

# **The Design of a New Programme to Increase the Energy Efficiency in Commercial and Public Companies**

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## **ABSTRACT**

The new Energy Efficiency Management and Audit Scheme (E2MAS) builds on the success and structure of the GreenLight Programme and the Eco-Management and Audit Scheme (EMAS) by focusing the attention of companies on the use of energy and energy efficiency. The E2MAS is a voluntary programme through which private and public companies commit to continuous improvement of energy efficiency in order to:

- Achieve the major portion of technically and economically feasible energy savings. In particular, the actions undertaken must satisfy the criterion of economic efficiency, so that the allocation of scarce financial and human resources is justified from the viewpoint of the organisation.
- Establish top-management commitment to energy efficiency.
- Record progressive improvement in energy efficiency and communicate the achievement to the general public.

The E2MAS has been developed to involve organisations in the industrial, commercial and public sector in improving energy efficiency. Though not entailing legally binding obligations, joining E2MAS requires strong commitment and a substantial contribution to the objectives of the E2MAS. Joining proceeds through Registration whereby the organisation commits itself to fulfil the E2MAS requirements. The organisation's relevant activities are publicised in the E2MAS related promotional activities, such as Awards, the Catalogue, Advertising activities, etc. The necessary trend towards increased investments in energy will be stimulated in a visible manner through public relations activities, focusing public support programmes on the objectives of the E2MAS to raise general public awareness of energy issues. The Partnership also includes the planned monitoring through regular audits and reporting of the relevant actions.

## **Introduction**

The European Climate Change Programme (ECCP) Energy Consumption Working Groups (WG 3) established a subgroup working (JSWG) on energy efficiency in industry and commercial sector and end-use equipment with the task to identify the most cost-effective policy measures to help the EU meet its Kyoto targets. The industrial and commercial sector energy consumption in year 2000 was evaluated together with the forecasted consumption in year 2010 according to the business as usual scenario, and a

scenario based on the introduction of the ECCP recommended policies. The reference study was the “Economic Evaluation of Sectoral Emission Reduction Objectives for Climate Change” (ECOFYS). Beside the energy intensive sectors of industry (iron and steel, non-ferrous metals, building material, pulp and paper, and chemicals), which covers two thirds of total industry energy consumption, the JSWG analysed the less energy intensive sectors such as Small and Medium Size Enterprises (SMEs) and the commercial sector. In particular, for SMEs and the commercial sector the most common end-use equipment (i.e. cross-sectoral devices such as motor systems, lighting, office equipment, HVAC, etc.) have been considered. The range of policy evaluated was a combination of regulatory measures (e.g. mandatory efficiency standards), voluntary agreements and other market based mechanisms (such as equipment accelerated depreciation). Figure 1 gives an overview of the evaluated policy actions in the industrial sector: there is a strong interrelation among all the measures and programmes identified by the JSWG; moreover the contribution and feasibility of individual actions are strictly linked to other policies not discussed in the JSWG (e.g. Energy tax, tradable permits, environmental permits, etc.). During the policy analysis in particular, the provision of active energy service and schemes to foster the development of energy management in SMEs and the commercial sector were investigated.

Based on the analysis and the views of stakeholders, the JSWG identified the following saving potential for the most common end-use equipment in commercial buildings and industry:

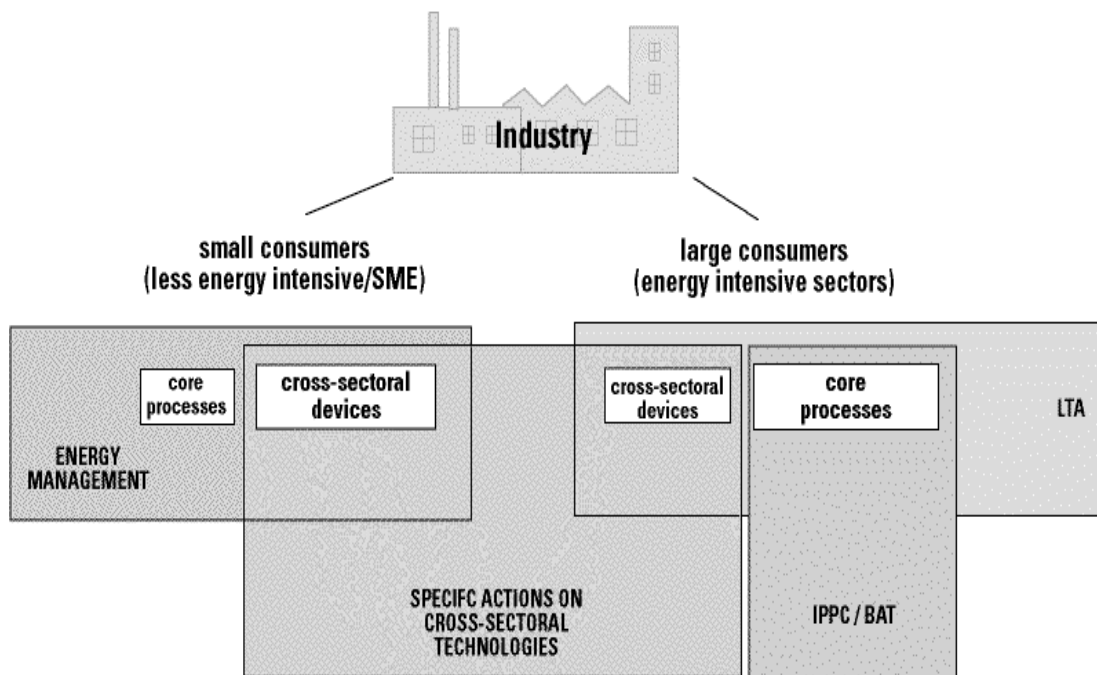
- **electric motor systems**, by addressing the efficiency and design of the entire motor system and in particular through the accelerated introduction of Variable Speed Drives (VSD), and actions on compress air systems [saving potential 38 MtCO<sub>2</sub>, about 2/3 industry and about 1/3 in commercial sector/buildings];
- **office equipment** in commercial sector/buildings [saving potential 16MtCO<sub>2</sub>];
- **lighting** in the commercial sector/buildings [saving potential 14 MtCO<sub>2</sub>]
- central **HVAC** systems [saving potential 8 MtCO<sub>2</sub>];
- **electric heating** equipment: e.g. substitution of electric heating with heat pumps [saving potential 4 MtCO<sub>2</sub>]
- commercial **refrigeration** systems [saving potential 2 MtCO<sub>2</sub>].

In particular in the ECCP final report the following policy actions were recommended by the JSWG. The first is the promotion of the current EU *GreenLight Programme* (Berrutto 2001), which was launched in year 2000 and it is right now taking off. The second is its gradual expansion to cover other cross-sectoral technologies, such as HVAC and office equipment; this action was provisionally called the *GreenBuilding Programme*. The third recommended policy was the implementation of *comprehensive energy audit and management scheme*. This was seen by the JSWG as one of the most important measures to foster energy efficiency in commercial buildings and industry, in particular in non-energy intensive sector and SMEs to achieve a large part of the cost-effective energy efficiency improvements. The scheme should particularly focus on the non-core processes, which represent about half of energy consumption of industry, and commercial buildings. This programme shall also foster training and education of energy

managers and maintenance personnel. SMEs will also require improved provision of active energy services.

After the publication of the ECCP report it was decided to combine the two above policy actions and to design a new programme suitable both for commercial buildings and less energy intensive industry, the provisional name of it is E2MAS, which stands for energy efficiency management and audit scheme. It shall be noted that until E2MAS is fully implemented and recognised the GreenLight programme will continue to exist and will be further promoted. Moreover the approach to be followed in the EU is not to have a specific programme for Building such as the US Energy Star, but a new programme which would gradually cover several cross sectoral technologies used in commercial building and industry. To this end recently the EU has launched the Motor Challenge Programme (Bertoldi 2001) dealing with all end-use motor technologies.

