, p. 49). An "energy efficiency"-case instead leaves energy prices at baseline-levels and assumes the full implementation of the energy service directive, buildings directive and eco-design directive This case results in stronger energy intensity improvements projecting an annual decline of -2.2% leading to values around 17% (un-weighted average) below the baseline in 2030 with the strongest improvements in the tertiary and residential sectors (MANTZOS und CAPROS 2006a, pp. 17-8, 55). This is attributed to a better perception of energy costs of energy consumers primarily due to labelling (MANTZOS und CAPROS 2006a, pp. 6, 20). However the exact micro-foundation remains unclear and is probably just based on different assumption between the scenarios.

The Wuppertal Institute's "policy & measure"-scenario is the most optimistic one even though its baseline is mainly based on an older version of the above modelling series that assumed significantly lower energy prices of 20$/bbl for 2010, 24$/bbl for 2020 and 28$/bbl for 2030. Despite these low energy prices the scenario projects improvements in energy intensity -2.2% pa and -2.8% pa, according to sector (projections until 2020), assuming implementation of 80% of macroeconomic potentials. This translates into a contribution of energy efficiency of 50% towards emission reduction. (LEUCHTENBÖHMER et al. 2005, pp. 13, 17, 74, 80; WI (WUPPERTAL INSTITUT FÜR KLIMA UMWELT ENERGIE) 2003; MANTZOS et al. 2003).

The IEA seems the least optimistic. Its current World Energy Outlook (WEO 2006) "reference scenario" assumes real crude oil prices of 52$/bbl in 2010 and 55$/bbl in 2030 (2005 US$) and projects energy intensity improvements of -1.3% pa for the OECD (EU rate not given), taking measures into account that have been enacted until mid-2006 (projections until 2030). The "alternative policy scenario" takes into account additional policies and projects a rate of -1.6% pa. In the latter scenario two thirds of emission reductions are said to come from improved end-use efficiency (IEA 2006b, pp. 54, 165-9, 178, 190). The IEA also produced long-term projections to 2050 that identified energy efficiency as single largest factor contributing to emission reductions. In five out of six scenarios that contribution is roughly between 40% and 53% (IEA 2006a, p. 51)

In terms of CO_2 emissions no scenario reaches the Kyoto-target or the envisaged -30%-target for 2020 except for the Wuppertal-scenario. In the baseline case of the Commission' projections the EU-25's emissions are 2.8% higher in 2010 and 4% higher in 2020 than in 1990. The "Soaring" oil prices lead to stabilization at 1990-levels by 2010 roughly keeping that level thereafter. In the "energy efficiency"-case, too, emissions are stabilized by 2010 but fall by roughly 10% under 1990-levels until 2020 and continue to decrease further thereafter. Emissions of the EU in the WEO 2006's "reference scenario" stay well above 1990-levels throughout the whole period. Emissions in the "alternative policy scenario" go down to 1990-levels by 2030. Emissions in the Wuppertal scenario, however, fall by 12% by 2010 and 29% by 2020.

1.4 What do we learn from this?

On the one hand an annual decline of energy intensity of -3.3% as envisaged by the EU appears to be a reasonably ambitious target as it does mean a significant acceleration of past trends and goes beyond most of the modelled rates above. On the other hand the shortfall of the projections may simply be the result that not all measures of the plan are mirrored in the scenarios. In addition, there is no scenario available that combines the (not unlikely) "soaring energy prices"-case with the "energy efficiency"-case that would probably yield the highest improvements in energy intensity. In addition, the Wuppertal-scenario yields the strongest improvements despite its least favourable baseline assumptions. From this point of view, the action plan may fall short of the possible economic potential.

All scenarios consider energy efficiency as the single largest factor for reducing GHG emissions, underlining its importance. Therefore, the energy efficiency action plan would provide an indispensable contribution (but does not suffice) to reach emission reductions. In addition, much (if not all) will depend on the details of implementation.

2. Achieving Higher Energy Efficiency: Specific Policy Areas

2.1 Power Sector and EU ETS

The European Emissions Trading Scheme is the EU's flagship instrument of a market-based climate policy that has also significant effects on energy efficiency. By setting an overall cap on emissions and introducing tradable emission permits a price has been put on carbon creating a carbon market for low cost carbon reduction options in the covered sectors. Carbon may be reduced either by fuel switch or by increased efficiency in the power sector and industry. The EU ETS is therefore the most important instrument for raising energy efficiency on the supply side of the energy system. Furthermore, emission trading will also increase energy prices to a certain extent, which also provides incentives for increased end-use energy efficiency.

However the EU ETS directive and its national implementation need to be revised in order to fully exploit that potential. Major problems of the directive originate from the allocation method of grandfathering (SRU 2006):

- *Lack of environmental integrity*: due to heavy rent seeking member countries over-allocate their sectors. The publication of the first round of verified emissions in May 2005 revealed over-allocation of the NAP I-round and resulted in a plunge in prices of emission rights from 30€/t CO_2 to 15€/t CO_2. Now some member states request to allocate more than the verified emissions of 2005.
- *Overburdening*: heavy rent seeking has led to a misguided competitiveness debate where high allocations have been wrongly associated with high competitiveness. Conversely, some governments try to implement industrial and energy policy objectives via overgenerous allocations.
- *Lack of transparency*: the former points have led to very complex allocation rules, diminishing efficiency and transparency of the scheme as could be seen by the above mentioned plunge in price.

- *Lack of predictability/investment security*: the possibility of changing allocation rules every 5 years significantly hampers predictability and therefore investment. This is especially true for the energy sector with its long investment cycles that reach over decades.

Taken together, the scheme has partially turned away from the underlying principle of providing a simple market-based framework where participants may compete for the most cost-effective emission reductions. Instead, the scheme was mistaken as a new means of subsidising domestic industries with all its complexities. The relatively high price of emission rights in comparison to the (too) moderate reduction target illustrates this resulting loss of cost-effectiveness. Therefore, the scheme could not play off its major advantage of providing low cost emission reduction. In order to overcome these shortcomings it is necessary that:

- The Commission fiercely sanctions overallocations in the second phase;
- Member States fully use the possibility of auctioning up to 10% of allowances;
- Full auctioning will be introduced for the third phase after 2012
- That adequate emission reductions for 2020 and beyond will decided: The CAP must adequately (i.e. at least proportionally) contribute to the intermediate target of 30% emission reduction until 2020 (w. r. t. 1990) to limit global warming to 2° above the pre-industrial level.

Auctioning represents the immediate remedy to the complexities and overburdening of the scheme. Together with appropriate emission reductions this will provide a transparent regime providing sufficient long-term investment security.

2.2 Building Sector

According to the EU energy use in buildings accounts for over a third of the EU's energy requirements and offers the largest single potential for energy efficiency. The Directive on the Energy Performance of buildings (2002/91/EC, "Building Directive") tries to tap that potential by setting minimum energy standards for new building and major refurbishments. Furthermore, the directive foresees a labelling instrument that requires landlords and sellers of buildings to provide information on the energetic quality of the building in question. However, so far only buildings that are larger than $1000m^2$ are included in the directive. The directive should have been transposed into the member states' national legislation by January of 2006.

One major barrier when trying to tap the potential in buildings is the so-called split incentives problem. Split incentives are present when the landlord invests in, for instance, insulation of a house and the tenant benefits from lower heating bills. The building directive foresees labelling of the energy performance of buildings as a remedy to this problem. The obligation to provide information on the energetic quality of a building when selling or renting it would trigger a competition for a high energy quality in buildings. That is, energy labelling may be used as instrument of price differentiation when letting or selling real-estate. Since a high energetic quality means lower cost for heating and electricity the seller or landlord may get a higher price when selling or renting a building or apartment.

So far, smaller buildings are not included in the directive leading to huge losses in the saving potential. According to the Action Plans' impact assessment, lowering the threshold of $1000m^2$ would cover about 90% of the EU's building stock and would double the directives' saving potential (EUROPEAN COMMISSION 2006b, p. 24). However, the applied standards themselves are not stringent enough to tap the economic potential. Therefore, it is necessary and welcome that the Action Plan foresees to raise the standards to the level of the passive house standard.

Furthermore, large scale investment programmes to redesign the existing building stock are needed. The emergence of Energy Service Companies (ESCO's) will be essential. As specialized companies with specialized know-how they will contribute to overcoming financial barriers by supplying contracting. There is an overlap here with the Energy Service Directive (2006/32/EC) that aims at providing an enabling environment for energy services including better financing for ESCO's and energy audit programmes for all end-users.

Concerning implementation, there have been time consuming discussions in some member states on how to appropriately implement some of the directives' provisions, e.g. with regard to the labelling. Consequently, many member states have used the possibility foreseen by the directive to extent the deadline until 2009). It is necessary to create a sense of urgency to ensure that at least the latter deadline will be kept.

2.3 Transport Sector

It is appreciated that the limited success of the voluntary agreement with ACEA and the necessity for binding legislation is finally acknowledged. The introduction of better labelling for cars and the promotion among member states to use fiscal measures is also a step in the right direction. The level of ambition of the new strategy is debatable, however.

It would be possible to reduce emissions for newly registered cars to 100g CO_2 per km right away using available technologies that is mainly related to engine technology (SRU 2005). Originally, the new strategy on CO_2-reductions from cars was envisaged to set the target of 120g CO_2 per km as the average for new cars in 2012 (ENDS Europe Daily, 7 Feb 2007). This is agreed target level of the voluntary agreement with ACEA from 1995. The announced legislation is now said to set a target of 130g CO_2 per km in 2012. Another 10g CO_2 per km saving is shall to come from accompanying measures such as standards for air conditioning systems and tyres (EUROPEAN COMMISSION 2007b; 2007a). A continuation of business as usual would result in 143 g CO_2 per km in 2012 for new vehicles. In addition, even the 130g-target does not need to come from the vehicle itself. Instead, emission reductions that are associated with the fuel may count towards the target. This puts two recent proposals into a whole new dimension: The proposed requirement for fuel suppliers to cut 10% of their fuels' life-cycle emissions and the proposition to raise the mandatory share of biofuels from 5.75% (by 2010) to 10% (by 2020). This raises the question whether the new target goes beyond business-as-usual at all.

Furthermore, it raises a number of issues. The use of biomass for biofuels to such a high degree is highly contentious. From the perspective of an efficient GHG mitigation strategy it would be better to use biomass in its solid state in stationary power plants to replace coal. The conversion of biomass to biofuels is quite expensive and does not entail high emission reductions (SRU 2005). This is especially true when considering the complete GHG-balance including possible CH_4 and N_2O emissions from land-use changes that may occur due to the new push for biomass. In addition, this high reliance on biomass will require imports from outside the EU raising a number of issues concerning the "export of our environmental problems into the south", namely the induction of land-use change, illegal logging a. s. o. The question whether these problems can be solved by certificates for imports is still completely uncharted territory (SRU 2007).

Another issue is the question of innovative effects and the (non-)connection to the Lisbon Strategy. Using biofuels as a substitute for innovative, low-emitting cars may cause competitiveness problems of the European car manufacturers in the (near) future. In light of the limited possibilities to use

biofuels and considering that climate change polices will become more stringent there is a case for a greater need of low-emitting cars in the future.

There is a range of measure to try to tackle CO_2 emissions from cars including the ones already mentioned (COMHAR - SUSTAINABLE DEVELOPMENT COUNCIL 2007). An effective and efficient approach to induce emission reductions of the car fleet would be to link the car fleets' emissions to the EU ETS. This can be done by obligating the car manufacturers to surrender allowances for their respective car fleets. In order to keep the system simple, approximations of average life times for cars may be used, perhaps differentiated for classes. As long as grandfathering for the EU ETS is still in use, allocations should be set in a way to target 100-120g CO_2 per km in 2012 (or beginning of 2013if the system would be installed in conjunction with the NAP III-round) with a view to target the European -30%-target by 2020 with respect to 1990. In addition to this measure, vehicle taxes should be based on their respective CO_2 emissions (SRU 2005).

2.4 Appliances & Product Policy

2.4.1 Dynamic & "Better" Energy Labelling

In a market system accurate and useful information should have a high priority (VINE et al. 2003). For a market to work consumers need to have access to reliable and up to date information on the products they purchase. A significant part of the no/negative-cost potential is due to sub-optimal choices of insufficiently informed consumer. That is, the signals of scarcity do not reach the relevant market actors – not even in the hypothetical situation of perfect internalization of environmental costs. An accurate, up-to-date label providing relevant information is a remedy for the split incentive problem mentioned above.

Labelling plays a pivotal role in creating demand for energy efficient products and services. Producers of appliances or machinery do not pay the energy bill and have no incentive to, for instance, use high quality but more expensive energy saving components. Consumers, on the other hand, do not know about the environmental impacts involved at each stage of the products life-cycle. In the absence of labelling they may not be able to accurately take into account life cycle cost when buying, for instance, household appliances. As a result, they may not be willing to pay higher purchase prices even though it would be reasonable in light of lower energy bills over the products' lifetime.

As with buildings mentioned above, labelling would allow for price differentiation with respect to energy consumption. That is, labelling would introduce competition for energy efficiency driving innovations for energy efficient solutions.

The EU labelling scheme goes back to the Framework Directive 92/75/EC. The main problem of the current scheme is that it is static. Furthermore, it does not contain all the necessary information that enables the average consumer to quickly assess break-even points when standing in front of an appliance in a retail market. The lack of periodic updates has led to the creation of ever new efficiency classes (A+, A++) jeopardizing the coherence of the system. The new classes send the message that class "A" is still good even though after an update it would be "C" or less. Therefore, a regular update of the scheme needs to be institutionalized and must ensure that available appliances are regrouped and that only the most efficient products (for instance the top 10-20% on the market) are labelled with the class "A". In addition, for each product there should be not only information on energy (and water) requirements per use but also on *annual* energy (and water) *costs* using prices from the time of the most recent update.

The need for better labelling is true for the so-called “white ware” (fridges, washing machines etc.) as well as “brown ware” (TV, digital boxes, office appliances etc.). In addition, the label for the latter group needs to provide the same information for stand-by and off mode as well. Furthermore, energy using systems in the (non-energy intensive) industrial sector (motor systems, air pressure systems, pumps etc.) need a similar labelling scheme. Labelling for buildings was mentioned earlier already. The update should be done within a reasonably short time period. That means that the periods would be much shorter for brown ware than white ware.

Taken together, a more dynamic approach for energy labelling of products and services is necessary to ensure that pricing structures support a progressive shift of consumer demand towards more efficient products and services. The proposition of the Action Plan to regularly update the Framework Directive 92/75/EC and to expand it to more product groups is a step in the right direction However, it will also be necessary to give information on annual costs so that the consumer is able to make quick assessments.

2.4.2 Dynamic Standards

Consumers may not make optimal choices despite the availability of adequate information. This is because energy efficiency does not belong to the core business of consumers and (non-energy intensive) manufacturers and there is a lack (perceived or real) of expertise. Furthermore, energy cost savings are dispersed (THOMAS et al. 2000). That is, they are low for the single market actor (business/household) despite their significance for the economy as a whole. This results in too high transaction costs (perceived or real) in comparison to the gains for the single market actor. In addition, market actors may not be willing or able to process all the available information (bounded rationality) and may therefore be unwilling, for instance, to pay higher upfront costs despite lower life cycle costs.

In light of this (and the political unwillingness/inability to correctly internalize external effects), product standards may be useful to realise some of the low/no-cost potentials of energy efficiency. In addition, under the assumption that global demand for energy efficient appliances will rise in the future (global needs) the creation of lead markets at home may provide additional benefits (first mover).

Under the auspice of the Energy Using Product Directive (EuP Directive, 2005/32/EC) studies are currently being carried out for 14 key energy using product groups. Based on the results standards will be set for these groups by a committee. The Action Plans foresees to regularly assess and update the standards and combine it with elements known from the Japanese Top-Runner-Approach: within each class of products today’s top performance levels shall be the minimum standard in the next round of assessments. Furthermore, the studies shall also be used for the above mentioned product labelling scheme. The Action Plan also intends to broaden the directive to include more product groups.

The work plan of the Commission on implementing measures within the EuP directive merits full support. Focusing on energy-using products is of strategic importance since they account for a high and growing share of energy requirements. Furthermore, the EuP directive is the first example of the EU’s integrated product policy that focuses not only on energy (as the Top-Runner) but on the whole life-cycle (EIFEL 2006; KESTNER 2006; JÄNICKE 2007). Much of the success of the EuP-directive will depend on the working of this committee (progressive/conservative) and whether a regular update of the standards is institutionalized within a reasonably short period.

