KEY SECTORS

1. Solar Energy

1.1 1,000,000 kWp Photovoltaic Systems

Photovoltaics (PV) is a high technology with strong export potential in a very competitive global market and fierce competition with Japan and the USA. There is a very motivated PV industry in Europe, which should be supported in its effort to further develop domestic and export markets. Besides leading European energy companies, many SMEs are active in the field. There is much scope for their number to increase and for large numbers of jobs to be created.

An ambitious and visible promotion campaign is needed in order to provide a sufficiently large market base to enable the prices to fall substantially, and so the Campaign will comprise an EU wide 650,000 kWp PV initiative for the domestic market and an export initiative for 350,000 kWp PV systems in developing countries.

A large part of the future PV market will be associated with building applications, especially in Europe where the electricity grid reaches almost all consumers. A 450,000 kWp roof top systems campaign in the European Union can be achieved with the installation of 150,000 systems of an average capacity of 3kWp each. An 150,000 kWp building facades programme in commercial, institutional and public buildings as well as in tourist, sport and recreational facilities can be achieved with the installation of 5,000 systems, assuming an average size of 30 kWp for each building. The campaign in the EU can be strengthened with an additional capacity of 50 MW for stand-alone systems. These systems can be installed in isolated homes (there are about 300,000 such homes in the Union), for small island electrification (particularly in the Mediterranean area) and for summerhouses especially in the Scandinavian countries. The campaign would make up 21% of the 3 GWp estimated implementation potential described in the White Paper. This is a very significant campaign for the future of PV, even though it will affect less than 1% of the 20 million houses and non-residential units which will probably be built between now and 2005. This is without taking into consideration the equally large potential for PV retrofitting in existing buildings.

PV can have a major contribution in the electrification of the more than one billion people without electricity in the developing world. A very well distributed and decentralised electricity system of very low capacity for minimum basic needs is the only realistic system which could be implemented in a foreseeable time frame of 20 to 25 years. The PV potential in the non-electrified developing world is estimated to be more than 16 GWp. Europe with its industry can and should play a major role in this process. The present Campaign includes an export initiative for 350,000 PV village systems of an average capacity of 1 kWp each, for the developing countries. The emphasis will be on systems for rural household electrification (150 MWp), but all the basic applications will be covered (water pumping - 80 MWp, Education - 80 MWp, Health - 20 MWp, Communication - 20 MWp).

This campaign should incorporate specific actions such as:

- Promotion of photovoltaics in schools and other public buildings. This action has not only an educational effect to increase knowledge and awareness at an early and receptive age, but it is technically sound as it minimises the need for storage capacity and in many cases can benefit from advantageous financing;
- incentives for photovoltaics applications in tourism, and sports and recreational facilities, which offer considerable potential due to strongly peaking seasonal demand in mass tourism and the fact that a large proportion of tourist sites are isolated and/or mountainous or otherwise expensive to supply from grids;
- Incentives for financing from public funds and city utilities, for instance by spreading the extra cost for photovoltaics over the entire customer base as opposed to the sole purchasers for solar electricity.

The present average PV system cost for grid- connected applications is about 6 €/Wp. This cost is expected to decrease substantially over the next years. It is assumed that, for the period 1999 - 2003, the average cost could be around 4 €/Wp. This cost increases according to the type of application as can be seen from table attached. The overall investment cost needed for the PV Campaign is estimated to be 5.3 billion €.

1.2 15 million m^2 of Solar Thermal Collectors

Solar thermal heating technology is almost fully mature. High quality products are available, solar systems are reliable and their productivity can be guaranteed. There is nevertheless scope for further cost reductions from larger scale production and improvements in both production processes and marketing.

The market is growing at accelerated rates: from the half a million square meters of solar collectors produced in 1993 to the current annual installation rate of one million square meters. The main market development is concentrated in only three European Union countries (Austria, Germany and Greece). In the White Paper it is estimated that a total installed capacity of 100 million square meters could be achieved by 2010. In order to maintain an important market growth rate a long-term action plan involving the solar industry, the market actors and the public authorities is needed. The Campaign for Take Off could contribute substantially to this direction. Domestic hot water (DOW) production has been by far the main application until today. The possibilities of further penetration into the market of DOW systems are still very high, especially in those countries and regions where their presence is weak or non-existent. It is extremely important, though, that other applications (large collective systems, district heating, space heating and cooling etc.) which are already technologically mature penetrate the market in a large scale. The Campaign for Take Off has a target of 15 million square meters of collectors for 2003 and is concentrated in five market/application segments:

- Domestic hot water production. An installed capacity of 5 million square meters in those countries and regions where the solar thermal market is not developed seems a feasible estimation for the Campaign. Special effort should be made for the development of the market in Southern Europe where the economics are better.