**Figure 1. Selected Policies and Measures to Reduce Energy and Resource Use in Industry**



Ramesohl 2001

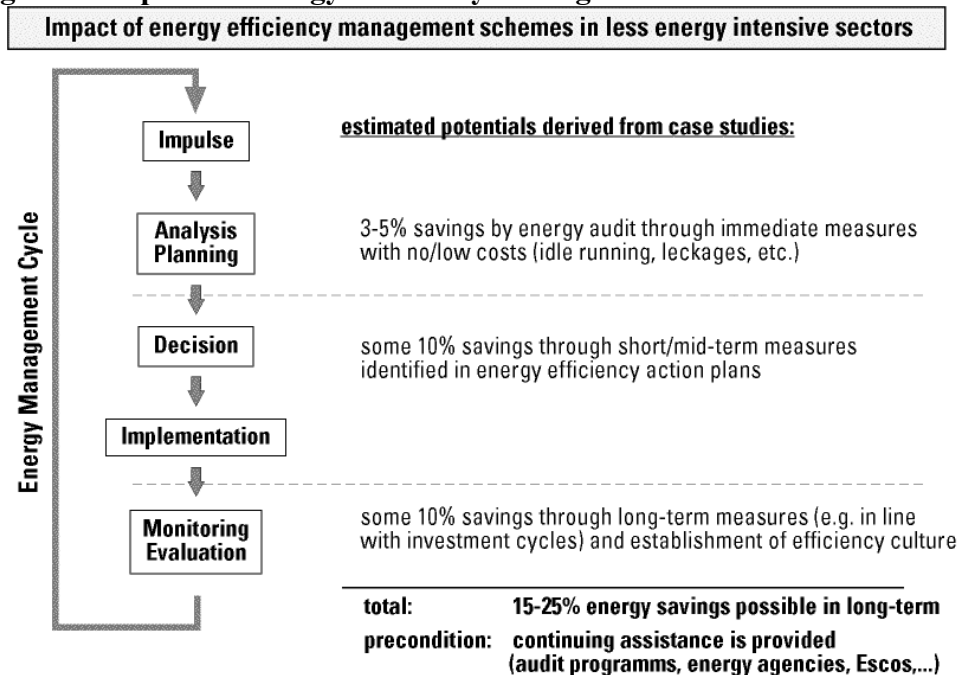
Source: Ramesohl 2001

## The Framework of E2MAS

The scope of E2MAS is improving the use of energy and accelerating the penetration of energy efficient technologies in public and private companies and thus to contribute to achieving the objectives of the European Union's energy and environmental policies. Moreover the implementation of cost-effective energy efficiency measures would

contribute to improve the competitiveness of European companies. The last objective of E2MAS is to contribute to the uptake of EMAS.<sup>1</sup>

**Figure 2. Impact of Energy Efficiency Management Schemes**



Source: Ramesohl 2001

The basic features of E2MAS are:

1. E2MAS is a voluntary programme managed by the Commission, as GreenLight and Motor Challenge;
2. Participating companies commit to an action plan for improvement of energy efficiency in selected areas and end-use technologies;
3. Top-management commits to energy efficiency;
4. E2MAS is open to all companies - especially SMEs;

<sup>1</sup> The Eco-Management and Audit Scheme, EMAS, was adopted by the European Council on 29th of June 1993, allowing voluntary participation in an environmental management scheme, based on harmonised lines and principles throughout the European Union. It was originally open to companies in industrial sectors operating in the European Union and the European Economic Area (EEA). The scheme has been available for participation by companies since April 1995 and its aim is to promote continuous environmental performance improvements of activities by committing organisations to evaluate and improve their own environmental performance. The overall objective of the scheme is to promote continuous environmental performance improvements of economic activities by committing organisations to evaluate and improve their environmental performance and provide relevant information to the public. The scheme does not replace existing Community or national environmental legislation or technical standards nor does it, in any way, remove a organisation's responsibility to fulfil all of its legal obligations under such legislation or standards. The EMAS Regulation has now been revised and the revision was adopted by the Council of the European Union and by the European Parliament in March 2001.

The main responsibilities of E2MAS participants are: compliance with all relevant environmental and energy legislation; establishment of a management commitment to energy efficiency; implementation of selected cost-effective energy efficiency actions based on the initial energy review;

The first activity during the programme design phase has been to establish the basic elements of E2MAS described in the E2MAS Guidelines. As the GreenLight Programme (Berrutto 2001) as demonstrated, it is expected that this will be an iterative process, and that experience from the pilot test phase will be used to correct and improve the proposed Guidelines.

The purpose of the Guidelines is to define the nature of the commitment of companies, which choose to participate in E2MAS, and the requirements, which have to be fulfilled by participants. While the E2MAS must be sufficiently flexible to accommodate diverse situations, the general requirements of the approach must be sufficiently rigorous so that the commitment to the Guidelines has meaning. Thus, the commitment must contain clearly defined and verifiable actions, which the companies will carry out. These actions must be of such a nature, that they will lead to realising the bulk of profitable energy savings measures in plants and buildings in the covered end-use technologies of participating companies. The actions will include: inspection and audit procedures, to allow top-level management to control energy consumption; integration into management procedures of those reporting and evaluation mechanisms necessary to verify dissemination of the E2MAS actions within the company; a public Commitment, including internal communication of this Commitment; integration of energy consumption criteria into design and purchasing procedures (including, for instance, "Life Cycle Costing"); and implementation of the identified and chosen cost-effective energy efficiency measures and investments.