3. Mainstreaming Energy Efficiency: Overall Incentives

3.1 Energy Service Directive & Public Procurement

The full integration of energy efficiency policies in other relevant policy strategies and programmes such as the follow up to the EU Sustainable Development Strategy and the forthcoming Action Plan for Sustainable Consumption and Production is pivotal in reaching lasting efficiency improvements. The Energy Service Directive (2006/32/EC), if fully implemented and strengthened, will provide important steps towards mainstreaming energy efficiency. The Directive requires member states to save 9% of end-use energy within nine years and to present Energy Efficiency Action Plans (EEAC) every three years (first in June 2007) to the European Commission that show how the goal is to be achieved. Furthermore, a framework for measuring and reporting is provided.

The Directive contains a number of important measures for mainstreaming Energy Efficiency. These relate (i) to an exemplary role of the public sector, (ii) to an enabling environment for energy services and energy service companies (ESCO) and (iii) to information mechanisms to overcome informational barriers in order to enable consumers to reap the economic potentials of energy efficiency.

The exemplary role of the public sector as a significant market player relates to public procurement and the utilization of ESCO's (Art. 5). The requirement of the public sector to consider energy efficiency could have a decisive impact on overcoming barriers that relate to the market launch of efficient products, including cars. Furthermore, the large number of public buildings will contribute significantly to the creation of a viable market for ESCO's. There are important synergies with the Directives' other measure to create an enabling environment for ESCO's as well as the Buildings Directive mentioned above.

Concerning an enabling environment for ESCOs the role of the public sector was already mentioned above. In addition, the Directive requires member states to repeal or amend national legislation that impedes financing measures for ESCOs (Art. 9). This may be particularly important for tenancy law. Furthermore, member states may consider funds and/or white certificate schemes to aid the development of a viable market (Art. 11). Other measures include requirements that energy pricing structures shall not give incentives to extend energy use (Art. 10).

Concerning information polices the Energy Service Directive requires energy distributors to provide information necessary for energy efficiency programmes and to provide energy audits. In addition, member states shall put necessary conditions and incentives in place to provide more information for consumers (Art. 6, 7 & 12). In addition the Directive requires more accurate metering of "true" energy consumption to raise the consumer awareness (Art. 13). This induces the adaptation of his behaviour in terms of everyday habits (switch of light when not at home) and of a critical review of the energy use of the consumers' appliances.

However, the goal of the Directive appears moderate and an earlier proposition to require the public sector for higher rates of improvements did not pass the legislative process. The Action Plan foresees a revision of the Directive mostly concerning its technical workings but also concerning an assessment of a white Certificate Scheme. Implementation of the Energy Services Directive by mid 2007, drafting ambitious national efficiency action plans able to deliver at the very least these moderate reductions and mending its technical difficulties will be pivotal. Together with the Action Plans' priority action 5 "better finance for energy efficiency for SME" it will play a crucial role for mainstreaming.

3.2 Energy Taxation

The Action Plans' priority action 7 "coherent use of taxation" merits full support. This is in synergy with the renewed EU Sustainable Development Strategy's (§23) suggestion of an active consideration of "further steps to shift taxation from labour to resource and energy consumption and/or pollution, to contribute to the EU goals of increasing employment and reducing negative environmental impacts in a cost-effective way".

Historically, the level energy prices has been one of the most important factors in explaining changing rates in energy intensity improvements (IEA 2004b; 2004a). Therefore, environmental scarcities such as climate change need to be reflected in energy prices and play a pivotal role in mainstreaming energy efficiency in day-by-day operations. For the energy sector the internalization strategies' focus is on the supply side with the EU ETS as its premiere instrument. In the absence of an overarching scheme sectors not sufficiently covered/affected may be covered by energy/eco taxation.

Eco taxes have been successfully introduced in several member states (Nordic Countries, UK, Germany). As part of an ecological tax reform package, they contributed to lower CO_2-emissions as well as to reduced labour cost. Both effects however where modest, as tax escalation frequently was stopped after a few years. Because of the higher freedom of market players to adjust to higher prices, taxation may have some advantages vis à vis standards and may be used more extensively in sectors that are not covered/sufficiently affected by the EU ETS. However when overall energy prices increased recently most member states became reluctant to continue their tax escalator programmes.

Being consumption or excise taxes on (primary or secondary) energy, eco taxes still are an issue of national sovereignty, leaving the EU little room for manoeuvre. The Commission proposal for a combined energy/CO_2-tax from 1992 did not find sufficient support. Hence the Energy Tax Directive (Directive 2003/96/EC), that was eventually adopted, only sets minimum tax rates on energy products and grants a number of exceptions to several member states. The European Commission intends to publish a green paper on indirect taxation for 2007 and a subsequent review of the Energy Tax Directive as part of the Energy Efficiency Action Plan (Com(2006)545 final). However, member states do not seem to be in favour of such actions as there is no reference to this in the preliminary council conclusions (Council conclusions 14155/2/06, ENDS Europe Daily 07 Nov 2006). The action plans' aim to develop a Green Book on indirect taxation maybe therefore an important contribution to encourage member states to use this most important tool.

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4 Surface Transport and Cars

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1. Context

Transport contributes greatly to global energy consumption and greenhouse gas emissions and is forecast to remain a significant source of concern in this regard in the future. Worldwide, transport contributes approximately 20% of global carbon dioxide emissions (IPCC 2001). While energy consumption by transport from the developing world currently is relatively small compared with more industrial countries due to low rates of motorisation, a dramatic increase in ownership is forecast to take place in the future. The U.S. National Research Council (NRC 2003) estimates that vehicle sales in China will grow at over 7% annually between 2005 and 2020. This could lead to China overtaking the US in the future as the largest car market (Sauer and Wellington 2004) and highlights the challenge that transport is predicted to continue to cause in the future.

Transport currently makes up 31% of final energy consumption in EU25 (EEA 2006). The continuing increase is partly due to the rise in transport volumes, and in particular the growth of road transport. Road transport passenger and freight demand has increased in the EU by 30% and 34% respectively (EEA 2007) over the past decade. Passenger cars are becoming more efficient, and are forecast to offset the projected growth in passenger car volumes (16.1% by 2015) with a resulting drop in total energy demand from passenger cars of 2.1%. However, the expected growth in road freight transport means a projected increase in energy demand from road transport of around 20% over the next decade.

EU legislation currently being prepared could have a major impact on the future energy performance of passenger cars sold in Europe. Given the potential significance of this legislation and the importance of private automobile transport on Europe's use of energy, this paper focuses largely on the potential for realising energy efficiency in passenger cars.

2. Policy measures for transport

Government initiatives, such as regulations, agreements and economic instruments, can play an important role in arresting the trends in the transport sector described above. The excessive consumption of energy by transport (and other sectors) is a manifestation of market failure, which arises as a result of the public good nature of greenhouse gas emissions. Policy instruments can be mobilised to influence both the supply of and demand for transport. Although it may be possible to realise a sustainable transport system with a concerted effort to promote and deploy new technologies, changing travel demand behaviour is a complementary policy that is necessary to encourage the uptake of technological change and reduce travel demand.

Although historically the most common instrument implemented in the area of environmental policy has been command and control policies, these have been found frequently to be inefficient. Standard regulation may not achieve environmental objectives at minimum cost, and it may be dynamically inefficient, since there may be no incentive for polluters continually to improve. In latter years demand-side market-based instruments such as taxes, green subsidies, and emissions trading have become more popular, as they provide an incentive to improve environmental performance

continually. The revenue generated by market-based instruments can provide a double dividend if it is used to reduce other taxes that may be slowing economic growth[1] or creating inequity in society.

Supply-side policy instruments such as voluntary agreements and investment in research and development are relevant as they provide a push to bring new technology to the market. While information is a policy instrument in its own right, it is also fundamental to all other policy instruments. Without good information policymakers cannot understand the underlying environmental problem, their impacts, nor the cost of resolving them.

Regarding greenhouse gas emissions, which is closely related to the energy consumption of vehicles since nearly all vehicles are operated on fossil fuels, and transport, the OECD Working Group on 'Analytical Methods of Road Transport Sector Strategies to Reduce Greenhouse Gas Emissions' (OECD, 2002) has produced a catalogue of existing measures to reduce greenhouse gas emissions from road transport.

The OECD has identified the following three categories of existing measures to reduce greenhouse gas emissions from transport:

- Improvement of vehicle fuel efficiency
- Alternative fuels and technologies
- Traffic demand management.

The first and third categories are particularly relevant for the improvement of energy efficiency of the fleet. The policy instruments associated with the first two categories tend to relate to supply-side management of transport, whereas the third category focuses on the management of consumer demand for transport.

The OECD Environmental Policy Committee's Task Force on Transport conducted the project Environmentally Sustainable Transport, which defined the concept of sustainable transport and germane criteria for evaluation. The group estimates that under their business-as-usual (or "no new policy") scenario, greenhouse gas emissions and therefore energy consumption will make the largest contribution, both absolutely and relatively, to the increases in external costs of transport in 2015 (OECD 2002).

Although there are many instruments available to policymakers to tackle the reduction of energy consumption from transport, it is still proving a difficult task to accomplish. Passenger road transport (i.e. cars) represents a non-point source of energy consumption with many independent users. It is difficult to monitor and implement an abatement policy with so many small users, since measurement of individual vehicle energy consumption or greenhouse gas emissions is near impossible on a wide scale. Passenger cars are durable goods with a long product development and user life cycles. It is difficult to influence consumer behaviour over a long period and therefore long-standing policies are required.

[1] An example is the eco tax in Germany where a tax was levied on fossil fuels and the revenue was used to reduce labour taxes.

3. Implementation of EU Policy measures

The decoupling of economic growth from resource utilisation has become a centrepiece of EU sustainable-development policy. The EU White Paper on transport lists 60 measures to improve the quality and efficiency of transport in the EU.[2] Many of the measures identified impact directly on greenhouse gas emissions. Also in the EU, the TERM (Transport and Environment Reporting Mechanism) project – Towards a transport and environment reporting mechanism for the EU – has been developing indicators for assessing the effect of transport on the environment (EEA, 1998) and reports annually on the effect of transport on the environment.

The EU has a CO_2 emissions fleet intensity target of 120g/km by 2010 for all new passenger cars sold in the EU. Achieving this target would lead to an associated reduction in energy consumption, since these are directly related in vehicles running on fossil fuels. Until 2007, the strategy to do this has consisted of three so-called pillars of policy measures, which are the following:[3]

1) Voluntary Agreements committing the automobile manufacturers to reduce CO_2 emissions intensity from passenger cars mainly by means of improved vehicle technology.
2) Improvements of consumer information on the fuel-economy of cars. A labelling directive was implemented in the EU in 2001.
3) Market-orientated measures to influence motorists' choice towards more fuel-efficient cars. This has not been implemented EU-wide to date.

In addition, an independent data collection system has been implemented in order to collect data and monitor progress of these policies.[4] The EU strategy has been reviewed with regard to passenger cars and CO_2 emissions as part of the European Climate Change Programme II. Partly as a result of this work, in 2007 the European Commission presented a Communication to the European Parliament and Council on a revised Community strategy to reduce CO_2 emissions from light-duty vehicles.

4. Passenger Car Voluntary Agreement

In 1999 the European automobile manufacturers (ACEA) signed a Voluntary Agreement with the European Commission to reduce CO_2 emissions from passenger cars.[5] An equivalent agreement was adopted by the Korean (KAMA) and Japanese (JAMA) manufacturers with the Commission in 2000. This Voluntary Agreement represents the main mechanism in place at EU level to reduce greenhouse gases from the passenger road transport sector. It is the first of the three pillars described above that comprised the European Union's strategy to reduce CO_2 emissions from passenger cars. The automobile industry committed to reducing the average CO_2 emissions intensity of passenger cars sold in the EU by approximately 25% compared to 1995 emissions by 2008.

The Voluntary Agreement specified several goals to be met as indicative to meeting the final target of 140g/km in 2008/2009. These interim goals were the following:

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2 European Commission, 2001: White Paper "European transport policy for 2010 : time to decide". Available at http://ec.europa.eu/transport/white_paper/index_en.htm

3 Information is provided on the DG Environment website http://ec.europa.eu/environment/co2/co2_home.htm

4 Decision no 1753/2000/EC of the European Parliament and of the Council of 22 June 2000 establishing a scheme to monitor the average specific emissions of CO2 from new passenger cars.

5 Published in the Recommendation of the European Commission (1999/125/EC).

- Achieve an intermediate target range of 165 – 170 CO_2 g/km by 2003/2004;
- Bring to the market by 2000 some individual car models with CO_2 emissions of less than 120g/km;
- Review in 2003 the potential for additional improvements with a view to moving the new car fleet average further towards 120 gCO_2 g/km by 2012;
- Undertake annual joint ACEA/Commission monitoring of all the relevant factors related to the commitments.

The most recent year for which monitoring data is available is 2004. The monitoring reports show that the intermediate CO_2 emissions target was met by ACEA in 2000 and that the upper end of the range was met by JAMA in 2002. Since 1995, the fuel efficiency of diesel passenger cars has improved more than the efficiency of petrol cars. It is estimated that it will become increasingly difficult and more costly in the last few years of the Voluntary Agreement to meet the target in 2008, which indicates an upward-sloping marginal abatement cost curve. On average, an annual reduction of approximately 1.2% has been achieved over the period 1995-2004; however it is estimated that for the period remaining up to 2008, reductions in emissions would have to continue at a rate of 3.5% per year to meet the 140g/km target (CEC 2006), which is probably unlikely to happen and is why the Commission revised the strategy in 2007. The trend for CO_2 emissions from both JAMA and ACEA vehicle fleets pre-1999 was already negative. This may be due to the length of the protracted negotiation of the agreement, so that manufacturers were aware of the impending agreement since 1992.

The proportion of fuel efficient new vehicles sold in EU in 2003 was higher than ever before, with the share of sales of vehicles generating less than 140g/km reaching 23%, up by 970% from 1995. Sales of ultra-low CO_2 emitting vehicles (120g/km) in Europe were 306,514 units in 2001 (2.1%). An EU study noted that total CO_2 emissions from the new passenger car fleet average were expected to stabilise as a result of the car industry's commitment to 140 g CO_2/km in 2008 (COWI 2002). With the change in strategy in 2007, it is unclear what the value of the fleet CO_2 emissions intensity is now expected to be in 2008.

5. Vehicle fuel economy labelling

The European Parliament and Council initiated the second pillar of the EU strategy when it adopted the Directive on vehicle labelling in 1999.[6] This Directive promulgates consumer information to be made available in the form of fuel economy and CO_2 emissions labels, guides and posters in car dealer showrooms from 18 January 2001. The amended Directive on labelling requires dealers to provide information on fuel economy and CO_2 emissions to consumers by means of media such as television, radio, and the internet, as well as electronic storage devices such as videotapes, DVDs and CD-ROMs.[7] The car dealer is required to ensure that a label on fuel economy and CO_2 emissions is attached on or displayed near each new passenger vehicle on sale. The car showroom should contain a poster listing and ranking all the vehicles sold at that outlet according to fuel consumption and CO_2

[6] Directive 1999/94/EC of the European Parliament and of the Council of 13 December 1999 relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the marketing of new passenger cars.

[7] Commission Directive 2003/73/EC of 24 July 2003 amending Annex III to Directive 1999/94/EC of the European Parliament and of the Council.

emissions. Additionally, a complete guide to the fuel consumption and CO_2 emissions from all passenger vehicles offered on sale in that Member State must be available in the form of a portable booklet free of charge to customers.

The Commission has issued general guidelines on the design of the CO_2 labels, requiring the presentation of values of the fuel economy, CO_2 emissions and the model and fuel type of the passenger car. Some Member States have created labels that provide a more illustrative portrayal of the fuel economy of the vehicle, awarding a grade to the vehicle model based on its fuel economy and CO_2 emissions.

There is a growing literature on the subject of green-and eco-labelling that suggests that clearer seal-of-approval labels are usually better understood by consumers than information-disclosure labels. "Experience has shown that the proportion of consumers who are willing and able to use technical information effectively is low" (Banerjee and Solomon 2003). Therefore several Member States have favoured the seal-of-approval labels in CO_2 emissions labelling. The car industry prefers direct disclosure labels that are neutral and do not rate or differentiate products but which are probably less easily understood by consumers.

