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Energy Efficient Equipment

SESSION IV / Lecture 1
1. INTRODUCTION

The European Commission under the SAVE and PACE programmes has pursued several actions to improve energy efficiency of equipment in the domestic, commercial and industrial sectors. These actions include labelling and classification schemes, minimum efficiency standards and negotiated agreements, and technology procurement.

During the initial phase of the programme particular attention has been paid to the domestic sector, because it accounts for about 30% of total electricity demand in the EU. In addition, it was indicated by experts that the traditional barriers to penetration of energy efficiency technologies were particularly difficult to overcome in the domestic sector.

The need for governmental action to transform the market is, at present, subject to increasingly long discussions among policy-makers in the European Union: several policy-makers claim that ‘if energy efficiency is economically viable it should happen by itself’ and insist on the need to reduce legislation and governmental intervention in economic affairs. This has largely affected energy efficiency policy and programmes and it has resulted in increased difficulty to introduce legislation for minimum efficiency standards. This paper focuses on the experience gained in the EU in the market transformation and in fostering the penetration of more efficient equipment.

It is widely accepted that to enhance the average efficiency of equipment present on the market today, a range of different actions is needed in order to exploit the full energy efficiency potentials of the available technology. Market transformation in terms of energy performance is the goal of any energy efficiency action for appliances. The various instruments (minimum efficiency standards, labelling, incentives, procurement etc.) are intended to interact and influence the market, which in the case of energy efficiency does not function well enough on its own, because of the well known barriers to energy efficiency. Consumer/user information is effective in shifting the whole energy efficiency distribution curve: however the effectiveness of energy labelling schemes is more difficult to evaluate than for other policy measures, because labelling relies heavily on consumer/user behaviour. Labelling actions focus customers’ attention on operating costs and other environmental aspects of the equipment, thus enlarging the market share of efficient equipment. To eliminate the “bad” equipment from the market minimum efficiency standards, setting the lowest acceptable performance level, are a well known and tried method. As it is described in this paper, negotiated agreements have also been used in the EU as an alternative to MEPS established through legislation. Technology procurement (i.e. the process of aggregating purchase power in order to specify new high efficiency equipment) acts on the higher end of the market by accelerating and expanding the penetration of new and more efficient products into the market place. Technology procurement might also include incentives aimed at both customers and/or manufacturers. The European Commission under the SAVE programme has implemented a proposed combination of these policy instruments to transform the market for equipment in the domestic, commercial and industrial sectors.
2. MINIMUM EFFICIENCY STANDARDS

Minimum efficiency performance standards (MEPS) are a very powerful and effective tool in transforming the market: they act on the low-efficiency end of the market and are particularly effective when consumer/user’s are not influenced by information and labels, in particular for the commercial and industrial equipment. In the European context the introduction of MEPS presents some additional aspects. One of the aims of the EU is to create an internal market for, inter alia, tradable goods: therefore Member States cannot introduce national legislation which may lead to barriers to trade unless justified on the basis of very limited criteria such as protection of human health, as indicated in Article 36 of the EU Treaty. Energy efficiency is not considered an area sufficient to justify barriers to trade. Some Member States (e.g., Denmark, the Netherlands, etc.) which have a very ambitious energy efficiency policy have notified the Commission of their intention to introduce in their territory MEPS (for refrigerators in the case of the Netherlands; for washing machines, dishwashers and tumble dryers in the case of Denmark). The Commission has the power to stop the introduction of national legislation if it is established that it may create a potential barrier to trade among Member States, and it is not justified according to the criteria laid down in the EU Treaties. To solve the conflict between the internal market and energy efficiency policies of Member States, the solution normally adopted is to introduce common MEPS throughout the Union and the EEA area (Norway, Iceland and Liechtenstein).

The process leading to the adoption of mandatory MEPS in the EU context is quite long. The Commission makes an initial proposal for a Directive. There is a double reading in both the Institutions, the European Parliament and the Council, which have to agree on a common text. In particular, in the Council the Directive has to be agreed by a qualified majority of Member States.