The E2MAS is based on a number of "building blocks" covering the main end-use systems such as lighting, office equipment, HVAC systems, electric motor systems, power and heat generation systems, cooling systems (including water and food preservation systems), heat recovery systems, industrial ovens. The basic element of the building block defines the technical nature of an appropriate commitment for the specific type of end-use equipment. Because of the very heterogeneous nature of these systems, and the diversity of specific building and company installations, the "building block" must specify a general approach, consisting of verifiable actions, which when carried out lead to optimal system functioning.

The building block defines the notion of a "profitable energy savings measure". It is clear that this cannot be limited to lowering cost, but must include reliability and quality of service criteria. One important consideration is that the targeted types of systems (e.g. lighting, HVAC, etc.) are usually considered as "technical services" within a building or enterprise. Their failure, or a drop in quality of service, can have catastrophic results on the comfort and productivity of the building occupants. Thus, from a management point of view, reliability and quality of service are the overriding criteria for judging the cost-effectiveness of the service, rather than the actual cost of producing the service. For this reason, the E2MAS Guidelines will clearly state that profitable energy savings must maintain or improve reliability and quality.

## **The E2MAS Guidelines**

The E2MAS Guideline contains an overall framework for the “building blocks” already described. The framework is modular, so as to permit the incorporation, in the future, of new building blocks (for instance on commercial refrigeration systems). The framework has an “à la carte” nature, that is to say that companies must be able to choose the elements or types of systems relevant to their operations or energy consumption. This in general means that a company will commit to examine those types of end-use devices, systems or buildings that are large energy users. Some companies might also choose a transversal approach focusing on different modules. Furthermore, the framework must be compatible with the range of approaches of the EU Member State Energy Efficiency programmes for commercial buildings and industry, and the existing EU programme (e.g. GreenLight).

In the case of E2MAS it is not possible to specify quantitative requirements for energy savings as is the case for the GreenLight programme, since the level of savings possible depends on the precise nature of each installation or building. Rather, the target for energy savings must be determined as a part of the audit process to which the company commits itself when signing on to E2MAS. The Guidelines define the process by which companies commit to E2MAS, define their specific company plan, carry out their plan and evaluate the results. Since the process is similar to other environmental and quality certification methods such as ISO 9000, ISO14000 and EMAS, care has been taken to use elements from these methods so as to simplify and reduce the cost of committing to the programmes.

The Guidelines will be accompanied by the following documents, initially available only in English, which at a later stage will be translated into national languages: awareness raising material to help top managers understand the purpose of the E2MAS Programme and the potential for energy savings; guidelines for the audit and implementation processes, including initial measurements and ex-post evaluation procedures; and lists of resources (co-operating equipment manufacturers, engineering consultants, software, documents and books, training material, list of possible financing mechanism, list of ESCOs operating in this field, etc.).