It is difficult to estimate the effectiveness of fuel consumption labelling (Vine et al., 2001). The academic literature suggests that labelling is most effective when there is government involvement to win consumers' confidence (Banerjee and Solomon, 2003). Publicity is also important to gain consumer awareness and to impress upon manufacturers the significance of the programme. Good label clarity helps consumers make the right choices and incentives to do so, such as tax relief, are an added bonus.

EU Member States are required to report on the effectiveness of the labelling Directive following specific guidelines on the reporting format.[8] The automobile club of Germany (ADAC) was commissioned by DG Environment to collate the preliminary results (ADAC e.V., 2004), which include information on the status of implementation of the Directive in the Member States, any fiscal measures that affect car purchase decisions, as well as the effectiveness of the initiative, as judged by the individual Member States. In general, in most Member States it is the responsibility of the car manufacturers to supply the label and poster, whereas the guide tends to be produced by national Ministries or an independent authorised institution.

Only the Netherlands has attempted to quantify the impact of the labelling Directive on CO_2 emissions from the vehicle fleet. It is estimated that after the implementation of the labelling Directive in 2001, the market share of vehicle classes B and C (6.5% and 41.4% in 2001) increased slightly to 9.5% and 45.7% in 2001; the share of vehicles in classes D, E, and F decreased, and classes A and G were unchanged. In 2002, a refund of the vehicle acquisition tax existed for vehicles in class A. It was observed that the increase in share of classes A and B vehicles increased disproportionately from 0.3% to 3.2% and from 9.5% to 16.1%. The tax refund was abolished in 2003 and the share of vehicles sold in classes A and B once again decreased. The experience in this Member State provides a demonstration of the increase in effectiveness of consumer information in influencing vehicle-purchasing behaviour when combined with fiscal measures.

Member States have made proposals to improve the effectiveness of the labelling Directive. The main proposals are the following:

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[8] Commission Decision 2001/677/EC of 10 August 2001 on a reporting format for completion by Member States in accordance with Article 9 of Directive 1999/94/EC.

- Consumers need to be made further aware of fuel economy, CO_2 emissions and the information tools available to them through this Directive.
- Dealers require sensitisation to the importance of the Directive's provisions. Often the poster is ineffective since its production and updating requires too much effort and is not in line with the dealers' ideas for their showroom.
- Harmonisation of the content and design of information tools would simplify the issue for manufacturers and reduce costs since the labels could be attached at the vehicle production stage.
- Harmonisation of an energy-rating system for all vehicle labels would make vehicle labels more transparent for consumers. This is also corroborated in a previous study (Boardman et al., 2000).
- Since cost is a high priority for consumers when purchasing a vehicle, the fuel consumption and CO_2 emissions should be converted to vehicle running costs on the label.

From these first reports on the effectiveness of the labelling Directive, it appears that in the EU most policymakers regard this instrument as underperforming and not achieving the reduction potential desired. It is difficult to judge the effectiveness of any instrument in separation from the other factors that are in place concurrently. It seems imperative that the information on technological advancements in passenger cars, achieved for example as a result of the Voluntary Agreement, reaches consumers. The proposals by Member States on improving this information tool need to be considered.

6. Fiscal measures

The third pillar of EU passenger car measures concerns the use of fiscal measures to address greenhouse gas emissions. Taxes and charges as measures to reduce greenhouse gas emissions from transport have gained in popularity among policymakers, since they can influence both consumers and firms' behaviour. When taxes are applied to firms they affect the firms production decision and may determine (similar to emissions permits discussed above) the firms choice both of product and production abatement technologies. Taxes applied to consumers affect their purchasing behaviour and should drive a demand for lower-emitting goods. Economic theory tells us that if greenhouse gas emissions are taxed or charged at the right amount, then the efficient outcome will result – the sector will reduce greenhouse gases to the optimal level. However, many countries in the EU do not agree with the harmonisation of taxes of any kind and therefore it has been difficult to reach agreement in the European Council on this measure.

Taxes and charges applied to road transport can be generally categorised as follows:

- Taxes on acquisitions, mostly referred to as registration tax (RT) and value added tax (VAT)
- Periodic taxes in connection with ownership such as annual motor taxes, termed circulation tax here (ACT)
- Fuel taxes
- Other, such as road user fees, congestion charges, parking fees etc.

The European Commission established the "Expert Group in Fiscal Framework Measures", which commissioned a study to assist the Commission in considering the potential of fiscal measures to assist in achieving the target of 120g/km on average per vehicle. The study, completed in 2002, modelled scenarios with the implications of different changes to the current vehicle tax systems in nine Member

States (COWI 2002).[9] The analysis results led to several conclusions that are relevant to a general discussion on taxes and charges related to the reduction of greenhouse gas emissions from passenger cars and are paraphrased here:

- It is essential to apply a tax scheme that is directly or indirectly CO_2 related in order to provide for significant reductions in the average CO_2 emissions from new cars.
- Differentiation of the taxes is necessary in such a way that promotes energy efficient cars over cars with poor energy efficiency.
- The largest reductions are achieved when the existing vehicle taxes are replaced with purely and directly CO_2-related taxes that are sufficiently differentiated.
- The level of the potential CO_2 reductions does not depend on whether the tax is an annual circulation or registration tax, but rather on the CO_2 emissions and the associated level of tax differentiation.
- Simple increases of tax that do not change the parameters upon which they are based do not have much impact on CO_2 emissions.
- Fuel tax increases lead to very small reductions in average new vehicle CO_2 emissions, compared to vehicle taxes. They may however be effective at reducing the CO_2 emissions from the overall passenger car fleet.

The European Commission has made a proposal for a Directive on passenger car related taxes, to reform and harmonise registration and annual circulation taxes on passenger cars in EU Member States.[10] The proposal has two objectives: to "remove tax obstacles and distortions to free movement of passenger cars within the internal market" and also to restructure "existing vehicle taxes to put more emphasis on environmental objectives in line with Community policy and Kyoto Protocol". The main points of the proposed Directive are:

- The abolition of car registration taxes over a transitional period of five to ten years.
- A system whereby a Member State would be required to refund a portion of registration tax, pending its abolition, where a passenger car that is registered in that Member State is subsequently exported or permanently transferred to another Member State.
- The introduction of a CO_2 emissions element into the tax base of both annual circulation taxes and registration taxes in the short-term.

Other challenges associated with greenhouse gas taxes are common to most taxes. There can be equity issues associated with taxes and charges, where for example a car tax may represent a greater share of poorer drivers' incomes and hence they are priced off the road. Distribution of the revenue can also provide a concern. When one sector is taxed, there can be pressure to use the revenues to the benefit of that sector. This leads to the subject of earmarking and the option to refund tax revenues to low polluters. A charge or tax that is partially refunded to abaters provides an incentive to abate and may lower resistance to the introduction of a charge. Although this measure is more generally applied to industrial sectors, it could be potentially feasible with motorists, for example where the revenue from fossil fuel taxes could be used to subsidise alternative fuels and related technologies. Care is needed in

[9] Available at http://europa.eu.int/comm/taxation_customs/taxation/car_taxes/co2_cars_study_25-02-2002.pdf

[10] Proposal for a Council Directive on passenger car related taxes (presented by the Commission) SEC(2005) 809.

regard to measures such as these to ensure that they remain general or performance-based, to avoid any one technology development becoming locked-in.

Fuel taxes are subject to political feasibility and increases may be very unpopular. The literature shows however that countries with higher fuel taxes generally have lower fleet CO_2 emissions intensity and that they can be effective in reducing transport CO_2 emissions (Sterner 2007, Ryan et al. 2007). A challenge faced by fiscal measures in the European Union is the lack of harmonisation of initiatives between countries to reduce greenhouse gas emissions and fuel consumption from passenger cars, which clouds the incentives for manufacturers to supply fuel-efficient vehicles to the market. Even across a single, economically unified continent such as Europe, where EU-wide initiatives exist to harmonise policies, governments continue to apply different taxes and regulations to passenger cars.

7. Additional EU legislation on energy efficiency in passenger vehicles

The Commission recently announced that "the strategy has brought only limited progress towards achieving the target of 120g CO_2/km by 2012" and that "the review of the strategy has concluded that the voluntary commitments have not succeeded and that the 120g target will not be met on time without further measures" (CEC 2007). Therefore a revised EU strategy will include legislation to regulate CO_2 emissions from passenger cars. The Commission stated that it would propose legislation by mid 2008 that would require average CO_2 emissions from passenger cars in EU27 to reach a target of 120 g/km in 2012. Vehicle technology improvements should be responsible for the reaching 130 g/km, while "complementary measures" should contribute a further emissions reduction of 10 g/km, leading to achievement of the target of 120 g/km overall. The Commission added that

> "These complementary measures include efficiency improvements for car components with the highest impact on fuel consumption, such as tyres and air conditioning systems, and a gradual reduction in the carbon content of road fuels, notably through greater use of biofuels. Efficiency requirements will be introduced for these car components." (CEC 2007)

Further elements of the revised strategy include fleet average CO_2 emissions targets for vans of 175 g/km by 2012 and 160 g/km by 2015; support for research which will lead to cars with an average of 95 g/km by 2020; improvement of the vehicle labelling scheme and encouragement of Member States to base vehicle taxes on vehicle CO_2 emissions; and to draw up an EU code of good practice to promote more sustainable consumption patterns through marketing and advertising (CEC 2007).

The European Parliament Environment Committee rapporteur has tabled an alternative proposal for a lower target for passenger cars of 120 g/km but to be implemented by a later date – 2015 – and longer-term targets of 95 g/km by 2020 and 70 g/km by 2025. In addition, by 2013 the top speed of all cars would be limited to no more than 162 km/hour and no cars would be permitted which have averaged more than 240 g/km by 2015. The annual reduction targets would be set according to a "limit value curb" taking into account car size and the cost of achieving emission reductions.

In debate in the European Parliament's Environment Committee at the end of June, the Commission representative continued to call for the Commission proposals with some support from the former Chairman of the Committee and another member from Germany. There was however general support for the rapporteur's proposal to define an emission reduction target for different models of vehicle based on their size and weight (broadly equivalent to proposals from the industry itself) but rather less enthusiasm for his much more demanding longer-term targets for 2020 and 2025. The European

Parliament Industry Committee has called for 120 g/kg figure but set no specific date. It has also supported further cuts to 80 g/km in the medium term.

European car makers have called for a later introductory date of 2015 because of the lag time in developing new cars and have criticised the proposals as adding to the cost of new cars and thereby increasing the life of the existing car fleet hence delaying the benefits of replacing them with more efficient modern cars. Their trade association, ACEA, announced on 8 June 2007 that it would prefer a system basing future reduction targets to be differentiated between manufacturers according to the average weight of their model range with makers of smaller cars subjected to tighter targets than those making larger cars. This also seems to be a model favoured by the German Government, which is concerned that the structure of its car industry would be unduly affected by a single CO_2 reduction target figure.

On 17 July ACEA confirmed that it wanted a system differentiated on the basis of weight, as is already used in Japan and China. Jos Dings of the T&E green mobility lobby group has argued instead that any differentiation should be on the basis of size, i.e. length times width. This would avoid perverse incentives to discourage economising through reducing weight for cars just above the dividing line. Any system of differentiation will create anomalies at the margins, however.

At its meeting on 28 June, the Environment Council accepted in principle the Commission's approach and called for a legislative proposal but also for further work to analyse the cost impact and to ensure that the detailed proposals were cost effective. It also called for proposals regarding air conditioning systems, tyre pressure monitoring systems, standards for the rolling resistance of tyres, gear shift indicators, fuel efficiency progress in light commercial vehicles and sustainable biofuels, containing methodologies for verifying the CO_2 emission reductions delivered by these measures.

All motor vehicles sold in the EU are type approved by the certification authority and as part of this process are required to measure CO_2 emissions and fuel consumption. For passenger cars this means driving a standardised cycle called the New European Driving Cycle (NEDC), which is made up of urban and non-urban driving components. Heavy-duty vehicles are not tested as complete vehicles but rather the engines are tested using the transient (ETC) and steady-state (ESC) cycles and therefore are measured in terms of kWh rather than kilometres.

8. Policy implications and conclusions

This paper has focused on existing and proposed policies and measures to increase energy efficiency in the transport sector through improvements in passenger vehicles, either through technical improvements in the performance of the cars themselves or through information or fiscal measures to encourage consumers to improve energy efficiency through their personal decisions. The three-pillared EU strategy has succeeded in delivering some improvements, but there is clearly a need for additional measures beyond the 1999 Voluntary Agreement. For this reason, the proposed new legislative measures to require a reduction in average car-fleet emissions is welcome. There is also a need to ensure that EU strategy's overall objectives are being met, through *inter alia* improved availability of national data and better quantification and reporting of the effects of policies and measures to date.

The experience of various measures to improve consumer information showed that such approaches work best in tandem with fiscal measures, providing further evidence that different policies can complement each other. This supports the mixed policy approach of the three-pillared strategy but it

also points to a continued need for fiscal and legislative measures to complement any voluntary measures.

Although outside the scope of this paper, energy efficiency in the transport sector will depend on measures that focus on all modes of transport and, crucially, on managing demand for transport. The recent rise in popularity of congestion charging following the successful introduction of schemes in London and Stockholm is an encouraging sign, and such schemes can be modified further to take into account the different energy performance of different vehicles (e.g. in London hybrid vehicles like the Prius are exempt from the charge). Charging users for the use of the entire national road network is being discussed in the United Kingdom and other countries and is technically possible following advances in satellite technology. Such a measure could replace fuel tax and annual licence fees, but any such change should allow differentiation of charging based on CO2 emissions. Other policies could include

- Personal CO_2 allowances
- Lower speed limits
- Measures to reduce congestion
- Driver education to maximise fuel efficiency through driving practices
- Driver information with real time feedback on fuel usage

Commercial vehicles are already designed with fuel efficiency as one of the key performance factors (such vehicles are essentially sold on the basis of running costs), but an area with some potential could be to reduce the need to keep the engine running when the vehicle is stationary, e.g. through providing power outlets for cooling/heating at vehicle stops.

Finally, a major area for reductions in the energy demands of the transport sector is through better land-use planning. There is a consistent link between population density and energy consumption, and urban sprawl – seen in the increasing consumption of land and reductions in population density as cities spread out in low-density development – is causing cities to become dominated by relatively energy inefficient car use. This is because the car is frequently the only practical alternative to more energy efficient, but often inadequate and increasingly expensive public transportation systems (EEA 2006, 29-30).

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5 Energy Efficiency in the German housing sector (*Steffen Hentrich, SRU)*

In Germany the share of end-use energy used for heating and warm water has declined considerably in the last ten years and has even led to a slight decline of absolute energy use for these applications. However, fossil fuels are still the dominant energy source. Furthermore, the trend towards rising living space per capita lessens the effects from increased efficiency per area. An absolute decline in energy use may only be reached through measures in the existing building stock that on average still exhibits relatively high heating energy uses. Despite the heterogeneity of the German building stock, a significant part of the differences in energy use is also due to regionally different climatic conditions.

The implementation of ambitious standards is still a major problem. Even though energy efficiency measures result in energy savings between 17 and 33 per cent (sometimes more) they fall short of expectations (HERTLE et al. 2005). Under the current framework it is estimated that only half of the cost-effective measures is actually realised. Apart from standard setting for buildings and environmentally motivated taxes on heating fuels a major policy tool of the German government is the subsidy of energy saving refurbishment.

There are a number of reasons for the gap between the cost-effective and realised potential. One reason is a lack of capacity and communication of relevant stakeholders. Another reason is the regulation of the housing market that is motivated by distributional aspects. As the costs of energy saving refurbishments may only be partially passed on to the tenants, their profitability is lowered. That is, the so-called split incentive problem is actually induced by regulation due to social reasons. This leads to under investment in housing in general and energy efficiency in particular. It also lowers the effectiveness of the other instruments, namely standards and subsidies.

Furthermore, the subsidies for refurbishment may induce sub-optimal behaviour as they are granted only for pre-defined packages that include low-cost and high-cost measures. This may delay the most cost-effective measures. In addition, the subsidies are attached solely to the investment and the associated estimated potential but not to the energy savings that are actually realized. As the behaviour of the user is important in realizing the saving potential the subsidy would be more effective if it was (at least partly) based on the realized savings. However, this may increase transaction costs.

Effective climate policy in the German housing sector requires changes in regulation that allows improvements in the energetic quality of houses to be reflected in price signals. Regulation should, inter alia, allow and encourage to include part of the heating costs in the rents and contracting. The foreseen labelling instrument for housing is an important step for increasing transparency. Despite the presence of cost-effective measure rising housing costs may be expected in some cases. However, the social aspect of housing should be dealt with in a manner that does not destroy price signals in the housing market. Therefore, lump-sum transfers to people in need are preferable over price regulations or refunds of heating costs.