The first appliances for which minimum efficiency requirements were introduced were refrigerators and freezers, the largest electricity consuming domestic appliance in the Union, with a total consumption of about 120 TWh per year (about 20% of total domestic electricity consumption). Following the Dutch notification in 1992, the Commission prepared the proposal for a Directive which was presented to the Council and to the European Parliament in December 1994. The long delay in presenting this was due to lengthy negotiations with manufacturers, which expressed strong opposition to the introduction of legislation. The Commission proposal was for a 10% average effi-
ciency improvement compared to the 1993 models and it was based on the analysis performed by the Group for Efficient Appliances (GEA, 1993). This was far from the life-cycle minimum as identified in the technical-economic analysis (GEA, 1993), which was corresponding to about a 50% reduction in energy consumption of the 1993 'base case' model. However, the proposal had a big impact on manufacturers, as it required at the time the phasing out of about 50% of the then available models. The Commission proposed also a second more stringent level of MEPS after 3 year from the entry into force of the first in order to follow technological progress. However the Commission did not set any quantified level for the second phase in its proposal in order to establish it later on to follow the technological evolution. Some Member States were opposing the Commission proposal fiercely as the impact on their manufacturers was bigger than for other Member States manufacturers; other Member States were not happy given the modest efficiency improvement. The European Parliament on the contrary asked for more stringent MEPS: for the first level an efficiency improvement of 20% and for the second level to a further 20% efficiency improvements. A compromise was found with an efficiency improvement of 15% to come into force after three years and a strong engagement for a second level to be based on the technical-economic analysis.

The European Directive was adopted on 3 September 1996. The first level came into force on 3 September 1999. This will leave on the market only refrigerators in class. The new technical-economic analysis to quantify the second level is right now under way.

The lessons learned from this process were: 1) the extremely long time it took from the time of the Dutch notification to the adoption of the Directive - more than four years; 2) the strong opposition by manufacturers to the introduction of any legislation which might affect their market and the influence that manufacturers had on the policy makers, this was mainly due to the strong reaction that politician have when industry claims that the proposed legislation would result in job losses; and 3) the process of mediation between Council and Parliament which resulted in a more ambitious Directive, however still far from the cost effective level, but caused some considerable delays in the adoption.

3. LABELLING

Although the environmental and energy issues are rising in the priority list of buying criteria, the present-day purchase decision is still dominated by the price and the brand name. In addition, it is quite common that purchase decisions are "forced" by retailers, who often have different commissions on different brands and therefore they tend to induce customers to buy the products on which they can maximise their profits. One of the main barriers to the penetration of energy efficient appliances is lack of consumer awareness, information, and technical knowledge on energy consumption of individual appliances and possible energy savings.

To increase consumers' awareness and persuade them to make the rational choice, a European energy labelling scheme for domestic appliances has been established. A common European energy labelling scheme minimises the cost to manufacturers and maximises the impact on consumers. The scheme requires showrooms and mail order catalogues to display energy information labels which rank appliances in 7 efficiency classes.

So far labels have been adopted for refrigeration appliances, dryers and washing machines, lamps and dishwashers, labels for ovens, electric water heaters and room air conditioners will be finalised during year 2000. However for a labelling scheme to be effective it has to be promoted to the general public, to make them aware of the existence of the label and to make them to understand its meaning. The responsibility to promote the EU labelling scheme shall be shared among public authorities (both at national and local level, for instance by using energy agencies) utilities, and the retail sector. A big effort is being made to increase consumer awareness of the labels and to train retail staff through pilot projects in Member States. The first evaluation of the impact of EU labelling scheme has been carried out. The evaluation shows that there has been a shift toward sales of more efficient appliances: the sales weighted average has improved by 29% between 1992 and 1999. It is estimated that 16% is the impact of MEPS and 10% due to the impact of labelling. It is important
to note that this was also combined with an undertaking by the retailer to offer more high-efficiency appliances and to train its retail staff on energy efficiency issues. The role of utilities in promoting the energy label should also be strengthened. Utilities should use the label in their DSM activities in the residential sector and should link grants towards more efficient appliances to the efficiency classes of the label.