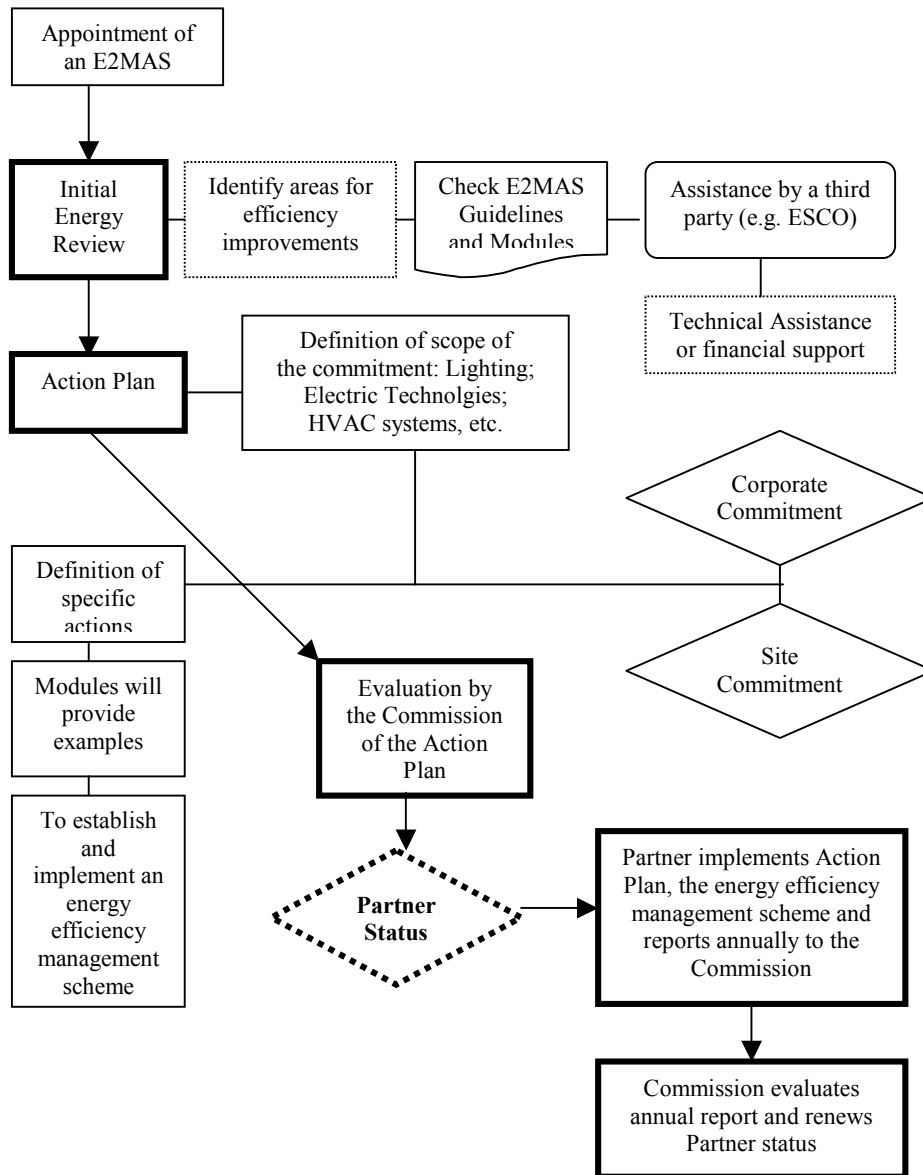
As it was experienced with the GreenLight Programme, initially there will be an ongoing and permanent manner to improve the E2MAS Programme. Thus, it is to be expected that more than one working version of Guidelines will be issued during the course of the programme, leading to a consolidated version about one year after the launch of the programme. The first year will be used to test the overall E2MAS concept, and should contribute to improving and validating the E2MAS Guidelines.

## **The E2MAS procedures**

Companies wishing to join E2MAS will proceed by the following 5 step process:

1. Carrying out the initial energy review (based on energy audit carried out by company staff or chosen contractor);

**Figure 3. The E2MAS Flowchart**



2. Formulating an Action Plan, defining the scope and nature of the company's commitment (buildings and equipment covered);
3. Evaluation and approval of the Action Plan by the Commission
4. Implementation of the Action Plan by the company, and annual reports to the Commission
5. Renewal of Partner status by the Commission, upon review of the annual report

## Initial Energy Review

Companies shall carry out an initial energy review to identify areas for energy efficiency improvements in the selected end-use technologies. The E2MAS Modules (this contains for each building block the technical details, audit procedures, list of energy saving options, and tips on how to save energy) will provide assistance to help companies in evaluating the cost-effective energy efficiency potential benefits of joining E2MAS.

Where appropriate, companies may choose to be assisted by a third party, for instance an Energy Service Company (ESCO). The E2MAS website provides lists of ESCOs who offer such a service. In some cases, National Energy Agencies may offer some type of technical assistance or financial support. Alternatively, the company's staff may be qualified to carry out the initial energy review. An external audit and verification (as is the case for EMAS) is not a condition for submitting an application for Partner status. All audits will include description and measurement of the initial state of the systems, so as to permit ex-post evaluation of the success of actions carried out. The audit recommendations will of course respect the "Reliability" and "Quality of service" clauses of the Guidelines.