In sum, from an economic point of view regulation should not create additional split incentive problems and subsidies should focus on least cost measures and take into account actual instead of anticipated savings. Furthermore, the social aspect of housing should be dealt with in the realm of social policy and in a manner that does not distort price signals.

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Hertle, H., Duscha, M., Eisenmann, L., Bliss, U. (2005): Verbrauchs- oder Bedarfspass? Anforderungen an den Energiepass für Wohngebäude aus Sicht privater Käufer und Mieter. Heidelberg: Institut für Energie- und Umweltforschung gGmbH.

6 Environmental Tax Reform – The Double Dvidend Issue

(*Henrique Schwarz, CNADS*)

The art of taxation consists in so plucking the goose
as to obtain the largest possible amount of feathers
with the smallest possible amount of hissing.

Jean Baptiste Colbert

1. Introduction

The issue of the environmental tax reform (ETR) is increasingly catching the attention not only of economists and taxation specialists, but also of businessmen and public decision-makers, which implies from the start the perception by ever growing sections of the society that economy inserts itself in the natural environment and interacts with it in a co-evolutionary process, in which public policies and, especially, tax policy, play a central role[11], due to the influence they have on the behaviour of the economic agents.

Simultaneously, the environmentalists' ever rising interest for this issue shows their growing adhesion to the use of economic incentives in environmental policy rather than command and control mechanisms, which were, until recently, more of their preference, even if that was due to ethical or philosophical assumptions.

The question that arises is that of knowing if a change of the traditional taxation, which falls upon the incomes and the consumption of the economic agents, for taxes over the use of natural resources and polluting emissions, not only improves the quality of the environment, as increases economic welfare: this is what is called the *double dividend hypothesis,* an expression coined by David Pearce[12].

Pearce's argument is that if we raise environmental taxes and reduce in equal amount the taxation over capital and labour, we will have less pollution and more jobs and production. Moreover, if we look at it closely, it's this concern with the recycling of the tax revenue that sets the ETR apart from a simple *ad hoc* introduction of environmental taxes in the public taxation system.

In a book published in 1920, English economist Pigou[13] recommended internalising in the market prices the external costs of the polluting emissions, recurring to taxes, and defended the thesis that the

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[11] However, it is a paradox that the recent interest on environmental taxation coincides with the neoliberal inspired offensive against distortionary taxes and in favour of the so-called *flat tax,* with a supposedly low level and universal incidence, which, as it is known, destroys the traditional taxation concerns regarding social justice, shown in dispositions such as the labour income tax progression and in the several rates of the value added tax.

[12] Pearce, D. (1991), The role of carbon taxes in adjusting to global warming, *Economic Journal*, 101 (407): 938-48.

[13] Pigou, A.C. (1920), *The Economics of Welfare,* Macmillan, London (4th. edition, 1932).

optimal tax per emission unit (the so-called *pigouvian tax*) should be set at the level which corresponded to the marginal social damage of the environment's degradation. This means that if businessmen act as rational economic agents, they will reduce pollution to the point in which the marginal cost of control equals the gained marginal benefit.

Pigou understood that this tax's revenue, intending to correct the *market failures*, should be totally returned to the economy, in a *lump sum* fashion, therefore not causing distortions in the economic agents' behaviours, from which could ensue inefficiencies in goods and services allocation by the market and, therefore, a diminution of well-being.

Public finance theory tells us that the replacement of income taxes, especially capital and labour taxation, by non-distortionary taxes results in an improvement in the taxation's efficiency, as a revenue-raising system. In their turn, the facts seem to show that, in itself, taxation promotes an improvement in environmental quality, since it diminishes the households' disposable income, putting a brake in goods and services consumption, including those whose production and consumption cause more environmental damages.

In this chain of thought, the retained work hypothesis is that the ETR is on the basis of two benefits or simultaneous dividends: an environmental dividend, called *green*, and a non-environmental dividend, called *blue.*

The literature distinguishes three versions of the double dividend hypothesis[14]. They all have in common the fact that they admit the green dividend principle that is that the quality of the environment improves with the ETR. However, they differ in regard to the blue dividend:

- the first version, based on the *weak double dividend* thesis, is not very controversial. It states that we will have more social welfare if we recycle the environmental taxes' revenue, reducing distortionary taxes, instead of directly recycling the revenue taken from the economy in a *lump sum* fashion;
- the second version, called the *strong double dividend*, arises more controversy. It defends that, if we use the environmental taxes' revenue to reduce other taxes, especially the level of taxation over primary factors, we will achieve an improvement in the social well being, regardless of the fact we consider the contribution given by the green dividend;
- the third version defends that we will achieve an *employment double dividend* if after the ETR's introduction the level of employment is higher to what it was before.

The economists generally agree that it is desirable to compensate the revenue generated by environmental taxes making cuts in traditional direct taxes and in Social Security contributions, in the part that is the employers' responsibility.

The first goal of recycling the taxation revenue consists in minimizing the allocation inefficiencies generated by distortionary taxes, without forgetting, nevertheless, that according to some of them, as it is the case of F. P. Ramsey[15], these inefficiencies will only be totally eliminated with the application of a uniform low tax over all goods and services, in alternative to higher taxation levels which would only fall upon a small number of them.

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[14] A clear and accessible exposition of these three versions may be found in Goulder, L. H. (1995), Environmental Taxation and the "Double Dividend": A Reader's Guide, *International Tax and Public Finance*, 2 (2), pp.157-183.

[15] Ramsey, F. P. (1927), A contribution to the theory of taxation, *Economic Journal*, 37: 47-61.

A second goal of the recycling of the taxation revenue deals with the concern that the ETR does not increase the taxation weight in the GDP, meaning that it will not generate

an increase in the tax burden over business and households. Therefore, one strives for a neutral political measure in the budget perspective.

The theoretical priority given to the weak version of the double dividend hypothesis does not mean that the other two versions were not subjected to thinking and, in some cases, to controversy between experts, existing those who defend the radical thesis that the ETR always implies a reduction in employment and social welfare, being also less efficient than the traditional labour taxation in respect of revenue raising. The main argument stated by the adepts of this thesis is that, by inducing changes in the consumption structure between "clean" and "dirty" goods, the environmental taxes are at the genesis of a significant erosion of their own incidental basis[16].

The introduction, last April, in Portugal, of a tax over incandescent bulbs is an example of the possible contradiction between the need for a reduction in energy use and the goal of ensuring efficiency in tax revenue raising: being the unity value of that tax of only 30 cents for a 60 watts bulb, it is feared that it will miss the goal of their replacement by fluorescent bulbs, with a lower energy consumption, and that it will mainly serve the purpose of generating the revenues needed by the *Portuguese Carbon Fund*.

There are also those who sustain the thesis that a neutral ETR stimulates final consumption, whether of "clean" or "dirty" goods, by its beneficial impacts on employment and labourers' liquid wages. This means that, in virtue of a *tax interaction effect*, it translates itself in an incentive to economic growth: new environmental taxes compensated by a decrease in taxes on capital or labour stimulate investment and work supply and demand, as well as the creation of more material wealth[17], but they would be counterproductive, from an ecological perspective, for they conflict with the goal of environmental quality.

However, the mere account of the theoretical positions over the double dividend hypothesis, especially in its *strong* version, is of little use to us, since this is a question that only empirical studies can solve. Therefore, it is important to focus attention over some econometric models, which have been used to investigate this version of the double dividend hypothesis, as well as the version of the employment double dividend.

The simulations so far done consider two distinct situations: the first that environmental taxes are introduced unilaterally in a specific country; the second that the ETR is coordinated at a supranational level and its introduction is effected simultaneously in countries that integrate the same block or economic region. On the other hand, they take into account the effects of the ETR on three major categories of economic agents: industries, households and government.

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[16] Bovenberg, A. L. e de Mooij, R.A. (1994), Environmental taxes and labour-market distortions, *European Journal of Political Economy*, 10: 655-83.

[17] Nielsen, S.B., Sorensen, P.B. e Pedersen, L.H. (1995), Environmental policy, pollution, unemployment, and endogenous growth, *International Tax and Public Finance*, 2: 185-205.

2. Industries

The results of an econometric analysis of the CPB Netherlands Bureau for Economic Policy Analysis[18] allow us two main conclusions: firstly, that a unilateral tax over the use of energy implies a more accentuated reduction in employment than if the same taxation measure is coordinated at a supranational level; secondly, that if the more intensive activities from an energy perspective are exempt from that tax or benefit from lower taxes, as was the case with the German ETR, in 1999, and if it falls mostly upon final consumers, its negative economic consequences will be less serious.

The explanation is that environmental taxes, especially when unilaterally applied, degrade the competitive position of national companies in the global market and increment the flight of capital, stimulating displacement processes to countries with more permissive environmental policies, with inevitable reflexes in the employment level. This is something that reveals to be particularly dramatic in the case of small open economies with high levels of involuntary unemployment, such as Portugal today.

This perspective is not, however, supported by the results of similar investigations, namely the simulations performed with the GREEN model of the Organisation for Economic Cooperation and Development (OECD). In this case, the effects of an ETR on business competition, to be coordinated and executed within the European Union, appear to be essentially irrelevant.

But the same does not always happen when one considers the several sectors in economic activity, in which situations that distort competition can occur, a fact that lead some specialists to propose, as a sufficient compensatory measure, minor border tax adjustments be it subsidies to exports or taxes on imported goods with a higher energy content[19]. But we still have to know how to conciliate this kind of adjustments, even if minor, with the principles of free trade, defended for instance by the World Trade Organisation (WTO), knowing that econometric research[20] has shown a low price elasticity of the demand of imported primary goods in the case of more developed countries.

Nevertheless, the concern with the effects that an ETR may have on production costs and, therefore, on business competitiveness forced certain countries to establish exemption schemes or lower environmental taxes for the industrial sector. For example, Sweden as well as the Netherlands, when introducing in their taxation systems the *carbon tax*, recurred to measures of this nature, exempting businesses with greater energy consumption and more exposed to international competition.

Technological innovation is another important fact to bear in mind in any investigation about the ETR's double dividend hypothesis. Before anything else, let us recall the thesis of Michael Porter[21], according to whom environmental policy (and environmental taxation is, obviously, a part of that policy) can stimulate technological progress, giving pioneer companies advantages that, in the long run, exceed the costs of the initial deterioration of their competitive position. In this aspect, some

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18 CPB (1992), *Long term economic consequences of energy taxes*, Working Paper, n.43, The Hague.

19 Mooij, R.A. de, P.J.G. Tang e R. Nahuis (1997), *European energy taxes and border-tax adjustments: simulations with WorldScan*, OCFEB Research Memorandum 9705, Erasmus University, Rotterdam.

20 Kox, H., (1997) Developing countries' primary exports and the internalization of environmental externalities, in Van der Bergh, J. C. J. M. and Van der Straaten, J. (eds), *Economy and Ecosystems in Change*, Edward Elgar Publishing Limited, Chektenham, UK.

21 Porter, M. E. and van der Linde, C. (1995), Toward a new conception of the environment-competitiveness relationship, *Environmental and Resource Economics*, 11: 503-520.

econometric models[22] suggest the existence of positive effects of an environmental tax reform on employment levels, as a consequence of investments in energy efficient technologies, the main cause being the fact that these technologies are labour intensive.

There are also signs that the long term consequences of an ETR can differ from its immediate consequences: in a shorter horizon, by reducing taxation on labour, it originates a decrease in the cost of this production factor, which improves business competitiveness; in a broader time horizon, this effect would no longer be as conspicuous.

3. Households

If we consider environmental taxes, which fall directly upon final consumption goods, logically we no longer verify any adverse impact in terms of competitiveness, since they indistinctly affect domestic goods and imported goods. Its effects are therefore mainly on labour supply and households' purchasing power.

The impact of environmental taxation on households' consumption is, however, far from being univocal. If, by hypothesis, it leads to the adoption of more energy efficient devices in the dwellings, it will generate monetary savings, at least in the medium run. However, if the money thus saved is used to acquire other goods and services of high energy content, then the balance of the consumers' behavioural changes in terms of energy conservation can be null or even negative. Likewise, the replacement of traditional bulbs by more energy efficient bulbs will only result in energy saving if the consumers do not use the latter in a more intensive manner. In both cases, we will be faced with phenomena, mentioned in economic literature as "rebound effects"[23], which show us that energy efficiency does not ensure an absolute energy saving, therefore having to that effect to be accompanied by other consumption containment measures.

Environmental taxes also have repercussions on labour supply, even if they are not significant: for example, the CPB's econometric simulation model predicts that the introduction, in the European Union, of a tax over small consumers simultaneous with a reduction of the tax on labour incomes would increase the employment rate in only 0,1%.

It is known that the impacts of an ETR, which includes, for instance, a reduction of the taxation on human capital, will affect more strongly the social groups more vulnerable in economic terms (rural populations, elders, pensioners, single parent families, etc.), for it changes the structure of the income distribution in a way unfavourable to them: a tax on the use of energy could have positive consequences on the employment level, but it will aggravate the price of electricity, a basic good, imposing disproportionate sacrifices to households with lower purchasing power. That is why Administration shows some reluctance in putting it in action.

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[22] Brunello, G. (1996), Labour market institutions and the double dividend hypothesis: an application of the WARM model, in C. Carraro and D. Siniscalco (eds), *Environmental Fiscal Reform and Unemployment*, Kluwer Academic Publishers, Dordrecht.

[23] Hinterberger, F. et alli, Sustainable consumption: a research agenda (1999), in Kohn, J., Gowdy, J., Hinterberger, F. and Van der Straaten, J. (eds), *Sustainability in Question*, Edward Elgar, Cheltenham, UK, define "rebound effects" as being "counter productive effects at macro, meso and micro levels due to adaptive behaviour on the demand side, when new resource saving technologies and/or behavioural options are introduced" (in the economy) (p.274).

However, it is always possible to take measures capable of neutralising this kind of social effects. The CPB's simulation model[24] predicts the ETR will have a deeper effect on the employment level, in the form of an increase of about 2%, when the reduction of the level of labour taxation is stronger, in the case of households with lower incomes. The explanation for this seems to be that the special incentive that higher liquid wages give to the labour supply of workers with lower professional qualifications.

4. Government

It is a matter of great importance not to forget that when public powers introduce environmental taxes in the taxation system, they are implicitly changing the distribution of social costs and benefits, redistributing property rights over environmental public assets, taking them from the polluters and giving them to the victims of pollution. This explains why the first oppose to political measures of this kind, which harm their interests, for they force them to financially compensate the victims, whose representation is formally assumed by the State. On the opposite, the logic of state subsidies given to business means that it is the society in its whole that compensates the polluting agents for the costs they support when controlling their activities, and helps us to understand why they are well accepted by the business community, unless they strongly affect fair competition.

The redistribution of property rights over environmental public assets modifies, in fact, the power relationships within society, while causing simultaneously changes in the personal income structure, being, therefore, a controversial matter, capable of causing great social conflict. The fact that the ETR can benefit environment quality and the society as a whole, does not mean, practically, that all social groups will gain from it: there will always be winning and losing groups, which means that from it can result ecological distribution conflicts[25]. Now, government officials are aware or, at least, predict these politically delicate facts, which make any taxation reform particularly hard and complex: it infers the ability to find a balance between interests that are, from the beginning, strongly divergent, and according to which it is possible to achieve a solid and lasting compromise, which will contain concerns about economic efficiency, environmental quality and social justice.

For this reason, it is not surprising the common practice of returning part of the revenue of environmental taxes to those that are responsible for degrading the environment's quality. In this way, they are being helped in their pollution abatement investments. An example, amongst many others, that we could give of this kind of financial compensations, whose logic is manifestly contrary to the user-pays and polluter-pays principles, was that of Denmark, that, in 1996, introduced in its fiscal system a tax on energy, whose revenue was transferred in the form of subsidies to the more polluting sectors and industries, the only way that was found to make it politically acceptable.

Within the specific problem of government financial aids to some sectors of the economy (with special emphasis for agriculture, transportation and energy itself), I do not resist the temptation to mention a

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[24] CPB (1993), Effects of an energy tax on small-scale users at low and high price levels, *Working Paper no. 64*, The Hague.