Evolution of the model database for domestic refrigeration appliances in the EU market
(source the CECED cold appliances database)

4. TECHNOLOGY PROCUREMENT

Technology procurement acts on the higher end of the market by accelerating the penetration of products into the market place. Technology procurement aims at encouraging new products to meet the demand (in this case for energy efficiency) that existing products on the market are unable to fulfil. Technology procurement is used to match producers’ and consumers’ perspectives, in order to make the market work more efficiently with regard to energy efficiency. The idea is that a group of knowledgeable and influential purchasers, defined as a ‘buyers group’, formulate product specifications and let producers compete to meet these demands. It is important to notice that in the European context, ‘buyers group’ can be constituted both by ‘final’ owner of appliances or by any intermediate ‘actor’ (e.g. OEM, retailers, etc.) in the product path from manufacturers to final users. One option that is thoroughly investigated is whether retailers could act as a buyer group. Technology procurement is part of market-pull activities, characterised by showing manufacturers a large potential markets (important buyers) and by providing manufacturers with consistent efficiency targets. Technology procurement have been proven successful in introducing new appliances (refrigerators) in the market both in the USA, through the Golden Carrot competition (a consortium of US utilities promoted a technology procurement for a super-efficient domestic refrigerator-freezers: this has resulted in a new refrigerator 25 % more efficient) and in Sweden in the technology procurement run by Nutek, the national energy agency. A major SAVE project involving ten national energy agencies is testing the feasibility of a EU-wide co-operative procurement for a super efficient combined refrigerator-freezer.
5. THE NEGOTIATED AGREEMENT INSTRUMENT

First of all it must be noted that often in literature the term “voluntary agreement” is used to describe this policy instrument, however the Commission decided to define this policy instrument as “negotiated agreement” to highlight the negotiating process between public authorities and industry; in addition, it was felt that the term “voluntary” was somehow misleading, because if the participation by industry is voluntary, once the agreement has been concluded the delivery of the result is not any more voluntary, but governed by sanctions in case of non-compliance.

In recent years, the need to enlarge the mix of policy instruments to promote energy efficiency has resulted in a growing interest in policy measures based on collaboration and sharing of responsibility between public authorities and industry. Recently the Commission adopted a Communication on Environmental Agreements, which aims to promote and facilitate the use of effective and acceptable Environmental Agreements as part of the efforts to broaden the range of policy instruments; this Communication describes the essential characteristics of this instrument.

During the discussions in Council leading to the adoption of the “Refrigerator Directive” several Member States insisted on the use of more flexible instruments, in particular negotiated agreements with manufacturers to reach the energy efficiency improvement comparable to the one achieved with MEPS. It must be added that an EU Directive can regulate only tradable goods, i.e. each appliance shall meet the set efficiency requirement to be allowed to be placed on the EU market, and of course the requirement must be the same throughout the EU. This rules out the possibility to have legislation including average or composite target values for energy efficiency (e.g. fleet undertakings or sale weighted average to be reached by a certain date).

European appliances manufacturers have also indicated their strong opposition to regulatory approaches, as products different in energy efficiency are sold in different Member States (sometimes the difference in efficiency has a regional character, other times it is simply linked to different types of end-users). Manufacturers expressed their willingness to reach negotiated agreements to achieve energy savings where a target average efficiency is agreed. According to manufacturers, this would give them more freedom in reaching the target, by selling more high efficiency products, by having flexibility when to phase out low efficiency units and therefore maximise their profits. In addition, manufacturers have highlighted the advantages of having a demand driven process, which would favour cost-effective solutions and which would allow manufacturers to have a pro-active role in setting quantified criteria, in implementing the measures and achieving the results. This is a clear advantage in a very competitive market.

In addition, negotiated agreements might present advantages even for public authorities as negotiated agreements can be more flexible and quicker to implement than regulation. In addition, negotiated agreements are easier and quicker to upgrade than legislation allowing them to follow technological evolution and market changes. Since industry has the best knowledge of the production processes and the technologies required to improve efficiency, it is clear that co-operation between public authorities and industry can facilitate the establishment of ambitious energy efficiency targets. Moreover the extra flexibility can be used to identify cost-effective solutions, which might lead to higher efficiency improvements than a simple cut-off line as in the case of regulation. In addition, by co-operation on energy efficiency improvements, public authorities and industry can share responsibility in setting ambitious targets, which are at the same time realistic and achievable. The Commission considers that the negotiated agreement can be a valid alternative to the introduction of legislation for mandatory MEPS, if they include the following three elements: i) commitments by manufacturers accounting for most of the equipment sold on the Union market (80% at least), ii) quantified commitments to significant improvements in the energy efficiencies of the equipment they produce over a reasonable time-scale, and iii) an effective monitoring scheme with some degree of independence to monitor the energy efficiency improvements achieved.