## Formulation of the Action Plan

On the basis of the energy review in step 1, the company wishing to participate in E2MAS formulates an Action Plan, defining scope and nature of its commitment and establishes an energy efficiency management system decides on an Action Plan. This plan must define the **scope** and **nature** of the company's commitment. The commitment will also include a proposed reporting scheme. The **scope** of the commitment defines the sites/buildings at which energy efficiency actions will be undertaken. The company will identify, within the chosen sites, the systems and devices to which the commitment applies. The commitment may cover all or some of the following systems (called "Modules" in E2MAS):

- lighting
- office equipment systems
- electric motor systems
- power and heat generation systems
- HVAC systems (including heat-pumps to replace direct electric heating).
- Cooling systems (including water and food preservation systems)
- industrial cooking, ovens and laundry equipment

A Partner's commitment may be applicable to all European sites/buildings, to some sites/buildings, or may be limited to a single site/building<sup>2</sup>.

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<sup>2</sup> According to the company choice of scope, the commitment will apply only to this specific site(s) or corporate level. The scope has to be clearly indicated in the proposed commitment. When a organisation joins E2MAS for a specific site (e.g. an enterprise joining only for plant XY in city ZZ), this has to be clearly indicated by the company in all the communication material relating to E2MAS, e.g. web-site, advertisement, etc. The Commission will also indicate the name of the site(s) in all its communication material e.g. web-site,



- **Corporate Commitment:** a company will have “Corporate Partner” status if the commitment covers the major proportion of its energy consumption (i.e. more than 50% of consumption) at all of its European sites/buildings<sup>3</sup>.
- **Site Commitment:** a company may choose one or several of its production sites or buildings. Within these sites, it may commit to treating one or several Modules.

The **nature** of the commitment defines the Action Plan that the company proposes to carry out. The Action Plan will include **specific actions**, which have been evaluated and decided upon (e.g. investments to upgrade or replace equipment, improved maintenance, etc.). The Modules provide guidance on typical actions for each of the above end-use technologies that are recommended and/or expected by Partners. In addition to these specific actions, Partners are required to establish an **energy efficiency management scheme**, as described in the “Management Policies” Module. This Module proposes tools, which can help companies in making energy efficiency an element of management priorities, at every step of the life cycle of the equipment or systems: system and component design; equipment selection and procurement activities; installation of systems; ongoing operation and maintenance. The reporting scheme should respect the recommendations and formats of the relevant “Module” documents, and be based on a suggested template.

In the Action Plan, the company shall designate a person who would be responsible for ensuring the implementation of the plan. This person shall: verify that appropriate management tools and policies are created to implement the programme; report to top-management on progress; and prepare the annual report to the Commission.

### **Acceptance of the Action Plan**

The proposed commitment (scope and nature of Action Plan, including reporting procedure, and the proposed management scheme) will be submitted to the Commission. The Commission before it grants Partner status to the applying company, will verify that the plan: takes into account the essential recommendations of the relevant E2MAS Module documents; retains the major part of technically and economically viable energy savings options identified by the initial energy review; contains a satisfactory estimation of energy savings and overall reporting procedure.

The Commission will approve the Action Plan, otherwise it will explain to the applicant company its reasons for not approving. Once the plan is approved, the Commission will grant E2MAS Partner status to the company, with all participation benefits.

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catalogue, posters, etc. More sites/shops can be added to the company commitment and it is always possible to move from a site/shop partnership to a corporate partnership or vice-versa.

<sup>3</sup> This proportion will be applied in a flexible manner. A company may, for instance, choose to exclude a very large production system which represents specific engineering problems for which E2MAS tools are inappropriate. The partner should generally include subsidiaries in which the parent enterprise has a controlling share. The partner may choose to include or exclude other partially owned subsidiaries.

## **Implementation of the Action Plan**

The Partner shall carry out its Action Plan, implement the energy efficiency management scheme, and reports annually to the Commission on progress, in accordance with the reporting scheme proposed by the Partner in step 2. The Partner may be assisted in reporting by a third party, for instance an ESCO.

## **Commission Evaluates Annual Report and Renews Partner Status**

The Commission will review the Partner's annual report, and upon approval, will renew Partner status. The Commission reserves for itself the right to verify the fulfilment of Action Plan by any Partner. If the report is not approved, the Commission will explain the reasons to the applicant company. If the implementation of the company's Action Plan is notably weaker than agreed upon, or if the company does not honour its reporting commitments, the Commission reserves the right to terminate the company's participation in the E2MAS.