[25] William K. Kapp (1950), in *The Social Costs of Business Enterprise*, Russell Press Lda., Nottingham, already defended the thesis that one can interpret the "political history of the last 150 years as a revolt of large masses of people (including small businesses) against social costs" (p.15). Inside that reaction in preventing social costs or aiming their fairer division, Kapp included passing social protection legislation, the concerns with water and air pollution and, in a more general manner, the measures meant to restrict destructive production methods, as well as the over-exploitation of natural resources.

World Bank's study[26], according to which the suppression of subsidies and other financial incentives to energy use will allow a drastic reduction of pollution: in the case of the less developed countries, such revenues could reach 20% of their GDP!

5. Concluding Remarks

Despite the complexity of the issues posed by the ETR and the controversy surrounding the conditions of its implementation, we can conclude that environmental taxes and traditional taxes are complementary instruments, which enable us to achieve two major taxation policy goals: firstly, financing public expenses, that is producing public goods, such as defence, justice administration, health, education, national security, etc.; and, secondly, a higher environmental protection level. Moreover, the simultaneous achievement of these two goals means that the political instance may even have a basis to stabilize the environmental taxation level, of corrective characteristics, above the optimum level and, in exchange, reduce the traditional direct taxes, whose effects are,doubtlessly, distortionary, but, let us not forget, are also aimed at putting in practice fundamental goals of social equity.

Another important conclusion is that, although it is capable of generating a double dividend, the environmental tax reform always implies changes in the comparative well-being of the different social groups and also in the personal income distribution, being, for this reason, a social conflict factor: if, in one hand, the repercussions in the economy and in society of the problems of the environment strongly depend on the way wealth and incomes are socially distributed, on the other hand, the measures of environmental policy have differentiated consequences, in what concerns the distribution of the economic agents' rights over the environmental public assents.

The perception of this complex reality tells us that the ETR is a policy that demands a high level of social acceptability: in some cases, because of concerns about equity, but most of the times, due to changes in the relative power of the several players and social groups it operates.

Be it as it may, the arguments generally put forward, regarding the socially regressive effects of environmental taxes, do not justify putting aside or postponing the ETR, for it is always possible to find innovating ways of recycling these taxes' revenue or to implement compensatory policy measures, to diminish eventual distributive consequences that prove to be socially unfair: the "energy certification of buildings", introduced by a Directive of the European Union, is a good example of this type of measures, since it aims at reducing households' energy use and energy bill, something of major significance, especially for the families with lower incomes. Generally speaking, complementary policy measures to environmental taxation, for instance in the fields of urban planning and transportation, can play a decisive role in mitigating some of ETR's regressive effects.

Therefore, the arguments that fundament the need for an ETR are mainly of two natures: firstly, it must help to promote, in an economically efficient way, environmental sustainability; secondly, it should worry itself in creating conditions to reinforce inter and intragenerational equity, from which social and territorial cohesion depends.

This will be, in my opinion, the real double dividend from the ETR, the great contribution it can give to sustainable development!

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[26] World Bank (1993), *Energy efficiency and conservation in the developing world*, A World Bank Policy Paper, Washington D.C.

7 Some notes on the Directive 2006/32/EC of the European Parliament and of the Council on energy end-use efficiency and energy services

(Andrea Kollmann, Energy Institute at the Johannes Kepler University Linz)

1. Introduction

In December 2003 the European Commission presented a proposal for the *Directive of the European Parliament and of the Council on energy end-use efficiency and energy services* (COM (2003) 739) in which it called for a 1 % p.a. slowdown of the increase of end-use energy demand in the private sector and a 1.5 % p.a. decrease of end-use energy demand in the public sector in all member countries of the European Union.

This directive comes in line with a number of publications of the European Commission dealing with energy efficiency matters that have been published in recent years. Energy efficiency turned out to be a major concern for the European Union for mainly three reasons:

- Firstly, *the energy import dependence* of the European Union is projected to reach 70 % in the year 2030. At the moment the EU imports about 50 % of its energy requirements with 45 % of oil imports coming from the Middle East and 40 % of natural gas imports coming from Russia. This external energy dependence is regarded as an economical, social and ecological risk for the EU because the EU does not have control over the development of energy prices. The efficient use of energy is considered one of the best possible ways to reduce import dependence.
- Secondly, with the commitment of all member countries of the European Union to the *Kyoto-Protocol* ways to reduce the emissions of the Kyoto gases need to be found and implemented.
- Thirdly, *security of supply* is a crucial factor for economic growth in the long-run. On the one hand reducing the demand for energy mitigates dependence on imports and therewith the effects possible external shocks to energy production (i.e. wars, natural catastrophies) could have for the EU. On the other hand the EU has experienced a number of unexpected power outages in recent years that caused enormous economic costs. These outages are partly induced by overusing the energy distribution infrastructure and could therefore be reduced by lowering the demand for energy.

In a nutshell, the European Union assumes that improving energy efficiency leads to a reduction in the total demand for energy (or at least a slower growth of demand), which again reduces CO_2-emissions, the use of energy-related infrastructure so dampening the energy import dependence of the European Union. Furthermore, the development of more energy efficient technologies has the potential to improve the innovativeness and the competitiveness of the Community in the light of the Lisbon strategy.

The ambitious goals outlined in the draft of the directive were considerably reduced in the final version that entered into force on 17 May 2006. Above all, the most notable difference between the draft and the final version is that the energy efficiency targets are no longer mandatory but only indicative and that there no longer is an ambitious target for the public sector (but the public sector is still encouraged to fulfill an exemplary role).

The Energy Institute at the Johannes Kepler University Linz has been working with the directive for over two years. Reason for this early action was that Upper Austria has implemented an energy efficiency program called "Energie Star 2010" which makes Upper Austria one of the first regions in the European Union to put the directive into action. The task of the Energy Institute has been the development of a bottom-up modeling approach that allows the participants of the Energie Star program to easily quantify the energy savings induced by the various energy efficiency measures taken.

In the following an outline of those aspects of the directive most crucial from the view of the Energy Institute is given:

2. Efficiency versus Savings

Economists, sociologists, technicians, jurists and many more take part in the ongoing discussion on how to make the use of energy more efficient. Alongside the scientific analysis, energy efficiency naturally is a political topic as well. The various points of view taken by those who engage in the debate have led to various definitions of *energy efficiency and energy efficiency improvements*. In the following some of these definitions are described and put into context with the other most important keywords used in the energy debate: energy conservation, energy intensity and energy savings.

> *"'Energy efficiency": the reduction of energy consumption on the basis of technological and/or economic changes and/or changes in behavior resulting in the same standard or degree of comfort being assured."*[27]

The definition stated above represents the official definition of energy efficiency improvements of the European Parliament and the European Commission by December 2003 (draft of the directive). It covers the technological, economical and social aspects of energy efficiency in one phrase and thus acknowledges how extensive an analysis of energy efficiency must be. The definition used by the Commission has changed significantly in the final version of the directive (article 3(c)): *"energy efficiency improvement': an increase in energy end-use efficiency as a result of technological, behavioral and/or economic changes"* whereas energy efficiency is defined as *"a ratio between an output of performance, service, goods or energy, and an input of energy;"* (article 3(b)). The definitions now used obviously lack the clearness of the definitions in the draft and are definitely not supportive for clarifying the debate. Furthermore, a look at other countries' definitions shows how different the approaches to energy efficiency can be:

In contrast to the definition of the European Union, the Energy Information Administration (EIA), the statistical agency of the US Department of Energy, does not point at the various ways energy efficiency improvements emerge but states that *"increases in energy efficiency take place when either energy inputs are reduced for a given level of service or there are increased or enhanced services for a given amount of energy inputs."*[28] Another definition provided by the EIA is *"energy efficiency is the relative thrift or extravagance with which energy inputs are used to provide goods or services."*[29] Even more briefly is the official definition of the Australian Government: *"Energy efficiency is*

[27] European Parliament (2005), p. 12
[28] Energy Information Administration (1995), p. 1
[29] Energy Information Administration (1995), p. 1

defined […] as maintaining or increasing the level of useful output or outcome delivered, while reducing energy consumption."[30]

Nearly any discussion about energy efficiency is brought into context with phrases like energy conservation, energy intensity and energy savings thus often leading to confusion. To be able to develop a clear picture of the issue at hand, a delimitation of these phrases in comparison to energy efficiency must be made.

The phrase *energy conservation* describes technical, economical or social changes leading to a reduction in the use or production of a specific service that initiates a reduction in the usage of energy. If an individual decides not to use his or her car for car rides shorter than 2 kilometers, energy is conserved but there is no gain in energy efficiency as the service "car use" is reduced as well. The phrase *energy savings* can be assigned to energy conservation as well as to energy efficiency. It does not give an idea for how energy is saved and therefore needs to be interpreted according to the context it is used in.

The indicator *energy intensity* allows a more technical view on the use of energy and is mainly applied when it comes to measuring energy efficiency. The following classification of energy intensity is taken from the Odyssee Indicators database of the European Commission. It states: *"energy intensities are defined […] as a ratio between an energy consumption (measured in energy units: toe, joule, etc) and an indicator of activity measured in monetary units (gdp, value added, etc)".*

3. Measuring energy efficiency

Prior to considering if the goals of the directive described above can be achieved at all and whether they contradict each other or not, it is important to decide how energy efficiency improvements shall be measured. Without an "agreed upon" measurement procedure, it is neither possible nor meaningful to discuss targets that are to be reached, may they be binding or indicative.

The directive proposes a harmonized calculation model that utilizes top-down as well as bottom-up modeling approaches. The model shall *"to the extent possible [use], data which are already routinely provided by Eurostat and/or the national statistical"* (annex 4).

3.1 Top-down

"A top-down calculation method means that the amount of energy savings is calculated using the national or larger-scale aggregated sectoral levels of energy savings as the starting point. Adjustments of the annual data are then made for extraneous factors such as degree days, structural changes, product mix, […]." Top-down calculations are already in use in the European Union (most notable: the Odyssee Indicators, the ODEX model). These methods are practicable when it comes to develop an overview of intertemporal changes in the use of energy (example for a top-down indicator: how did the energy intensity of GDP [GDP/total energy consumption] vary over time?). Top-down calculations do not indicate how the measured energy efficiency improvements were reached. Therefore they are of no benefit when it comes to identifying the most effective energy efficiency measures. Furthermore, within a top-down model it can not be identified whether someone took an active part in the implementation of the directive's goals or not, therefore a free-rider situation is likely to arise.

[30] Australian Government (2004), p. 13

3.2 Bottom-up

"A bottom-up calculation method means that energy savings obtained through the implementation of a specific energy efficiency improvement measure, are represented in kilowatt-hours (kWh) […] and added to energy savings results from other specific energy efficiency improvement measures." (Annex 4)

The main advantages of bottom-up modelling are that every improvement in energy efficiency can easily be assigned to the party causing it (free-riders are eliminated). So individual measures can be evaluated according to their effectiveness and also the reasons why the target was reached (or maybe was not reached) can be evaluated ex-post. The strongest argument speaking against bottom-up modelling is the high amount of time needed to collect the data.

According to the directive, the Commission will develop a harmonised bottom-up model before January 1, 2008.

By combining top-down and bottom-up models it will be possible to explain the effects of energy efficiency improvement measures accurately. But before doing so, the models (harmonised models!) need to be developed. How difficult that will be, can be illustrated by the following two examples:

- top-down: to calculate the energy efficiency improvements made in the year 2006, one actually takes the values of the total energy consumption in the year 2005 taking this data as a basis to estimate the energy consumption in year 2006. The estimation includes information on degree days, overall economic development and so forth. Then the outcome of this estimation is compared with the actual energy consumption values of the year 2006 as soon as these numbers become available (in Austria the data for the year 2005 will be available sometime in 2007). The difference is assigned to energy efficiency improvements. That is: the quality of the estimation model strongly influences the scale of the energy efficiency improvements as there is no way to control for every possible influence, because one can never build a perfect model. (e.g. with models that estimate the development of the GDP definitely are the most analysed models in econometrics, still an estimation mistake of +/- 1 % is absolutely normal; so the energy efficiency improvements that we have calculated using a top-down model may be nothing but residuals of the estimation).
- Bottom-up: the directive puts a strong emphasis on the importance of the distribution of information. As the target is defined in kilowatt hours, the difficulty is e.g. to measure how many kilowatt hours were saved by making the energy bill of a household more comprehensive for the household. It is hard to determine how many kilowatt hours can be saved by implementing an information platform (i.e. www.topten.info a site that lists the most energy efficient white ware available).

Problems like these are currently discussed on the regional and on the national level in Austria; most problems still are unsolved.

4. The target: -9 % in a period of 9 years

The overall target of the directive is to encourage (as mentioned before the target is not binding!) the member countries to save 9 % of their final energy demand within a period of nine years (starting with January 1, 2008). The calculation of the national saving target is described in annex 1 of the directive: the total final energy demand of a country previous to the implementation of the directive is summed up divided by 5. 9 % of its yearly average demand is set to be the overall energy savings target. The final energy demand used for the calculation of the target does not include aviation, maritime bunker fuels and all companies taking part in the greenhouse gas emission allowance trading scheme within the Community.[31] Therefore, the energy efficiency target will not lead to an absolute reduction in final energy demand but will (only) dampen the growth of final energy demand.

5. How to reach the targets: audits, services and co

In the following a short overview of the relevant articles in the directive is given. The articles are shortened.

Article 1: Purpose

The main purpose of the directive is to remove market barriers and imperfections that prevent efficient use of energy by mechanisms, incentives and institutional, financial and legal frameworks. Furthermore a market for energy services and for the delivery of other energy efficiency improvement measures to final consumers shall be developed.

Article 4: Energy end-use efficiency in the public sector

The public sector is urged to take an exemplary role in the implementation of the directive by informing the public (individuals as well as companies) about their energy efficiency efforts, by implementing cost-efficient energy efficiency measures, by making energy efficiency considerations an aspect of competitive tendering for public contracts and by making energy efficiency considerations an aspect of public procurement

Article 6: Energy distributors, distribution system operators and retail energy sales companies

Every country can choose between the following options to be implemented by distributors, distribution system operators and retail energy sales companies

a. Offer Energy services[32] to final customers (competitively-priced)

b. Offer Energy audits[33] (competitively-priced)

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[31] The directive speaks of companies in the greenhouse gas emission allowance trading scheme, even though the green certificates were not given to companies but to facilities which again is slightly confusing and needs interpretation.

[32] 'energy service': the physical benefit, utility or good derived from a combination of energy with energy efficient technology and/or with action, which may include the operations, maintenance and control necessary to deliver the service, which is delivered on the basis of a contract and in normal circumstances has proven to lead to verifiable and measurable or estimable energy efficiency improvement and/or primary energy savings.

[33] 'energy audit': a systematic procedure to obtain adequate knowledge of the existing energy consumption profile of a building or group of buildings, of an industrial operation and/or installation or of a private or public service, identify and quantify cost effective energy savings opportunities, and report the findings;

c. Offer energy efficiency improvement measures according to article 9(2) and article 12; or

d. Contribute to a fund according to article 11 referred to in Article 11.

e. Set up voluntary agreements and/or other market-oriented schemes (White Certificates)

Article 7: Information

The member countries take care that information about the target of the directive and the way it will be reached (financial and legal aspects) are communicated to the public, and that conditions and incentives are given to enforce information and advice to the final customers on energy efficiency measures.

Article 8: Availability of qualification, accreditation and certification schemes

The member states take care for an appropriate qualification, accreditation and/or certification schemes for providers of energy services, energy audits and energy efficiency improvement measures.

Article 9: Financial instruments for energy savings

The member states take care, that the legal framework does not impede using financial instruments for energy savings in the market for energy services or other energy efficiency improvement measures and that model contracts for financial instruments are made available for purchasers of energy services and other energy efficiency improvement measures in the public and private sectors.

Article 10: Energy efficient tariffs and other regulations for netbound energy

The member states ensure that all incentives in transmission and distribution tariffs that increase the volume of distributed or transmitted energy are removed.

Article 11: Funds and funding mechanisms

Markets for energy improvement measures may be established by funding. Such measures shall include the promotion of energy auditing, financial instruments for energy savings and, where appropriate, improved metering and informative billing. The funds may provide for grants, loans, financial guarantees and/or other types of financing that guarantee results. The funds may be open to all concerned parties (including final customers).

Article 12: Energy audits

The member states ensure that energy audits are available to all final customers.

Article 13: Metering and informative billing of energy consumption

Member States shall take care that competitively priced individual meters are provided if it is technically possible, financially reasonable and proportionate in relation to the potential energy savings.

Member States shall ensure that, billing is based on actual energy consumption, and is presented in clear and understandable terms.