Since the EU treaties impede the Commission to sign contracts with the private sector to implement policy actions, negotiated agreements concluded between the Commission and manufacturers have to take the form of a unilateral commitment with the endorsement by the Commission. However, to
avoid non-compliance negotiated agreements must include additional and credible instruments to discourage non-compliance. These can include mechanisms to ensure loss of public image for the non-compliant company (e.g. press announcement by public authority) or the threat to introduce legislation by public authorities.

It is essential that negotiated agreements are in conformity with the rules of the EU treaties. In particular, the freedom of co-operation of the companies is limited by the requirement of preserving effective competition: in practice any form of co-operation has to be done in respect of Article 85 of the EU Treaty, which rules out anti-competitive practices. To this end negotiated agreements have to be notified to the EU competition authorities to be cleared before they enter into force.

However, as it has been clearly indicated in the Communication on Environmental Agreements, besides the above indicated advantages of the negotiated agreements approach (and of environmental agreements in general), there are also certain risks associated with such agreements. In particular the reader’s attention is drawn to the fact that there is the risk that the negotiated energy efficiency targets reflect little more than “Business as Usual” (BaU). To avoid this it is certainly helpful to set general targets (e.g. CO₂ emissions reduction targets) through legislation. A high public awareness for CO₂ emissions reduction would also help, as well as a negotiation process open to public scrutiny. Moreover the risk of “free-riding”, which increases the more demanding the targets are, must be clearly assessed. In particular, the number of appliances imported into the EU must be clearly assessed, as usually only EU based manufacturers member of the EU trade association are likely to enter into the negotiated agreement process.

To evaluate the effectiveness of the negotiated agreement instrument in improving energy efficiency, it is important to determine the level of the quantified target compared to the efficiency improvement that would in any case have taken place in the BaU scenario. It is worth noting that the definition of the BaU might be complex and sometimes controversial, and, in some cases, it might be more appropriate to compare the energy efficiency target (e.g. 20% improvement in 10 years) with the historical trend.

The main characteristic of the negotiated agreement is that is a target-based instrument. Any negotiated agreement shall promote energy efficiency beyond the BaU scenario and shall aim at least at the economic potential, which, because of existing market barriers, does not coincide with the BaU scenario. In principle, the negotiated agreement instrument offers the possibility to pursue ambitious efficiency targets, such as aiming at the technical potential.

6. ANALYSIS OF THE NEGOTIATED AGREEMENTS SO FAR CONCLUDED

During 1997 two agreements were negotiated by the Commission with manufacturers; the first for the reduction of stand-by losses of TVs and VCRs the second for the reduction of energy consumption of washing machines.

Consumer electronics (TVs and VCRs)

The analyses (Novem 1995, Novem 1996) indicated that power consumption on stand-by was the present average of 8 Watts, for televisions, and 10 Watts, for video recorders. When evaluating the policy options it was clear that to set maximum consumption limits for the stand-by mode through regulation was extremely difficult, given the fast changing technology for these products. Therefore it was agreed with manufacturers that a sales-weighted fleet approach was better suited and more cost-effective to improve efficiency. Negotiations took place between May 1996 and April 1997, when the agreement was signed by 16 companies (representing about 80 % of the market) and notified to the competition authorities. Negotiations led to the following agreed targets: televisions and video recorders with stand-by consumption greater than 10 W will not be commercialised after 1 January 2000; each manufacturers has individually to reach a sales-weighted average (per company) of 6 W by year 2000. Manufacturers agreed that the company sales-weighted average would be pro-
gressively reduced towards 3 Watts by year 2009. This gives manufacturers flexibility in their implementation regarding how they achieve the desired result and how they can cover the extra cost of compliance since high-end/high-cost sets will have very low stand-by values, allowing the low-end to have higher than the average value to keep these sets competitively priced thus minimising the cost impact on the consumer. The implementation of the negotiated agreement by manufacturers responsible for 90% of the products sold on the EU market would save 7 TWh per year by 2010 when all the current equipment stock has been replaced.

