Sustainable Energy Consumption

A Background Paper prepared for the European Conference under the Marrakech Process on Sustainable Consumption and Production (SCP)
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1 Introduction

1.1 Background

In the Johannesburg Plan of Implementation, all countries were called on to "encourage and promote the development of a 10-year framework of programmes (10YFP) in support of regional and national initiatives to accelerate the shift towards sustainable consumption and production" (Chapter 3). In response to this, several initiatives have been launched and the Marrakech Process - the designated programme for the development and implementation of 10YFP – was set up. Two international meetings (in Marrakech, Morocco and San José, Costa Rica) and various regional consultation meetings have taken place. The first European regional meeting took place in Ostend, Belgium, 24-26 November 2004 and involved European governments and stakeholders from all societal groups.

The upcoming meeting in Berlin will be the second European meeting of the Marrakech Process. Whereas the Ostend meeting had a general thematic focus, the Berlin meeting will focus specifically on sustainable energy consumption. It will address the issues that relate to energy use in households, offices and industry, but will not deal with those related to transport, energy generation and energy distribution.

Energy issues relating to sustainable development were discussed at inter-governmental level for the first time at the Ninth Session of the Commission for Sustainable Development (CSD-9), held in April 2001. Countries agreed that stronger emphasis should be placed on the development, implementation and transfer of cleaner, more efficient technologies and that urgent action is required to further develop and expand the role of alternative energy sources. In its 2006-2007 work cycle (CSD-14/15), CSD will review the progress in the areas of energy for sustainable development, air pollution/atmosphere and climate change along with industrial development. The outcomes from this Berlin meeting will also contribute to the discussion in the CSD sessions.

1.2 Objectives of the meeting

The general objectives of this meeting are to:

- contribute to the implementation of the Johannesburg commitments on sustainable consumption and production;
- contribute to the CSD 2006/07 work cycle where energy for sustainable development is one of the key topics;
• position SCP as one of the most important across-the-board issues within all the CSD work cycles;
• demonstrate the technical and economic potential for making energy consumption (and production) more sustainable;
• share information on ongoing activities and identify priority areas as well as potential gaps in policies and tools;
• identify key areas and corresponding measures for the implementation of sustainable consumption and production (SCP), and
• identify the role of each stakeholder group in the implementation processes (who does what?).

1.3 Objectives of this background paper

Within the overall objectives of the meeting, this background paper serves the following objectives:

• to outline the technical and economic potential for making energy consumption more sustainable through raising energy end-use efficiency and combining it with the use of renewable energy sources, as well as highlighting the policy priorities and challenges necessary to harness the potential;
• to briefly review the current status of policies, and
• particularly to provide background information for the four working groups which will convene during the meeting to discuss the themes of energy savings in households (WG1), eco-design and life cycle assessment (WG 2), renewable energy (WG 3), and public procurement (WG 4).

As it is written for a European conference of the Marrakech Process, this paper mainly focuses on European challenges, but also aims to provide good practice examples to other countries, especially emerging and transitional economies.
2 Technical Potential, and Policy Priorities and Challenges

2.1 Global challenges

Energy consumption is the ultimate cause of the challenges faced by energy supply and energy policies. Levels of consumption determine the need for energy supply and are, therefore, one side of the equation for the security of energy supply. Levels of consumption are also a key determinant in the overall cost of the energy supply system and the overall levels of emissions harmful to health and the environment.

Current trends in global energy use are far from sustainable. Oil demand continues to grow, while experts expect a historic peak in oil production within the next 20 years. Carbon dioxide (CO₂) emissions from fossil fuel combustion in 2002 were about 13% above the 1990 levels, whereas a stabilisation of the climate would demand a reduction by 50% until 2050 and further reductions thereafter. For OECD countries this would mean a reduction target of 60-80% in order to allow developing countries a certain temporary increase in emissions. In order to achieve this, global primary energy consumption would need to stop growing, while OECD energy consumption would need to decrease. Currently, nearly one third of the world population has no access to electricity and another third has only poor access. Reliance on traditional fuels for cooking and heating can have a serious impact on health and the environment. On the other hand, the world’s richest people, earning over 20,000 US dollars per annum, consume nearly 25 times as much energy per person as the poorest people.

However, energy is merely an intermediate good. Consuming energy is a means to an end, that end being the provision of energy-related needs ("energy services") such as cooking, maintaining a comfortable indoor temperature, producing goods, and providing mobility. The ultimate challenge for sustainable energy consumption and production is, therefore, to satisfy the appropriate level of energy-related needs of every human being by using a variety of technologies and fuels tailored to local conditions rather than merely increasing energy supplies, while keeping the overall cost and environmental damage as low as possible.

How can the use of energy in households, offices and industry become more sustainable? Although challenges vary greatly in different parts of the world, the ways of achieving sustainable energy consumption can be summarised in the following four basic options:
a) Demand-side energy efficiency (also termed energy end-use efficiency): This most important option relates to technical, organisational and individual measures to reduce the final energy needed to heat/cool our houses, produce goods etc.

b) Co-/tri-generation: Introduction of on-site co- or tri-generation of heat, cold, and power can dramatically improve energy efficiency on the supply side. This option is largely related to the issues of energy generation and distribution. It is, therefore, only further discussed here in relation to its applications at consumers’ sites (e.g. in industry or public buildings).

c) Renewable energy: The third option is renewable energy produced and used on-site through biomass or solar thermal collectors etc. as well as that fed into the electricity grids.

d) Limiting energy services: The final option could be to limit the amount of energy services we use (e.g. by capping dwelling floor space) to a level sufficient to cover our energy-related needs. Assessing this is, however, highly subjective and for that reason will not be discussed further in this paper.