Final customers shall be given the following information:

a. current actual prices and actual consumption of energy;

b. comparisons of the final customer's current energy consumption with consumption for the same period in the previous year, preferably in graphic form;

c. wherever possible and useful, comparisons with an average normalised or benchmarked user of energy in the same user category;

d. contact information for consumers' organisations, energy agencies or similar bodies, including website addresses, from which information may be obtained on available energy efficiency improvement measures, comparative end-user profiles and/or objective technical specifications for energy-using equipment.

Annex 3 of the directive gives examples for appropriate energy efficiency measures.

6. Primary energy

As the title of the directive indicates energy efficiency improvements in the production of energy are not targeted. It least so it seems. Now and then the directive still speaks about measures that should be undertaken in the production of energy. In annex III of the directive *"domestic generation of renewable energy sources, whereby the amount of purchased energy is reduced (e.g. solar thermal applications, domestic hot water, solar-assisted space heating and cooling)"* and *"high-efficiency cogeneration (e.g. combined heat and power appliances)"* are both listed as measures that improve energy efficiency. Including energy efficiency improvements on the production side into the overall target without also including energy producers in any way in the directive[34] is incomprehensible – after all the Commission took care that we now live in an "unbundled" world.

7. Agenda

Table 1 below gives an overview of the agenda as defined in the directive.

As the table shows the National Energy Efficiency Action plans should have been delivered by the end of June 2007. In the end of July 2007 the EEAP of eight countries was available on the homepage of DG TREN (Cyprus, Denmark, Finland, Hungary, Netherlands, Romania, Spain and the United Kingdom).

Another interesting aspect is the fact that in annex IV of the directive the Commission committed itself to presenting a harmonised bottom-up calculation model until 1 January 2008. For the development of this model a CEN Task Force (CEN TF 190) was set up in March 2007. The target of the Task Force is to present a harmonised bottom-up model till the end of 2010. Furthermore the project EMEEEES (Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services) which is EU-funded, is carried out by 21 European organisations. The project started in November 2006. The aim of EMEEEES is to support the Commission in developing harmonised calculations methods. It runs until April 2009.

[34] The directive basically applies to providers of energy efficiency improvement measures, energy distributors, distribution system operators and retail energy sales companies. To final customers except to those being part of the greenhouse gas emission allowance trading scheme as well as to the armed forces, but only as far as no conflicts are causes with the "nature and primary aim of the activities of the armed forces and with the exception of material used exclusively for military purposes". (see article 2 (a)-(c)).

Table 1: Agenda of the Directive

Entry into force	17 May 2006
Submission of existing calculation methods for measuring energy savings	17 November 2006
Submission of first Energy Efficiency Action Plan	30 June 2007
Start of implementation of directive	1 January 2008
Review of first Energy Efficiency Action Plan (EEAP) by the Commission	1 January 2008
Presentation of harmonised energy efficiency indicators and benchmarks by the Commission	30 June 2008
Report of the Commission to the European Parliament and the Council on the progress in setting indicators and benchmarks	17 May 2011
Submission of second Energy Efficiency Action Plan	30 June 2011
Review of second Energy Efficiency Action Plan by the Commission	1 January 2012
New harmonised calculation model with higher percentage of bottom-up calculations	1 January 2012
Submission of third Energy Efficiency Action Plan	30 June 2014
Review of third Energy Efficiency Action Plan by the Commission	1 January 2015
End of directive	31 December 2016

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8 What does “energy efficiency” mean for the households?

(Greg Wallenborn, Université Libre de Bruxelles)

After having put the pressure on industry, energy policies consider now household as an important target for measures aimed at controlling energy demand. Consumption logics and dynamics are however very different in both sectors. In a recent study funded by the Belgian Science Policy Office, we have assessed the “culture of energy” of Belgian people in their homes[35]. The aim of the study was to understand the households’ attitudes and practices towards “rational use of energy”, and also to appreciate the role of market actors, as architects, general building contractors, and heating specialists. We have then organised focus groups, visited households, conducted in-depth individual interviews and carried out a big quantitative survey.

What is a “culture of energy”?

As the subject of our study was home energy consumption of Belgian households (consequently excluding transport), the basic unit of study was the household in its accommodation. We thus considered all of the variables likely to influence a household’s energy consumption in Belgium. Our theoretical model takes up all of the relations that appear to be the most decisive for residential energy consumption.

The relations that a household can have with these elements of setting and atmosphere are what we call *action variables*, because they are what determine the household’s energy consumption directly and can be mobilised at the outset to reduce its energy consumption. In contrast, we call the relations that influence energy consumption indirectly *situation variables*. These variables are socio-demographic characteristics, attitudes and cognitive resources, the characteristics of the dwelling and appliances, the supply of products that can change the residential setting, and the energy supply. In our model, these factors are represented as external constraints or even the situation’s *givens*. However, it is clear that these variables can change: changes in the characteristics of the accommodation and its appliances, changes in representations of comfort, even changes in ownership. Policy instruments have a special place in our model, given the analysis of them that we want to conduct. These instruments do not act directly upon the households’ characteristics and behaviours, but rather on certain attitudes and representations, as well as on market opportunities. We shall explain briefly the various situation variables, that is to say, what must be taken into account to understand how and why households use energy.

We can define a “culture of energy” as the way all these variables are interrelated. In order to assess this “culture of energy” of Belgian households today, we have considered four dimensions that can be translated into indicators: equipment (or material culture), attitudes (or representations), knowledge, practices (or behaviours). Equipment indicators include the energy-consuming equipment (furnace, type of fuel, and electrical appliances), the regulation device of heating and the shell of the building (volume, surface area, and insulation). Attitudes indicators are either general and about the environment, the others (including the future generations), the self and its capacity (self-esteem); or

[35] http://www.belspo.be/belspo/fedra/proj.asp?l=fr&COD=CP/50

specific and in this case are about energy and its conservation (sensitivity to prices and to information about one's consumption, representation of the importance to make savings, choice criteria when buying new appliances, confidence in sources of information, motivations that lead to installation to efficient equipment). Knowledge indicators have several levels: about energy in general (its production and transport) and the related problems (global warming, pollution), about the practical options (policy instruments), and about the capacity to asses the relative impact of each action (amount of bills). Practices indicators concern the ways to regulate indoor temperature (level of temperature, regulation according to the rooms and to the hours), use of light and electric appliances, maintenance of the heating system.

These four dimensions are relatively independent form each other, in the sense that there is no systematic correlation between them. One household can have a good "mark" for one dimension while not being so good in the other. For instance, many people have favourable attitudes towards the protection of environment and climate, know global warming problems, but eventually act rather little in order to reduce their energy consumption. Inversely, some people have energy-saving behaviours without having attitudes and knowledge that are a priori favourable to these behaviours: it is often the case of low income persons, that have no funds to invest in energy efficient equipment. Moreover, somebody can have the latest most efficient furnace and make very little attention to the way its heating system is regulated.

Some results of the research

General findings

The public at large continues to have problems grasping energy as a physical parameter. Energy gets visibility only through its various uses, as heating, lighting, the functioning of household appliances, and so on.

Very often, our respondents were unable to say how much energy they used, be it overall or by type of source (gas, heating oil, electricity, etc.), or even by type of use (heating, lighting, etc.). They were not able to give even a rough estimate of how much they used, whether in cubic metres or kilowatt-hours. Most of our respondents were no more able to give us estimates of their monthly or annual home energy use costs.

Generally speaking, the population is not guided by ONE single energy use rationale or ONE single energy-saving rationale. Their rationales tend to depend rather on the sector of household activity, *i.e.*, lighting, heating, cooking, washing clothes, etc. People make choices and adopt certain behaviours in each of these sectors in line with a set of criteria and constraints in which saving energy or money is often a less important factor than other personal criteria.

Our segmentation analysis established that socio-demographic criteria were more powerful explanatory factors of thrifty behaviours than attitudinal factors. The latter helped explain thrifty and wasteful behaviours, but in a complementary way. "Positive" attitudes (towards the environment or the impact of one's activities) were not indicators of taking action, but more positive attitudes were observed in those who did follow up word with deed. Negative attitudes (towards expensive energy, technological progress, difficulty of controlling one's energy consumption) did not seem to influence behaviour one way or the other. Those who took action attached more meaning to achieving savings than the others.

However, saving money is not a dominant motivation, either. For example, the energy savings that are achieved by an investment are not considered financial savings, but slow returns on the investment.

Our respondents' motivations to adapt energy-saving behaviours were varied. They varied with the individual, but also with the sector of consumption and/or type of behaviour for the same individual. So, we saw different reasoning at work when it came to investments and daily practices. People tended to think that savings were more the results of investments than of daily behaviour. Those who invested thought that they had done what was necessary to save energy and made little effort to adopt more energy-saving behaviours. A good summary of the lack of knowledge is the following. People overestimate the state of the dwelling's insulation; they generally ignore subsidies and rebates or just don't use them; they are confident in source of advice that are not always reliable; but they declare they are well informed about how to save energy.

The qualitative approach underlined the influence of education on these types of behaviour. Changes in behaviour regarding energy use also occurred following breaks in routines or moments of sudden realisation, such as the worsening of one's financial situation after losing one's job.

Heating

In our sample, most of the dwellings (83%) had central heating fuelled by natural gas (57%) or heating oil (40%). Electricity was used very little as the main source of heat. Some people were likewise unable to specify the main features of their central heating system (type of energy source, type of furnace, etc.).

The majority of the respondents who had made investments were owner-occupants. These investments depended as a rule on the level of well-being to which these people aspired, but above all to the state of the dwelling (accommodation to renovate, new construction, etc.). Currently, the subsidies on offer do not play an entrainment role. Very few applications for these premiums are submitted when investments are made. This is because either they are not known or people do not know where to apply for them.

Many respondents said that they were willing to avoid energy consumption that they deemed useless or superfluous (willing to lower the temperature at night, when they are not home, etc.). In contrast, it appears much more difficult to get them to adopt new behaviours that influence their comfort or change they habits. Moreover, just one member of a household cannot regulate energy consumption due to heating on her/his own; a family consensus is required for this. The indoor temperature was found to be a source of disagreement in half of the households that we interviewed. Such conflicts were generally settled by setting the temperature in line with the needs of the person most sensitive to the cold.

The most frequently expressed motivation for undertaking energy consumption-related work was greater comfort. Measures aimed at improving infrastructure (*e.g.*, heating and insulation) so as to keep the home just as warm while consuming less energy would be better received than awareness-raising campaigns encouraging people to lower the temperature by lowering the thermostat, for example.

Electricity

Belgian households' electricity consumption is up. This is explained notably by the increase in the number of appliances that households own and the rise in their frequency of utilisation. Some appliances (refrigerators, TV sets, washing machines, and microwave ovens) were present in the majority of the households that we interviewed. Others (freezers, computers, electric cookers, clothes dryers, dish washers, and a series of small appliances) were present in a smaller number of households. As a rule, the households had at most one appliance of each type. The exceptions were television sets and computers, for the households that had one of these appliances usually had more than one.

However, we see no single, homogeneous electricity consumption pattern, nor do we see a consistent electricity saving pattern. Electricity consumption can be understood only by examining it in relation to the various sectors of activity (lighting, cooking, cleaning, recreation, etc.). This is borne out inside a household (for example, care will be taken to switch off appliances on standby, but rooms will be lit by powerful halogen bulbs) and in a given sector in different households (for example, when it comes to lighting, most of the respondents stated that they switched off lights when no one was in a room and considered this a way to avoid wasting energy, but many respondents said that they used lighting to "create an atmosphere", that is to say, to create an impression of animation, life, space, warmth, intimacy, or cosiness.

Unlike savings in heating, which require a consensus, a single person can, by her/himself, dictate when lights are to be switched off or limit the use of lighting in the family, for the consequences are not as vital as with heating. When it comes to electrical appliances, very few respondents felt it was possible to buy and use only the appliances that they might truly need. Similarly, very few respondents entertained the idea of using their appliances differently. However, many respondents felt it would be easier to buy more energy-efficient appliances.

Policies and measures

Some hobbles on investment showed up clearly. They were the occupancy status, envisioned length of occupancy, overestimation of the state of the dwelling's insulation, source of advice (heating specialist for the heating, no one for insulation), procedures to get information, ignorance of subsidies and rebates, and non-utilisation of subsidies.

The measures that the households stated as being the strongest incentives varied with the group, but there was general agreement on what would prompt people to pay more attention to their energy consumption, namely, more regulation, better visualisation of energy consumption and its environmental impacts, high energy prices, and personalised advice.

We have analysed the Belgian energy policy mix. Our analysis shows that the public that policy instruments target is primarily the "public at large", especially in the case of vast information campaigns, followed by owners ready to invest in energy-efficient appliances and structures. There are few "supporting" measures. Instead, emphasis is put on the households' "spontaneity" and the existence of strong motivations to save energy. A policy to control energy consumption must thus manage to allow for both low-income households, which have proportionately higher energy budgets and limited investment capacity, and high-income households, which spend relatively little on energy compared with their overall budgets but have high investment capacity.

To put their policy instruments into effect, the public authorities often rely implicitly on a relatively simple and seemingly obvious approach, i.e., each individual can control her/his own behaviour, but it

is up to industry to put more efficient products on the market. This dominant approach is effectively anchored in the microeconomic theory that describes the formation of consumers' preferences on the basis of a fiction, that of an individual acting rationally in a perfect market in order to maximise her/his satisfaction or personal use. This economic approach comes up against many problems when it is confronted with real consumer practices.

To complete our investigation, we met with various people deemed to be prime observers or practitioners in areas that concern residential energy consumption, i.e., architecture, heating, building, government administration, instructors, energy advisers, and so on. Subsidies were often perceived to be good tools for communication but of rather limited effectiveness when it came to influencing energy consumption. The interviews of certain professionals amongst these intermediaries actors confirmed their importance in residential energy consumption and the practices (whether good or often bad) that they perpetuate. The upshot was the continued weight of tradition in the building and heating trades and the need for household energy advisors – a role that has yet to be filled. The 'wait-and-see' attitude seems to remain widespread.

Conclusion: Which instruments for a new culture of energy?

At the beginning of the study we hypothesised that the way in which people live in their dwellings can be an adequate angle of analysis. Indeed, living habits can be connected to differentiated energy use practices and to the ways in which energy-saving arguments and incentives are received prior to all study. We thus drew up a typology of six profiles on this basis. However, we could not confirm this interesting result because it became apparent that the dynamics of household energy use differed with the various sectors (heating, electricity, and hot water) and sub-sectors (the various services provided by electricity) of energy consumption. Consequently, energy savings must be tackled differently according to the sector and cannot simply be linked up to the way a household lives in its home. Therefore rationality of consumers' choices must always be *situated*, that is, placed in the context of the constraints that limit their theoretical possibilities of action. Seen from this angle, information does not appear to be sufficient in itself. Such instruments are effective only if they back up other initiatives, such as financial incentives and regulations.

From the households' viewpoint, energy is distributed in a series of actions, the purpose of which is not to consume energy but to provide a set of services. This set of services is disparate and as a rule is not perceived to belong to the energy category (unless people are questioned on this point). Some households have got into the habit (through education in particular) of paying attention to certain uses, but energy-consuming practices continue to come in for varying degrees of thought. Of course, the households know in general that energy has a cost and its consumption poses environmental problems, but energy is an abstract notion, for it is not easily associated with the myriad of actions that lead to energy consumption.

Therefore, it does not seem relevant to start from the theoretical concept of energy to speak to people about their own practices. Practices leading to consume energy are fragmented through the services that are provided. And yet people don't speak about services, but about the quality of devices that provide comfort, cleanliness and convenience as Elisabeth Shove (2003) says. Energy is a bad concept from the point of view of practices. Energy is an abstract term for the lay person. It is without perception. It appears only with some manifestations.

The question of choosing adequate policy instruments is not of understanding the concept of energy. (Furthermore, which concept of energy should be used?) It is rather a question to implement new

practices. The ‘new culture of energy’ will arise from people’s practices. In the current culture, energy is abundant, cheap and invisible. In the new culture, energy would be fragile (black-outs), complicate (liberalisation of markets), and should be made visible and precious. In the old culture, users are defined as passive and ignorant. So the pedagogical model of blackboard is used. Discourses about rational use of energy in Belgium are typical of this kind of professorship. You just tell people as if they were in a school. How people could become active ? What would be a good practical lesson? How challenge the current appropriation (or domestication) of technology?