During 1998, the following sale average power consumption were achieved for TVs and VCRs respectively, 4.45w and 5.52w. This shows that the year 2000 target has already been met.

![Average Standby Power Consumption (Watts)](chart)

Washing Machines

The market assessment, savings potential and technical-economic analysis were completed in April 1995 by the Group for Efficient Appliances (GEA, 1995). The total energy consumption of washing machines in the EU is around 36 TWh and is estimated to increase to 38 TWh by the year 2015, if current trends continue. The analysis concluded that technically feasible and economically viable efficiency improvements on the average European machine, defined as the ‘base case’ model, are of the order of 25% for washing machines.

Based on the above analysis and on discussions with manufacturers, the Commission decided to negotiate with manufactures an agreement to reach a European average consumption of new models of 0.24 kWh/Kg by year 2000, allowing for higher consumption in the Southern European countries (i.e. by allowing machines with spin speed lower than 600 rpm to have higher energy consumption limits) and marketing the more efficient appliances in the Northern countries. Given that the 1994 average consumption of new models was 0.296 kWh/Kg the introduction of the negotiated agreement will result in about a 20% efficiency improvement. The negotiated agreement is based on the EU energy label for washing machines and foresees two steps: on 31 December 1997 all the washing machines in classes G, F, and E have been phased out; on 31 December 2000 all the washing
machines in classes D (with spin speed higher than 600 rpm) will as well be phased out. This approach shows the most favourable cost/benefit analysis, because of lower price increases in each individual country (washing machines with spin speed lower than 600 rpm are only sold in Southern European countries).

The monitoring is based on the labelling scheme for washing machines (which is compulsory in each EU Member States) and on a notary system, to which manufacturers have to supply production quantities for each model together with the specific energy consumption. The notary will then calculate the overall EU production-weighted average to check if the 0.24 kWh/Kg will be achieved. It is important to note that there is no company-specific energy efficiency target as in the case of TVs and VCRs. Through the labelling scheme it is possible to identify if non-compliant products have been marketed (the correctness of the energy label should be guarantee by Member State trade laws). As in the case of the TVs and VCRs agreement, the notary will prepare a report on the results achieved to check non-compliance and to allow the general public to scrutinise the results of the negotiated agreement. During 1998, the production-weighted average of 0.124 kWh/cycle has been achieved, indicating that the agreement so far has been rather successful and has already delivered the target for year 2000.

**Production Weighted Average Consumption**

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<th>A</th>
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<td>0.219</td>
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<td>0.256</td>
<td>0.292</td>
<td>0.336</td>
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**Conclusions**

The EU experience with negotiated agreement has shown the following positive elements (compared to equivalent legislation): much faster process from the start of the negotiations to the introduction of measures (entry into force of the negotiated agreement) compared to legislation; much lower administrative costs (for example no need to involve the Council and European Parliament, which is very expensive); much greater flexibility in the choice of the targets, which can be defined in terms of maximum consumption limit or fleet levels; the inclusion of soft targets, which might results in worthwhile additional savings; efficient monitoring mechanism (perhaps even more effective than in the case of legislation); greater co-operation by manufacturers and their proactive role in defining feasible and effective efficiency targets.
7. ACTIONS FOR OTHER APPLIANCES AND LIGHTING IN THE DOMESTIC SECTOR

Other domestic appliances

Negotiated agreement for dishwasher is currently under examination. Market assessment, saving potential evaluation and technical economic analyses for water heaters, air conditioners and ovens has been carried out. Following these analyses the best policy options will be chosen. Preliminary discussions with interested parties have indicated that the introduction of labelling and negotiated agreements would be the best options.

The European Strategy for Reducing Stand-by Losses

The European Commission has implemented a comprehensive strategy for the reduction of stand-by losses of consumer electronic. It is estimated that if adequate policies and programmes are implemented at European level, savings of 39TWh (and CO₂ emission reduction of 21 M tonnes) per year can be achieved by 2012.