## **Benefits of Participating in the E2MAS**

E2MAS Partners will receive advice and technical assistance from the Commission and from the E2MAS National Representatives (National Energy Agencies) in carrying out the initial energy review and in formulating and carrying out the E2MAS "Action Plan". The main sale message for the new programme will be that by carrying out the Action Plan, companies will be able to:

- maintain or improve both the reliability and the quality of service of the systems concerned;
- realise the major portion of technically and economically feasible energy savings in the covered end-uses, therefore increasing the company's competitiveness; and
- contribute to EU's environmental objectives, in particular climate change.

Throughout the promotion material and in the Guideline it is stressed that the plan must satisfy the criterion of economic efficiency, so that the allocation of scarce financial and human resources are justified from the viewpoint of the company.

In particular this last point could have a great importance in the Kyoto contest. Right now both emission trading schemes and energy efficiency certificates are being proposed in a number of Member States. The Commission will make sure that actions carried out in the framework of the E2MAS programme would enable company to gain credits or certificates in national schemes.

Furthermore, companies enhance their image in the marketplace by receiving public recognition for their efforts, through the E2MAS promotion campaign, aimed at raising public awareness of energy and environmental issue. Partners may post signs, publicising their energy saving actions and the contribution they are making to the environment. The list of E2MAS Partners, including a description of their specific contributions to the

Programme will be publicised widely (brochure, internet, etc.). Partners will be invited to provide documentation of a showcase installation that the European Commission can publicise, providing details on baseline energy use, what was done, and the resulting energy use after the upgrade.

## **Anticipated Project Goals**

In discussion with several GreenLight partners, it emerged that they were interested to undertake action in other end-use equipment (cooking equipment, refrigeration equipment, HVAC). They also confirmed that the GreenLight approach was useful and lead to new energy efficiency investments. Accordingly in the design of E2MAS the Commission has based itself on the GreenLight Programme. E2MAS tries also to raise awareness for energy efficiency in companies, which have not joined EMAS<sup>4</sup>. E2MAS is also designed with EMAS in mind and it will try to win new companies to EMAS, by allowing them to “experiment” this type of instrument in a simpler scheme. To this end E2MAS has been conceived to be a “easy” scheme for companies based on self-assessment and a company individual action plan. Moreover no registration fees will be requires by participating companies. Last, but not least, a point in the E2MAS design is it shall also foster active energy services, though the use of professional companies which can help with energy audits and financing of the investment identified in the action plans. Today through the GreenLight programme a number of ESCO’s operating in the lighting field have emerged and have become GreenLight endorsers. It is believed that several other existing building operation and management companies will join the new E2MAS programme as endorsers and offer energy services.

The paper has described the design of a new programme, which as not yet being launched, or pilot tested. The first phase will be to pilot test the concept with some of the GreenLight partners that have expressed interest in this concept. Through the pilot test the above described Guidelines, including the 5 phases will be tested and if necessary reformulated. Concerning the end-use technologies covered and the relative Modules, these will be developed one after the other starting from the most “requested” one such as HVAC. On interesting point would be to check the result of this programme versus the one achieved by the US EPA Energy Star Program, which has followed a different philosophy having started from the same approach (Green Lights). The long-term effect of the programme would, of course, be much greater. Experience shows that energy audits catalyse decision making on technical measures with a value approximately 10 to 20 times the value of the audit (Blaustein). The average payback time for the type of energy efficiency measures that the programme aims to encourage is under 2 years<sup>5</sup>. Thus the

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<sup>4</sup> EMAS foresees that participating companies carry out energy efficiency actions, if they want to do so. However it is not mandatory to develop an energy efficiency plan. Moreover a company joining EMAS has to undertaken a review of its environmental impact, and introduce an environmental management policy. Some company may be willing to carry out only energy efficiency actions and therefore may be interested in E2MAS.

<sup>5</sup> Note that 2 year payback time, while typical of current practice, is nonetheless a pessimistic estimate. It is hoped that the decision criteria of industrial enterprises will evolve (in part because of the Challenge

investments directly stimulated by the programme over five years should permit over 3 billion Euros of annual energy savings, equivalent to well over 30 TWh in annual savings. The benefits of a successful E2MAS would be very substantial. A conservative estimate would be 5% of commercial buildings and SMEs electricity use, i.e. about 30 TWh per year to be achieved after the five years life of the Programme.

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The GreenLight Programme: more information available at <http://www.eu-greenlight.org/>

The Motor Challenge Programme: more information available at <http://energyefficiency.jrc.cec.eu.int/motorchallenge/index.htm>

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Programme), so that longer payback time measures will be implemented. The use of Third Party or ESCO financing could play a role.