With a view to drawing up recommendations, we can ask the following question: Is talking in terms of energy relevant to affect these practices, or should we respect the fragmentation of these practices? We believe that both must be done, but in the right order, starting with the practices. The first step could be that of support policies, of policies that adapt to the myriad of cases that concern households and building professionals alike.

Our survey findings show that people are very interested in free audits. They would in a way like it if someone came to their homes and explained what energy consumption was and how they could reduce it. As each household and each house is a special case, it seems normal to request individualised assistance. If audits are to be followed by effects, they must nevertheless be accompanied (by financial support or by close, regular contacts). Moreover, the private individual who wants to do work in her/his home is currently completely at sea: It is very difficult to find reliable information (for households and professionals alike), and professional support for each of the stages in the process, from design (new construction or renovation) to inspection, is lacking.

In a second step, once a person has done something to save energy, it is possible to use these changes to turn energy into an important issue and thus give meaning to the Kyoto Protocol, for example. The two steps are linked not chronologically, but logically, that is, one must be as close to people’s daily practices as possible (*e.g.*, audits), to then be able to show them the connections between their actions and the environment. One cannot take as a starting point the essential issues that are raised by the consumption of non-renewable energy sources without first organising a general policy of aid and support that takes account of the many different practices that occur in the field, on pain of making people feel guilty (and thus rendering them powerless).

9 Social behaviour and energy efficiency – change and its brakes and catalysts

(Luísa Schmidt and Susana Fonseca, CNADS)

Abstract [36]

Most research into energy focuses on its economic and technical aspects. Social ones tend to be ignored or then pointed to as the great obstacle or barrier to achieving the technical potential and the efficient implementation of energy policies. Besides this constraint, it has become usual to focus on the most personal of people's everyday choices (what lamps they have, whether they get about by car, how many times a week they use a washing machine) and less on daily and regular behaviour resulting from the structural constraints of these choices (i.e. available public transport).

If our aim is to alter the patterns of energy consumption, we must know the factors that determine or condition them. Even though individual behaviour is a basic consideration, we must not underestimate factors that lie outside a person's decision-making sphere. For example, up to what point does the way a town or village has been planned encourage parents to take their children to school by car instead of by bus or on foot? Or then the way financial restrictions oblige people to choose homes in urbanisations that have not enjoyed any energy efficiency considerations at all.

This paper aims to demonstrate the importance of a sociological look at the subject of energy and how it is present and understood on a daily basis, with particular emphasis on energy efficiency. To this end it focuses on some of the most recent studies on this issue, particularly the ones related to the European reality.

The need to broaden the perspective on what can contribute to a more efficient use of energy in order to include structural factors, and the urgency of working with them all, if the challenging objectives that Europe faces are to be achieve, it's one of the main conclusions. Integration and coherence of measures and speeches, and the inclusion of all the players, leaving no one on the outside of the societal efforts for a more sustainable use of energy, seem also to be relevant elements. This paper also underlines the need to reflect on the energy efficiency concept and on its positive and negative impacts on the broader concept of sustainable development.

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1. Introduction

Most research into energy focuses on its economic and technical aspects. Social ones tend to be ignored or then pointed to as the great obstacles or barriers to achieving the technical potential and efficient implementation of energy policies. Besides this constraint, it has become usual to focus on the most personal of people's everyday choices (what lamps they have, whether they get about by car, how many times a week they use a washing machine) and less on daily and regular behaviour resulting from the structural constraints of these choices (i.e. available public transport).

If our aim is to alter the patterns of energy consumption, we must know the factors that determine or condition them. Even though individual behaviour is a basic consideration, we must not underestimate factors that lie outside a person's decision-making sphere. For example, up to what point does the way a town or village has been planned encourage parents to take their children to school by car instead of by bus or on foot? Or then the way financial restrictions oblige people to choose homes in urbanisations that have not enjoyed any energy efficiency considerations at all.

That energy is invisibility could also bring further problems, as it is difficult to recognise not only its many uses but also to establish a relation between the apparently harmless and invisible patterns of energy use and their impact on the global environment.

The first part of the paper aims to demonstrate the importance of a sociological look at the subject of energy and how it is present and understood on a daily basis, with particular emphasis on energy efficiency. To this end, it begins with presenting a set of results from various studies carried out on an international scale (specially in Europe) together with another tool, which is in fact only European – the Eurobarometer. It is organised according to key topics within the debate on energy efficiency. The second part deals with some solutions that have been put forward in various studies that could contribute significantly towards promoting society's more efficient use of energy.

2. A sociological view of energy efficiency

An examination into various social dimensions allows us to point to energy as one of the central themes in the plan for the future of the European Union. On the one hand, the EU's increasing involvement in establishing energy policies and regulations. Although energy has been a fundamental feature in the EU since the outset, it always tended to be a matter for Member States to decide upon separately. This has no longer been the case in recent years and the EU is progressively more inclined to intervene, which meets people's expectations as they increasingly recognise the EU's authority and need to intervene in this area (Eurobarometer, April 07).

Table 1. The best way to tackle energy-related issues:

	UE-27
Through measures agreed on EU level	62
Through national measures in each Member State	32
DK/NA	6

Source: Eurobarometer, April 07

On the other hand, the importance of the energy question on the European Union level can easily be seen by the impressive number of studies undertaken by Eurobarometer. Seven have been carried out since 2002 to measure Europeans' awareness, information and knowledge about different areas of energy.

This resolve reveals not just a growing concern with the issue but also with European citizens' information and awareness, which are basic to the sought-after change that will lead to more sustainable energy use as well as the decisive choices that must be made.

Other matters to be taken into consideration are rising fuel costs and the liberalisation of energy markets, which frequently involves tariff modifications so often controlled by monopolies or then regulated by governments. Or else the growing and globalised debate on climate change, its consequences and close connection to the predominant energy model.

Although the global context shows the need to question and ponder over the current energy model, presenting viable solutions that can be understood and integrated in people's daily lives is not always part of the basic issues that are dealt with, and the debate about energy ends up being channelled into areas other than that of saving or energy efficiency. This is flagrant in Portugal. A recent analysis made of Portugal's three leading TV channels shows that the media "seems to have contributed towards the construction in the public arena of the idea that the energy paradigm now in force is under threat, even in a state of crisis", but alternative solutions "have not been mediatised clearly", renewable energy has been given little (though favourable) coverage and there is no sign of any increase in energy efficiency (Horta, 2007).

Within this context, we see that the EU and even the various Member States acknowledge the importance of the energy efficiency question, but that it is difficult to communicate this concept and make it part of citizens' and decision-makers' lives.

Besides this problem, we should highlight the need to look carefully at the way the idea of energy efficiency is conveyed in case we construct and send a message at odds with more wide-ranging objectives that go beyond merely achieving Portuguese or European targets. It is vital that debate about global impact should be encouraged and that in the medium and long term, measures taken today to promote energy efficiency should have more wide-ranging consequences on sustainability. (SDC, 2006; Bartiaux et al. 2006; Shove et al. 2004). From the need to question and reflect on the nature and suitability of certain consumer goods (Shove et al. 2004) to the importance of ensuring that promoting a more sustainable or more efficient article will not imply increased consumption (SDC, 2006), even if it is different, the fundamental message seems to be that we must not allow ourselves to be pressed by a "rage" for energy efficiency and technological improvements without questioning any underlying messages. It is thus crucial to look more attentively at the way that demand is constructed (Shove et al. 2004) and the role that the different actors or agents have throughout this process chain, while taking into account social, institutional and cultural factors apart from personal ones (Bartiaux et al. 2006) when this same demand is first formed.

With this in mind, we will now look into some standard issues that some studies have identified as possibly playing a more or less active role in shaping a more efficient society in its use of energy.

We will start with socio-demographic variables, which are essential to any sociological examination, and afterwards expand on factors pointed out as perhaps acting as brakes on or catalysts for the required change in relation to energy, with particular attention to the subject of information, which is so frequently pointed to as a fundamental link to change.

Socio-demographic variables

It is generally accepted that a set of social variables tends to explain the configuration of individual behaviours. Variations in gender, age, income, social position, level of education, socio-professional group and home size are normally seen as influencing daily practices.

An examination of studies undertaken in other countries about practices, attitudes and outlooks with relation to energy has revealed that among the "classic" variables of social characterisation, those that have been considered more significant are those of income and education. Age, gender and family size are less important, while other indicators just occasionally mentioned are home ownership and home size.

Of these variables, family income has been highlighted as the main factor of social differentiation. The importance of income becomes evident in the limited or zero capacity of some families to invest in energy efficient work or equipment (Boardman and Darby, 2000; Ramsay and Pett, 2003; Anker-Nilsen, 2003). In effect, it is available income that allows them to invest in ways to use or save energy (Wallenborn et al. 2006). According to Bartiaux et al. (2006), families without the financial means to invest in more efficient equipment tend to change their consumer habits by reducing consumption. However, we should not forget that energy consumption is already reduced to basic needs in some of the lower-income households and they are unable to make further cutbacks. Homes of lower-income families also usually suffer environmental effects such as heat stress, lack of comfort and poor air quality (Santamouris et al. 2007).

On the other hand (Bartiaux et al. 2006), higher income is normally associated to fewer environmental concerns in practical terms. In fact, direct and indirect use of energy grows with the household's per capita income.

With respect to this, it should be noted that although higher income social groups are more aware and sensitive to "responsible" consumption, there is a wide gap between their discourse and their actual consumption practices (Delpal and Hatchuel, 2007). On the other hand, it seems that for this sector of the population, it is more important to have their social status recognised than to save energy, and this means increased energy consumption, such as favouring high-powered cars over public transport.

In short, the way energy is consumed consequently contributes towards there being a close relation between social differences and the quality of life of various sectors of the population, and this should be kept in mind when drawing up public policies on the matter.

Another relevant variable is the level of education. The general tendency here is for the better educated to present higher levels of environmental concern, as well as greater levels of information and knowledge about energy issues and a greater awareness of energy practices.

In fact, education is related with knowledge about energy (EB, Jan. 2007) and the capacity to understand aspects of energy use (Wallenborn et al. 2006). The better educated tend to show higher levels of understanding non-renewable energy problems, knowledge about climate change and the depletion of natural resources, as well as greater concern with energy saving in their homes (Prada et al. 2007). However, this does not necessarily mean that they adopt energy-saving behaviour (Bartiaux et al. 2006). Subsequently, although higher education may in some cases lead to a greater predisposition to save energy, other interests such as a desire to have their social status recognised usually take precedence over knowledge and consequently determines behaviour.

As for the influence of age, studies consulted are contradictory. Although there is a visible tendency for younger people to demonstrate greater awareness of energy as a result of school education, this

does not always translate into practices – which could be related to this age group's lack of financial responsibility (EB, Han. 2007). At the EU level, it has been shown that people aged 55 and over have the lowest levels of knowledge about energy production (EB, Jan. 2007) while simultaneously showing greater concern as to possible energy price rises (EB, Abr. 2007) while young people and students seem less worried about this (EB, Jan. 2007).

The habitat variable reveals that the most significant differences lie between urban and rural life, particularly with regard to access to information, support programmes or advice on energy efficiency (Ramsay and Pett, 2003).

Another variable often used in energy-use studies is household composition. It has been seen that the fewer the number of people per household, the greater per capita consumption. Consequently, although more energy in absolute terms is consumed, in relative terms a one-person household consumes 20% more energy that a two-person household (Wallenborn et al. 2006). This is a concern in view of current tendencies in demographic development, but also an exciting challenge to meet insofar as what technology to use and policies to implement in order to achieve national and European energy-efficiency objectives.

House ownership is considered an important variable despite the small number of known facts, seeing that it has an effect on people's greater or lesser degree of freedom and commitment to introducing innovations and investing in their homes (Wallenborn et al. 2006). This variable is of particular relevance in countries with well-established rental markets.

What are the potential factors for and obstructions to change?

Before discussing methodologies for change, some authors stress the importance of exploring measures to take not just for the sake of their immediate returns but also for the greater wide-ranging effects they could have (some long-term and hard to measure) on development and motivation for people to change their behaviour and develop sustainable practices (SDC, 2006). Even if the results, or the number of the people affected, may seem insignificant, there could be important gains with respect to dissemination, awareness and assimilation of information, proactive participation and development.

It is generally agreed that any policy to promote behaviour will only take effect if mechanisms to give all market agents the correct signals that encourage them to cooperate in energy efficiency are implemented in situ. Sound policies, high standards, incentives but also penalties for wrong or less sustainable behaviour are dimensions of the same intervention and fundamental to the desired change (Irrek et al. 2003; SDC, 2006; Lindén et al. 2006; Bartiaux et al. 2006).

As for factors that may act as brakes on or catalysts for change, studies have always pointed to some "classic" variables of a social nature, as was referred to beforehand. However, these studies also reveal that these variables are insufficient in order to define objectively practices relating to energy use. Similarly, the level of information and knowledge (albeit necessary) may not be so important for a change of behaviour to occur with regard to energy. Attitudes and values do not always translate into concrete actions. It is thus necessary to try and understand the factors that hinder behaviour change and what could bring about this change. To this end, we must take into account structural constraints (objective conditions such as public transport networks, for instance) and the very manner in which social relations are structured (action criteria linked to social identity and status).

The following factors taken together tend to act as obstructions to change (Bartiaux, 2006; SDC, 2006):

- The need to change daily routine and the idea that comfort and acquired rights will be lost;
- Difficulty in accessing equipment and solutions (public transport, for example);
- High costs of sustainable or more efficient options;
- Financial concerns (insufficient means to make investments);
- Lack of confidence in public organisations, governments and business companies;
- The organisation of energy policies;
- Market pressures; social norms, pressures and influences regarding consumption;
- The notion that individual action is useless;
- Identity issues.

On the other hand, as potential factors for change there is the fact that consumers can identify easily which products will allow them to save energy and money (Boardman, 2004). Likewise, penalties imposed on certain behaviour by public authorities tend to accelerate the process of behaviour change (Lindén et al. 2006) as does encouraging the development of more user-friendly systems to facilitate energy efficiency practices. An important role can also be carried out by the social framework itself, which is shaped by cultural trends that are more critical of some consumer conducts, social pressures that act as a spur to adopt more sustainable consumer habits as well as deeply-rooted (since childhood) values of thrift and efficient energy use.

As Lindén et al (2006) said, greater knowledge and more simplified practices are very important to bring about behaviour change. In fact, simply being unaware of the existence of subsidies or discounts, or not knowing how to get advice or information or how to use equipment itself more efficiently, can stop energy efficient measures from being adopted (Wallenborn et al. 2006; Lindén et al. 2006). Likewise, creating an environment that promotes the idea that each person can make a valid contribution is pointed to as another potential catalyst for change (SDC, 2006; Bartiaux et al. 2006).

The role played by information and knowledge

It can be concluded from the studies under analysis that information and knowledge are crucial for people to develop a greater awareness of the need to adopt more efficient practices. Knowledge and an understanding of the causes and consequences of some environmental problems seem good indicators of the acceptability of certain actions and policies aimed at resolving the problem (O'Connor, 2002).

A number of situations have shown it is only when environmental problems come to the general public's notice that people begin to consider them as threats. This seems to be the case in the recent increase in public understanding about climate change. Some studies suggest that people's knowledge and understanding of the causes and effects of climate change are what best explains the support given to policies and actions to reduce greenhouse gas emissions. In fact, people who best identify these causes and effects are also those who most support government initiatives and voluntary actions to reduce fossil fuel consumption (O'Connor, 2002). Information and knowledge are thus fundamental for people to adhere to environmental protection practices.

Climate change and its role in public debate in Europe is clearly expressed in the results of the latest Eurobarometer (April) on energy policies in Europe. Apart from the overall concern in terms of age, education, gender, socio-economic grouping, most people agreed that the way in which each country produces and uses energy contributes towards a problem of great concern. In fact, 82% Europeans say that energy production and consumption has a great (38%) or some (44%) negative impact on climate change. Despite the socio-demographic and economic homogeneity of the theme, it is still interesting to see a regional difference. It can be said that EU countries with colder climates are less concerned about climate change while the level of concern increases as one goes further south – Spain, Greece, Cyprus, Malta and Portugal (in 5th place).

Also worth highlighting is what Europeans envisage as the approaching impact their energy use will have in the near future in view of the climate change controversy. It is generally accepted that individual behaviour will inevitably have to change as a consequence of unavoidable energy price hikes.

Table 2: What effects will climate change have on the way you consume energy in 10 years time?