The strategy was presented in the Commission Policy Paper on Stand-by Losses (Com(1999)120 final). During the discussion in the European Council great appreciation for the Commission Paper was expressed by energy ministers together with strong support for the proposed actions. The paper succeeded in raising awareness among EU ministers for the urgent need to reduce stand-by losses.

Among the policy instruments used for market transformation (minimum efficiency requirements through legislation, labelling and consumer information, negotiated agreements, technology procurements), the Commission believes that voluntary agreements are the most effective instruments to reduce stand-by losses. However a series of requirements, including well defined and ambitious efficiency targets, have to be met. Three agreements (TVs, VCRs and audio equipment) are already concluded and operational; agreements for external power supplies and set top boxes will be concluded by the end of the year. Moreover strengthening consumer information, and in particular the use of energy labelling is also recommended.

Domestic Lighting

Domestic lighting has also been investigated and the only policy actions so far introduced are compulsory energy label and procurement; at national level several incentive schemes both for consumers and manufacturers have been proposed as part of utility DSM campaigns and governmental efforts to reduce energy consumption in the domestic sectors. The Commission has proposed for year 2000 a major EU information campaign in collaboration with Eurelectric.

Market research has indicated that to achieve durable market transformation and increase the use of CFLs in the residential sector, it is essential to develop and market attractive and well designed CFL dedicated lighting fixtures.

To this end a major European design competition for designers, students and fixture manufacturers has been launched at the beginning of 1999 for Dedicated CFL Fixture. The main challenge for competition participants is to produce innovative and attractive design solutions aimed at the residential market for lighting fixtures dedicated to pin-based CFLs. The key technical design feature is that fixtures embody the ballast for the CFLs, thus making the retrofit of an incandescent lamp impossible. One of the main expected results of the competition is to boost the market for pin-based CFLs, nowadays almost not present at points of sale for residential customer, because there are almost no domestic fixtures able to take them. This type of CFL is about four times cheaper than the CFLs with an integral ballast. The competition will be followed by a European-wide marketing and promotion campaigns for winning models, planned for the fall 2000. The competition has attracted a very large number of participants, representing 19 European countries, and about 1000 designs have been pro-
posed, including very well known designers and the largest European lighting fixtures companies. The winning models (about 100) will be shown at the largest European fair on domestic lighting, Euroluce in April 2000.

8. COMMERCIAL SECTOR

The European Proposal for Minimum Efficiency Standards for Ballasts

Energy consumption of fluorescent lighting amounts in the EU to 105 TWh per year. Large electricity savings of the order of 20 TWh per year can be achieved with the use of more energy efficient ballasts. To achieve these savings, it is essential to promote high efficiency ballasts and to phase out low efficiency units. Experts indicated that the most effective policy instrument to achieve market transformation in terms of energy efficiency is to introduce minimum efficiency requirements. The Commission explored the possibility to reach a negotiated agreement with industry to phase out low efficiency ballasts. The European manufacturers were ready to phase out voluntarily low efficiency ballasts, however they feared that imported products would take the market share they would abandon. Therefore the Commission decided to propose a Directive for minimum efficiency standards.

To minimise the impact on manufactures, a phased approach has been proposed, associated with long transition periods before the entry into force of each level of minimum efficiency standards. The first level of the proposal will phase out 'high-loss' ballasts and come into force one year after the adoption of the Directive. After three years a second efficiency step will come into force, by which the 'conventional' ballasts will be phased out. These ballasts represent about 75% of the current market. A third phase to phase out magnetic ballasts will be evaluated in four years time. The proposed minimum efficiency requirements have an acceptable payback period for all users, and the impact on industry is limited. EU legislation in this area is justified, as it will contribute to cost-effective reduction of CO₂ emissions with economic benefits for lighting users, and a low impact on manufacturers.

The European GreenLight Programme

The European Commission investigated the possibility of launching a voluntary programme to reduce lighting energy consumption in the non-residential sector. After the completion of the feasibility study and some preliminary market analyses, the Commission decided to launch the GreenLight Programme at the beginning of year 2000.