- Large collective solar systems. Several systems have been installed during the last few years in most EU countries, mainly as demonstration projects. The difficulties linked to system design, optimising the installation size and maintenance have now been mastered. The support of the Campaign could help reach an installed capacity of 3 million square meters in this sector.
- Space heating. This application is more adopted for the Northern part of Europe, since it is more interesting when the heating season is long. It can be used as a support to a conventional heating system. An active support during the Campaign could help in installing 3 million square meters of collectors for this application.
- District heating. This is the most economically rational way of using solar thermal energy. Numerous sites in Denmark and Sweden have been equipped with solar collector's areas covering from 1,000 to 5,500 square meters. Considerable market development is expected in Denmark, Sweden and Germany where district heating plants are frequently used. Two million square meters are expected to be supported during the Campaign.
- Air-conditioning and industrial process heating. Certain solar collectors can be used to heat a transfer fluid up to 110 C, efficiently. This heat source can be used in connection with an absorption cooling plant for air-conditioning or directly, as industrial process heat. Both of these applications have been experimented successfully in southern Europe. A 2 million square meters installed capacity in this sector seems feasible and highly desirable given the fact of the high rates of air conditioning installations in Southern Europe.

The present average solar collector cost for domestic hot water production is about 500 €/m2. This cost is expected to decrease over the next years. It is assumed that, for the

period 1999 - 2003, the average cost could be around 400 €/m2. This cost changes according to the type of application as can be seen from table attached. The overall investment cost needed for the Solar Collector Campaign is estimated to be 4.7 billion €.

2. Wind Energy

10,000 MW of Wind Turbine Generators

Wind energy today is competitive and has already been widely installed at specific sites with favourable conditions. Areas potentially suitable for wind energy applications are dispersed throughout the European Union. At present, some have to bear additional costs due to their particular location, which increases installation and/or operational costs (areas far from existing grids, in very cold, hot or dusty climates, offshore, islands, remote rural areas etc.). In particular, there is enormous potential for offshore wind farms. They have the advantage of higher wind speeds, although access is clearly more difficult. In order to achieve large- scale penetration of wind energy in the European Union these areas must also be used. A specific campaign is thus required to support large wind farms in such locations and the development of such new or adapted technology as may be appropriate. This programme will clearly imply a major role for the utilities most concerned.

The 10,000 MW of wind energy installations proposed here represent 25% of the feasible overall wind energy penetration for 2010 outlined in the White Paper. The objective of 10,000 MW can be divided into sub- objectives for different market segments. For each market segment the territory of application and the actors involved can, then, more easily be identified. Five market segments are included in the campaign with estimation for each segment of the feasible installed capacity for the period of the campaign:

- Privately owned wind turbines. They usually range from a few kW to 2 MW. They are owned by farmers, small co-operatives, local authorities, industrial factories etc. The campaign should support those that are installed in isolated areas, islands, low wind sites. Estimated capacity 450 MW.
- Small commercial wind farms. (<5MW). They are installed by investment groups, large co-operatives, industrial factories etc. The campaign should support those installed in hostile sites, isolated areas, islands, low wind sites. Estimated installed capacity 1,000 MW.
- Large commercial wind farms (5 - 100 MW). Large projects established by specialised developers (Independent Power Producers) which build and operate the project. The wind farms installed offshore, in hostile sites, far from the grid and in low wind sites will be supported during the campaign. Estimated installed capacity 4,500 MW.
- Utility owned wind farms (5-100 MW). The electricity from the wind is part of the generation mix of the utility. The main support should be given to offshore installations, but also to those installed in hostile areas and low wind sites. Estimated installed capacity 3,000 MW.
- Niche markets. In this category are included the relatively small stand alone installations for electrification in rural areas with only a little or no infrastructure as well as the special applications such as wind - desalination, wind - diesel, ice production, water pumping, telecommunications etc. An estimated installed capacity of 1,000 MW in islands and isolated areas is expected.

The effort of the European manufacturers to develop and test new Wind Turbine Generators will also actively be supported by the Campaign. It should include: a new generation of Multi Megawatt machines, especially for offshore applications, lightweight/flexible designs, small reliable turbines, specific designs for low or high wind speeds and for offshore or hostile sites. A total of 50 MW WTG is estimated to be developed and tested during the Campaign period.

The average ex-works cost of wind turbines for wind farms is today less than 800 €/kW of installed capacity. Project preparation cost depends heavily on local circumstances, such as condition of the soil, road conditions, proximity to electrical grid sub-stations, etc. For flat onshore sites the overall cost of an installed wind farm is about 1,000 €/kW. This cost could increase substantially for offshore and unconventional site applications. On the other hand, costs are expected to fall by at least 20% by 2005. It is then logical to

assume the average investment cost over the period 1999 - 2003 can be about 800 €/kW for flat onshore sites. The investment needed for the proposed 10,000 MW will be in the order of 10.1 billion €. (see table attached).