	UE-27
Have to change your everyday energy consumption habits to consume less, e.g. switching off the lights more often, or heat/cool less, or use the car less often	76
Have to change how you heat, light and cool your house or apartment, by installing equipments that save energy	72
Have to pay much more for the energy you use	68

Source: Eurobarometer, April 07

Despite differences in the selected choices depending on several socio-economic features (i.e., older people expecting less from technological changes but showing a greater deal of concern about increasing energy prices), it should be noted that increasing energy prices seem to be recognised equally by almost everyone. It seems that increasing energy prices is a very inconvenient truth, but acknowledged by all (Eurobarometer, April 07).

However, with respect to the relation between information and knowledge available to people and their actual practices, it is ironic that if on the one hand there is a clear perception of the need for more information about the problems of climate change and energy issues to be disseminated generally, on the other hand, the results of some studies show that the link between knowledge and practices is weak.

In effect, according to Bartiaux et al. (2006), greater knowledge and more information do not seem very relevant in getting energy savings practices adopted. Likewise, Goldblatt (2003) found that although information was one of the classic instruments in US policy for energy conservation, providing information was very ineffective in influencing household energy use. The same result was found in the latest Eurobarometer on energy. In an attempt to interconnect practices related with energy efficiency and environmental concern, that is to say, on trying to relate concerns about climate change with conscious behaviours in terms of energy, a correlation existed, though very weak, which seems to suggest that environmental concerns and behavioural responses are not automatically connected in Europe either (Eurobarometer, April 07: 10).

In view of this paradox, three observations should be made. In the first place, people's low level of energy literacy undoubtedly hinders them from understanding the information that is provided. This means we must change how information is passed on to the general public.

The second observation is about the quality of the transmitted information. There still seems to be a certain inability to use campaigns successfully. Among other problems, information campaigns fail to focus on attractiveness, clarity, simplicity and relevance of the messages, while also not being careful about the credibility of the sources of information (Goldblatt, 2003; Wortmann and Mohring-Huser, 2003; Bartiaux et al. 2006). Consumers must be provided with information that includes issues on a personal level – advice on how they can preserve energy -, as well as on a structural level – disseminating information about development in technologies, social practices and infrastructures that are more energy efficient. In fact, people must recognise environmental innovations as relevant to them and adapt them to their own lifestyles and home use (Goldblatt, 2003). Besides this, people need to feel that they are not the only ones who are trying to change their behaviour but that others are making the very same effort (SDC, 2006).

The third observation stresses that there are structural factors beyond information and knowledge that greatly influence practices and can act as brakes (Bartiaux et al. 2006). In effect, if some behaviours depend on micro-decisions taken according to a person's freedom of choice, others are subject to macro-restrictions that shape individual consumer behaviour (Goldblatt, 2003). As Owens (2006) said, information has no power to influence unless it is counterbalanced with other very strong influences, such as social norms and prices. This does not mean that information is expendable but rather that it must be part of a wide-ranging strategy that must not remain neutral and should flow in various directions.

3. Suggested solutions

Public policies

Within a context where on an international scale support is given to environmental conservation policies, which are essential to deal with climate change, public policies emerge on the front line of energy efficiency actions. There is vast support for energy saving policies within the sphere of public environmental polices, and a sense that we need to be consistent (Bartiaux et al. 2006; SDC, 2006). So, there is room for change: governments can be more demanding and provide more incentives as many people are willing and ready to see new policies put in place to help them change their consumer behaviour.

However, studies reveal that governments should not only give the example but also create conditions for consumers to be able to change their behaviour (Bartiaux et al. 2006; SDC, 2006). It is customary to stress the need to find a proper balance between regulations and awareness raising so that people do not feel that the change is simply imposed on them, but that they are also offered the gratifying opportunity to take part of their own free will as citizens (in the change) (SDC, 2006). Values that should frame and make these public policies more acceptable are:

- Equity and justice issues (making everyone responsible and protecting the interests of the poorer) (SDC, 2006),
- Trust in collective action in the sense that acting alone is considered useless and could well mean making a personal sacrifice for no guaranteed gains (SDC, 2006);

- Selected incentives must be positive and goals must be attainable and encouraging.

Data in several surveys carried out by Eurobarometer show that Europeans want help to reduce their energy consumption and thereby become part of the solution. It is interesting to see that fewer and fewer countries demand that their governments intervene basically on a more passive level by just supplying information. According to the latest survey (April 07), the majority tend to ask national governments to intervene and focus on supporting energy efficient solutions. Few countries stress the need for information, as is the case of Portugal.

Table 3: What do you think national governments should do to help people to reduce their energy consumption?

	UE-27
Subsidise energy efficient solutions, for example in the homes	48
Provide more information on efficient use of energy	25
Adopt stricter efficiency standards for energy consuming equipment	21
Other	3
Nothing	1
DK/NA	3

Source: Eurobarometer, April 07

Public policies can make use of a set of mechanisms that act in different ways, but taken together are vital in order to achieve the aims of improving energy efficiency, allowing for concerted efforts and sending the right signals to various market agents. According to studies analysed, the most suitable and efficient policy instruments to reduce barriers (financial, behaviours, market) are:

Adminstrative Instruments (Lindén et al. 2006) or regulations and controls (Urge-Vorsatz et al. 2007) – such as standards definition and application, environmental quality norms, construction regulations, labelling and certification programmes: energy efficiency obligations and quotas. A key condition for success is that they must be monitored, assessed and up-dated regularly (Urge-Vorsatz et al. 2007) and, at the same time, deviant behaviour should be penalised (Lindén et al. 2006)

Economic, Tax and Market Instruments (Fawcett et al. 2000: Lindén et al. 2006: Urge-Vorsatz et al. 2007): taxes; prices; subsidies; less tax or tax exemption on investment interest. These could act as catalysts for future change and a spur to putting in place more efficient technologies (Bartiaux et al. 2006). A coherent, consistent plan with the passing of time is fundamental in order to remember arguments promoting efficiency, apart from being reinforced by means of the media (Bartiaux et al. 2006).

Information Instruments (Lindén et al. 2006; Urge-Vorsatz et al. 2007; Bartiaux et al. 2006): we can include here written information in pamphlets and publicity; environmental awards; product labelling, but also advice giving. Communication strategies must be wide-ranging in order to influence consumers, retailers, installers and manufacturers (Fawcett et al. 2000). Some authors (Bartiaux et al. 2006; Darby, 2006) mention the extraordinary importance of advice given in the energy-related field, that is to say, transmitting more detailed information better adapted to particular contexts as fundamental to the information available to public policies. Likewise, communicating the results of a

country's adopted policies (implementing the Kioto Protocol, etc.) could be an interesting instrument, particularly if efficiency and contribution per sector were explored (Bartiaux et al. 2006).

Physical Instruments (Lindén et al. 2006): for instance, metres and equipment to measure household energy use that give consumers a real idea of how much they use. They are designed to promote new behaviours and are normally combined with other instruments.

Specific information and individual advice

As we have already seen, it has been suggested that information in itself does not encourage change, though the two are very often associated with each other. General information is basic, though it tends to have very limited proactive effects. Without it, we fail to understand the need for action or for the inevitable changes in society themselves (and which affect us). So there is a great difference between general information (TV campaigns, general handouts, etc.) and information that has been selected and adapted for the situation (preferably individual or local cases).

In fact, specific information with regard to the situation of each household/company tends to be very well accepted and to play an important role in adopting savings behaviour. A model already in use, which follows several methodologies, is information feedback for consumers on their energy consumption and the impact it can have. Rendering consumption visible, for instance, and showing it in the quantity of energy used (either simply, in comparison with others, in relation with previous years or in CO2 emissions) seems an uncomplicated way to achieve some change in consumption habits (Darby, 2006; Boardman et al. 2000; Jensen, 2003).

Personalised advice given by suppliers of energy, equipment or services to end users is also very important. By showing energy efficiency solutions in concrete and useful contexts, intermediaries/advisors facilitate knowledge on the subject and proactive actions (Irrek et al. 2003; Boardman et al. 2000).

But when we analyse the applicability of advice, despite its potential, we must consider for which groups it is targeted. To apply advice methodologies to disadvantaged communities introduces several difficulties to the whole process (Boardman et al. 2000). These are groups with their own specific ways of dealing with information (they generally have reading and comprehension difficulties and get very little out of written information) and have little capacity to modify their daily lives (for instance, financial resources to make investments). In these cases, specific strategies must be developed that may involve agencies or organisations already working in place, even if in completely different areas, as this would be a good way to come into close contact with their daily lives (Boardman et al. 2000).

When we speak about technical advice, it must be stressed that campaigns involving schools and children aimed at improving energy efficient behaviour outside school can be almost as efficient as professional technical advice given to families. The only great difference seems to be in the funding, which is usually far greater when a professional advisor is involved (CSE, 2004).

Media campaigns

Almost since the outset, the development of media campaigns has been identified as fundamental to behaviour change with regard to energy use. However, certain questions must be taken into account unless resources are to be invested with no chance of returns. It is important at this level to devise different strategic messages according to age groups and to present energy in a manner that is both interesting and informative (Bender et al. 2002) and, most of all, entertaining and fun (Lindseth,

2003). The right target audience must be reached; a careful choice made of who the message is for and what is the best way to get their attention by using different approaches that go beyond the immediate circumstances in order to grasp what people think and feel about these issues, what moves and motivates them. Some authors suggest humour, involvement and interaction as ways of effective persuasion (Lindseth, 2003). In several studies, feedback from children and their parents suggest that children can act as ambassadors of energy efficiency in their own homes (Lindseth, 2003; CSE, 2004). Also referred to were a long-term approach and a combination of various means and forms to reach people (SDC, 2006).

The message must be convincing, straightforward, easy to understand and ensure that energy consumption can be seen (made tangible) (Bender et al. 2002; SDC, 2006). To explore questions of energy use, but particularly questions on the ecological footprint or climate change and how they link up with energy issues could also work very well (Boardman, 2004; SDC, 2006; Santamouris, 2007b). Connecting individual domestic behaviour to important social effects could also have an impact.

A further key aspect to make these campaign successful involves including all the different actors needed to play a part in the whole process chain and not just focus on any particular one (Bender et al. 2002; Wortmann et al. 2003).

Focusing on the ecologically correct is not always the most efficient way to get the message across, as very often only those who are more open to it in the first place actually incorporate it into their everyday lives (SDC, 2006). It is vital to promote behaviours in line with the latest trends in life styles, such as, for instance, time savers, the latest fashion in terms of efficiency (technologies) or the welcoming comforts of home. As for lifestyle trends, energy efficient technologies and behaviours overlap, and changes that move in direction of a more energy efficient behaviour almost automatically emerge (Lindén et al. 2006).

In short, a social context should be created that will lead to desired results – for instance, encourage conservation activities that require no money, instruments or alterations at the level of construction – which will make people feel that they can do something. It is equally important to communicate the idea that everyone can do things that make a positive contribution (Bender et al. 2002)

Trying out changes

One of the impediments to a change in behaviour insofar as energy is concerned is the lack of knowledge or familiarity with certain processes or technologies, and together with the usual inertia resulting from practices that have been acquired or integrated into routine, they end up causing a sense of indifference to new trends. So, it would be an excellent help to devise new mechanisms that might allow not only the general public but also decision-makers to copy and try out new solutions that could contribute to energy efficiency or the use of renewable energies.

Software that allows people to simulate behaviours and the effects that personal, social and technological changes can have on energy consumption has an impact on people's lifestyles. The chance to experiment/visualise energy efficient technologies and techniques could also have an interesting influence on raising awareness (Feldman et al. 2002; Goldblatt et al, 2005).

Which agents to involve?

Schools are considered the best places to invest in with regard to raising awareness and providing information that guarantee manifold effects and they have been involved in the development of a myriad of projects. In Britain, the Energy Matters campaign has been very successful and several interesting conclusions have been drawn about how to do this well and how to improve on the results with time (CSE, 2004).

A brief analysis of the main conclusions will show the relevant factors that have already been mentioned in other contexts. Key aspects in order to achieve the best practices in schools were identified as (CSE, 2004):

The various school groups – teachers, directors, administrative staff, students and parents – must be represented and involved in the plans and activities to save energy;

Developing an approach to empower students, for instance through a school board that takes part in the running of the school;

Use of educational materials about energy that highlight the effects of energy use and the benefits of thrift. The fact that Energy Matters focuses on current use of energy in households and allows this topic to be an educational task was one of the most applauded aspects;

Set up links between any energy management programme or activities, for instance, related to health, safety inspections or routine maintenance.

Studies indicate that with regard to which agents to involve, the approach should be diversified and adapted to each specific situation. Young people, thanks to their current potentials (as consultants at home) and in the future (as decision-makers in different fields), emerge as one of the best groups to focus on (SCE, 2004). Community involvement as well as local authorities offer the potential of bringing wide ranging and very often abstract policies and measures together with local realities (SDC, 2006; Bartiaux et al. 2006).

Gas and electricity distribution companies themselves are also important agents because of their regular contact and possible application of feedback mechanisms (Fawcett et al. 2000; Irrek et al. 2003; Darby, 2006). Likewise retailers, though in a different manner, are also a point of contact and can introduce efficient technologies in general into people's everyday lives. But this work will not be possible without the cooperation and active contribution of manufacturers of consumer goods in presenting solutions to the market to allow targets of energy efficiency to be reached as well as implementing more responsible research strategies (Boardman, 2004). Social transformations that have taken place, such as the increasing number of small households (many just one-person households) particularly in more developed societies, present a challenge to manufacturers of equipment with regard to producing goods that can adapt to these new social realities (less cold capacity, equipment integrating several functions) (Fawcett et al. 2000).

Finally, we should also mention other areas that interface with energy, such as health or social welfare, with their networks, contacts and trustworthiness as social capital. In fact, many health workers are well positioned to pass on information and advice (specially to disadvantaged households), and thereby contribute significantly to promoting the message of energy efficiency (given their relation with health problems) (Ramsay et al. 2003). Organisations that supply social housing could also be important strategic partners in order to reach this target audience (Ramsay et al. 2003).

However, relations between energy and other areas are not restricted to the above but also concern matters involving climatic change (Boardman, 2004; SDC, 2006) or the ecological footprint (Santamouris, 2007b). In both cases it would be worth exploring the growing concern with some environmental problems as well as the possibilities of visualising and making concrete individual and daily contributions where energy can be expressed and becomes visible.

4. Conclusions

It has been accepted for a long time now that changes in behaviour are fundamental to the application of policies that promote greater efficiency in daily energy use both at the level of individual personal choices and in more corporate/business areas. Despite this, there has been no subsequent search to understand better the inception of behaviours linked to energy and the key factors that explain and affect them. Thus, to speak about social behaviour within the framework of the energy debate was to talk about something rather vague and to a great extent incomprehensible, almost irrational. This was especially the case when it became clear that relying on the "rational choice" of actors for the success of policies and measures was not getting the desired results.

A few ideas and lines of strategy have emerged in this brief description of recent studies that explore the "misunderstood" area of social behaviour with respect to energy, and suggest ways to connect better measures with the capacity to implement them.

A holistic approach must be devised that goes far beyond the individual; even though individual factors are vital, they are not sufficient as a work basis for such a complex question as everyday energy use. Structural factors of economic policy options, irrespective of individual choice and so often outside their capacity to influence, result in affecting everyday choices and even in sending the wrong messages.

There is a strong need for integration and consistency. At this level, it is essential that national governments make a major effort and ensure that the message transmitted is consistent and that mobilisation through example becomes a reality.

A strategic approach to develop further is that nobody can escape their responsibilities because everyone has a contribution to make. Causal policies and measures in one area or another are not only insufficient but also counterproductive for European countries with their ambitious aspirations. It is also a good plan to integrate the various groups and agents in different dimensions, times and responsibilities and with adapted measures.

Information is essential at the start and more demanding and challenging activities should be anchored in it. But after putting in place a base of standard information, recipients must be brought into contact with the message and information while advice provided must be as concrete as possible with respect to different individual, local or corporate contexts.

It is true that energy is invisibly. Its use is based on the services it provides and the comfort it affords. A door that might let energy become a concrete issue in people's everyday lives could be opened by exploring energy's relations with other more visible and concrete things such as the ecological footprint, climate change and the connection between health and well-being.

A reflection on the effects of energy efficiency on global sustainability should underpin public debate in order to avoid regressive effects. As well as promoting efficiency, it is important to think about the impact certain behaviours and technologies might have in terms of energy consumption in the medium

and long term. For instance, while it is important that there should be efficient systems of central heating, going about in a T-shirt and shorts at home in the middle of winter must not become the normal thing to do.

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