The programme participants (public or private companies) commit themselves to installing energy-efficient lighting technologies in their facilities wherever (1) it is profitable, and (2) lighting quality gets maintained or improved. The Programme invites top-managers to register with the European Commission and commit to fulfil the programme Guidelines. The programme requirements, i.e. to undertake profitable lighting upgrades within a given time period, and the benefits for programme participant companies are described in the Guidelines.

The GreenLight Programme has been established by the European Commission with a strong support from National Energy Agencies. The agencies would help to tailor and market the programme at national level. National Energy Agencies will also provide national partners with a customised technical support.
Office equipment

The market for personal computers and peripherals is a world-wide (global) market and is dominated by multinational companies; the same product is built in one country (for example located in the Far East) and then sold in Europe, United States, Japan, indeed all over the world. Harmonisation of environment and energy requirements, standards and labels is very important to manufacturers: different standards covering the same subject, e.g. energy efficiency, will add to their costs and administrative burdens.

Thus there is a need to harmonise standards not just on a Community-wide but also on a worldwide basis. In fact, the possibility of a world-wide voluntary labelling scheme (all equipment with stand-by power below a fixed level would qualify for the label) was recently proposed by the Commission and the US. In this area, manufacturers are willing to take part in a voluntary programme; pledges by large commercial purchasers and national administrations to buy only labelled equipment would encourage manufacturers to produce equipment complying with the maximum stand-by power levels.

In the discussion of possible actions to improve efficiency, it was proposed to extend the US Environmental Protection Agency (EPA) "Energy Star" labelling programme to Europe. This is a voluntary programme, drawn up in co-operation with manufacturers, the goal of which is to achieve substantial energy savings in office equipment. The manufacturers taking part in the programme sign a Memorandum of Understanding and commit themselves to producing computers, printers and monitors with a stand-by mode to satisfy the power requirement. Manufacturers who have signed the Memorandum of Understanding can use the "Energy Star" logo on equipment which satisfies the power requirements in stand-by-mode.

An agreement between the European Community and the USA has been negotiated by the Commission and currently a Council proposal for concluding the agreement is under discussion in the Council.
9. INDUSTRIAL SECTOR

Electric Motors

One of the first issues to arise when preparing a strategy to improve efficiency is to correctly assess the present consumption of electric motors, both in terms of size and quantity of installed motors, and the efficiency levels of the motors present on the market. Also it is important to evaluate the structure of the motor market including: the number of manufacturers, the level of imports, and the typical product path from manufacturer to user. The SAVE study concentrated on AC three phase squirrel cage induction motors in the range 0.75 kW to 750 kW, since these motors represent about 90% of the total motor electricity consumption. The motor load in the European Union was in 1992 548 TWh in the industrial sector and 170 TWh in the tertiary sector, i.e. the about 38% of the total Union electricity consumption. It was estimated that the growth rate of the motor load would be about 1.5% per year in the industrial sector and by 2.2% per year in the tertiary sector up to 2010. Some difficulties were encountered in the estimation of the average number of operating hours for the various sizes of motors and the load profile. The average number of operating hours was calculated from the installed stock data (number and capacity of motors in operation) and data on motors' electricity consumption, assuming an average load factor of 60% and a typical average efficiency by power range. The resulting European Union average number of operating hours, about 2000 hours, seems rather low. One reason for such uncertainty and disparity on electric motors operating hours was the fact that many industries have a substantial number of unused spare motors. Those motors are taken into account in number and power, but they operate only in case of emergency, which means only a few hours per year. As it is extremely important to determine accurately the number of operating hours it has been decided, as part of the Commission's actions towards more efficient motors, to launch some monitoring campaigns on the typical usage of motor (type of load, load profile, number and usage of spare motors, number of operating hours) in different types of industries and in different Member States.

The Proposed Negotiated Agreements for Motors

CEMEP and the European Commission have developed a new system of efficiency designation. This system has been designed for a product range of totally enclosed fan ventilated (IP 54 or IP 55) three phase A.C. squirrel cage induction motors in the power range of 1.1 to 90 kW, with 2- or 4-poles, rated for 400 V-line, 50 Hz, S1, Duty Class, in standard design. These motors are according to various studies the most important power ranges, which have to be improved in their efficiency in order to reduce electrical energy consumption.