3. Biomass

Biomass is a widespread resource as it includes in addition to woody biomass and the residues of the wood working industry, energy crops, agricultural residues and agro-food effluents, manures as well as the organic fraction of municipal solid waste or source, separated household waste and sewage sludge. Energy from biomass is versatile in that it can produce electricity, heat, or transport fuel as appropriate, and unlike electricity it can be stored simply and usually economically. In addition, production units can range from small scale up to multi-megawatt size. The overall objective of the White Paper of increasing the contribution of RES to 12% by 2010 can be achieved only with a large contribution from biomass use. For that reason, the biomass part of the Campaign has a particular weight. It will cover a wide range of selected applications in all three-demand areas - heat, electricity and transport. The overall contribution of the Campaign is estimated to be around 14.5 Mtoe representing 16% of the White Paper estimated, penetration of biomass by 2010. The investment needed for the Campaign is estimated to be 12.4 billion €.

3.1 10,000 MWth of Combined Heat and Power Biomass Installations

Bioenergy is among the most promising areas within the biomass sector, and combined heat and power using biomass has the greatest potential in volume among all renewable energies. Consequently, a campaign to promote and support decentralised biopower installations throughout the European Union is essential. Such installations could range in scale from a few hundred kW to multi-MW and combine different technologies, as appropriate to local circumstances, including fuel switching. Wherever possible use should be made of opportunities for rationalisation through regional and local level implementation.

The estimated contribution of biomass in combined heat and power plants, as outlined in the White Paper, could be 26 Mtoe by 2010. This corresponds typically to an overall installed capacity of approximately 20 GWe or 60 GWth. The promotion of 10 GWth through this campaign represents 1/6 of this amount. It will in particular be important to take measures in the early years of this action plan in order to launch a bioenergy market.

3.2 1,000,000 Dwellings Heated by Biomass

Presently the most important market for bioenergy in the E.U. is the low temperature heat market. The greater contribution of biomass comes from domestic heating. The ways of heating, however, are different from country to country.

More than 85% of all dwellings in the E.U. are being heated by single house systems. Depending on the country oil, natural gas or electricity is dominating. In countries where forestry traditionally plays a role, products form forestry have been utilised to heat houses for centuries. However, the number of houses heated with wood is decreasing constantly. It is important to reverse this trend with the introduction of modern, efficient wood furnaces (logwood, woodchip, pellet systems). Technologies for domestic heating with wood have seen a major breakthrough in the last two decades. Emissions dropped dramatically and at the same time efficiency was enhanced from around 50-55% to more than 90%. The conditions exist in order to change the image of domestic heating with wood from the perception of an outdated practice to that of a high tech, ecological lifestyle.

District heating (with or without cogeneration) provides a possibility to supply low temperature heat, but due to high investment costs (grids for distributing the heat) it needs financial support. It is more developed in those countries where relevant support schemes exist and the climatic conditions are appropriate (Austria, Denmark, Finland, Sweden).

In many countries, where district heating is not developed, dwellings are heated through central heating systems, mainly with natural gas. In areas outside district heating and natural gas distribution, biomass based central heating systems could be developed. A

significant potential exists for micro combined heat and power biomass units for large buildings (hotels, hospitals, office blocks, prisons etc) as well as block units.
The Campaign will include all three options (individual wood furnaces, central heating, district heating) for a total of 10,000 MWth or approximately 4.5 Mtoe.

3.3 1,000 MW of Biogas Installations

The exploitation of biogas has an important environmental benefit, since it consists largely of methane, a gas with a large greenhouse impact. In the last 10 years efforts in certain E.U. countries have focused on developing large centralised biogas plans. During the last few years many small farm plants have also been developed in certain areas of the Union. It is expected that a market will develop for both options. In the White Paper it was estimated that the contribution which could be made by biogas exploitation from livestock production, agro-industrial effluents, sewage treatment and landfill by 2010 is 15 Mtoe. For the Campaign the promotion of 1,000 MW of biogas installations representing approximately 15% of the overall White Paper projection for 2010 is considered appropriate.

3.4 5 million Tonnes of Liquid Biofuels

Liquid biofuels are currently finding competition difficult, given the low oil prices, but their implementation is particularly desirable. The White Paper estimates that the market of liquid biofuels could be in the order of 18 Mtoe per year in 2010. The Campaign could substantially help in the development of the sector by promoting the most productive crop species with the maximum benefit and minimum environmental impact. An objective of 5 million tonnes is put forward.