This power range has been subdivided into three bands of efficiency. The lowest band is called eff3 and covers round about two thirds of the motors currently sold in the EU. Therefore you may say that eff3 represents the current standard efficiency. The next class is called eff 2 and represents almost a third of the motors currently sold and finally the class eff1 which represents motors with an efficiency even higher than the efficiency asked for by the US EPACT legislation. This class of motors has a current market share of 1 to 2 percent.

In future the efficiency class of all the motors covered by this agreement has to be designated on the nameplates and in the catalogues. Additionally the efficiency at full load and at three-quarter load will be quoted in the catalogue. By this, efficiency will become an easy to handle quality criterion and OEMs will have the chance to use the different classes of motors for a cost effective efficiency optimisation of their applications. OEMs and the engineers of the project business are the people who have the best knowledge of operating conditions and saving potential. They may decide whether an eff2 motor is sufficient or whether an eff1 motor is the cost and energy efficient solution.

Round about 3.5 million standard motors that fit to the definition of the agreement are annually sold in the EU. The participants of the agreement cover round about 2.9 million units. Round about 70 percent of these motors belong to efficiency class eff3. The market share of these motors has to be
reduced by 50 percent till the year 2003. When in the long run only the mentioned 50 percent of the current eff 3 motor stock will be replaced by eff 2 motors, the annual energy consumption will be reduced by 3 TWh. Each percentage point in favour of eff1 would in the beginning enable an additional reduction of additionally 400 GWh annually. The parties are optimistic that the total energy saving by the promotion in favour of eff2 and eff1 will in the long run accumulate to at least 6 TWh annually.

EU/CEMEP Motor Efficiency - Classification scheme

![EUROPEAN EFFICIENCY STANDARDS FOR AC INDUCTION MOTORS](image)

Efficiency (%)

Eff 1
High efficiency

Eff 2
Improved

Eff 3
Standard

Rated Power (kW)

**Eurodeem**

The EURODEEM database is an independent software developed by the European Commission in collaboration with motor manufacturers for promoting high efficiency motor systems to the users, and for helping European utilities for carrying out Demand Side Management (DSM) programmes as a new service in a competitive electricity market.

EURODEEM is not just a database which can provide a comprehensive list of efficient motors and end use devices (pumps, compressors and fans) available on the market, but it is also a selection and assessment tool, designed to consider and treat the whole motor system chain. In this way it is possible to identify efficiency losses and optimise the motor system. In particular, EURODEEM can take into account of Variable Speed Drives (both mechanical and electronic); Load description (time usage, load pattern, control type, etc.); Utility data and rates, taking into account the possibility of different suppliers; Company’s Inventory of motor systems, organised for facilities and departments.

It is expected that in year 2000 a major SAVE project will be concluded to extensively promote to end users EURODEEM.
Other motor system equipment

For other motor systems end use equipment (fans, pumps, compressors) technical-economic analyses are under way and possible policy actions under assessment. For pumps a classification scheme will soon be proposed.

10. CONCLUSIONS

The paper has been describing the efforts by the Commission to promote efficiency of end use equipment. This has been the most effective (and cost-effective in term of CO2 emission cost) area of actions undertaken under the SAVE programme.

According to the Commission estimate, the market transformation process for major electric end-use equipment, started with the Domestic Refrigerators Directive, by adding individual equipment savings to the year 2015, will result in an electricity savings of 220 TWh/y by the year 2015, when the full installed park has been replaced. This corresponds to a reduction of about 10% of total EU electricity consumption. This is worth about 22000 M€ per year to domestic, commercial and industrial users (the cumulative saving up to year 2020 are worth 100000 M€).

These actions so far undertaken have been possible thanks to the collaboration of all the experts that have worked in the Commission study groups, the standardisation body and party to the great collaboration shown by manufacturers.

Too soon to be presented, Action Plan will indicated that the Commission will continue and strengthen its actions for equipment in the coming years making sure all possible economic savings are achieved.

BIBLIOGRAPHY


document available for download from:

Council Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances. Document available for download from:


University of Coimbra (Po), De Almeida A. et al. 1996 'Study for the Commission of the European Communities on actions to promote energy efficient electric motors in Europe' Final Report October 1996.