2.2 Demand-side energy efficiency and on-site co-/tri-generation

2.2.1 Potential
Demand-side energy efficiency involves an array of hundreds of different technologies for numerous energy uses in different sectors. To name a few, these include thermal insulation of buildings, energy-efficient household appliances, fluorescent lighting with T5 or T8 lamps, electronic ballasts, efficient luminaries, daylight or occupancy sensors, variable speed drives to control the power of electric motors etc. The implementation of measures depends on re-investment cycles and the decisions made by a large number of decision-makers who have different degrees of information and varying preferences. The same is true for small-scale on-site co-/tri-generation.

In its recent Green Paper on Energy Efficiency, Doing More With Less, the European Commission stated that “the EU could save at least 20% of its present energy consumption in a cost-effective manner, equivalent to 60 billion euros.
per year, or the present combined energy consumption of Germany and Finland”. “Cost-effective” means that it is cheaper to invest in saving energy than to supply or purchase the same amount of energy. On average, it would cost 1-2 eurocents to save one kilowatt-hour (kWh) of fuel and 2-4 cents to save 1 kWh of electricity. On the other hand, saving energy would avoid the long-term system costs to the national economy – 2-3 cents for 1 kWh of fuel and 5-6 cents for 1 kWh of electricity. Furthermore, the fuel prices for consumers are currently no less than 5 cents per kWh and electricity prices are 10-15 cents per kWh.

A recent policies and measures (P&M) scenario for the 25 EU Member States (EU-25) analyses the possibility of achieving a substantial reduction in greenhouse gas emissions by 2020. This scenario illustrates a strategy that fulfils about 80% of the currently available energy savings potential. It is assumed that via this strategy, decision-makers are better informed and will change their P&M towards incorporating the best available energy-efficient technologies.

Figure 1 shows that in this P&M scenario, energy demand would be reduced by 22.3% by 2020 compared with the business-as-usual (BAU) scenario. This is equivalent to energy savings of almost 2% per annum. Instead of an increasing energy demand of 1.1% per annum in the BAU scenario, a reduction of the demand by, on average, 0.4% per annum can be achieved in the P&M scenario.

Another recent study shows that improvements in the energy efficiency of new equipment and buildings by 5% or more per annum seem to be realistically achievable if a targeted innovation strategy is in place in industrialised countries. This study further shows that over a period of 50 years, such improvements can reduce the total energy consumption by 1% per annum (in absolute terms) and, therefore, may be capable of cutting the energy demand by half by the middle of the century. The other study projects that the average electricity consumption of home appliances can be reduced by 25% by 2010 and 33% by 2030, while the profit per ton of CO₂ emissions avoided is expected to be 160 euros.

As seen above, most of the technical potential for demand-side energy efficiency and on-site co-/tri-generation can be cost-effective, but only a small part of the potential has been exploited so far. A plethora of market barriers deriving from the diversity of energy-efficiency technologies – such as lack of information, prioritisation, funding, incentives and management capacity – leads to this deplorable reality.

### 2.2.2 Priorities and challenges

As Figure 1 shows, significant energy savings can be made in all three sectors under consideration here – households, tertiary, and industry. However, public policies need to support market actors to overcome the barriers mentioned above.
An effective policy for energy efficiency requires a combination of information, practical guidance, regulation, and financing incentives ("sticks, carrots, and tambourines"). Figure 2 gives an overview of the basic package, which consists of general economic instruments (top) and sector or technology specific instruments (the box in the centre). The package needs to be adopted by each actor in the market chain in order to realise energy-efficient buildings and equipment (shown at the bottom). An appropriate policy mix is required to make their actions for increased energy efficiency feasible, rewarding, and straightforward.

While most of the specific instruments listed in the box in Figure 2 directly address final customers or technology providers, energy policies can, and should, also involve energy companies and specialised energy service companies as professional intermediaries. They can mediate between the providers and customers of energy-efficient end-use solutions to overcome a multitude of barriers and to reduce the transaction cost for energy efficiency measures. Their mediation will multiply the effects of economic and legislative instruments such as energy taxes, minimum energy efficiency standards and labelling.

However, such professional intermediaries cannot work alone. Public policies need to create a framework that stimulates energy efficiency programmes and services. This can be done, for example, by creating a special fund that finances energy efficiency programmes, or by setting an energy efficiency obligation for energy suppliers or network companies, coupled with the permission to finance programme costs via energy prices. Such an obligation could also be coupled with a system of tradable energy saving certificates ("white certificates"). Energy performance contracting (EPC) is also in need of public policy support and promotion.

One of the basic tasks of energy policies is to ensure that energy prices reflect the true environmental and social costs by reducing subsidies for non-renewable sources and in-
corporating external cost by means of energy taxes etc. To correctly evaluate the cost and benefit of energy efficiency measures, it is important not to compare the marginal cost of saving energy with subsidised electricity prices but with the total systems cost (i.e. cost of production, transmission, distribution, and reserve capacity cost plus subsidies from the government). Emissions trading, the Clean Development Mechanism (CDM) and Joint Implementation (JI) (the Kyoto mechanisms) are additional policy instruments that should support energy efficiency and its integration with renewable energy. However, the small and dispersed nature of energy efficiency improvements leads to relatively high transaction cost. Simplified procedures for small-scale CDM/JI projects could provide a solution.

2.3 On-site renewable energy

2.3.1 Potential

Both the passive and the active use of renewable energy in a decentralised manner are of particular importance. Renewable energy not only generates clean energy but also has the potential to reduce levels of investment in large-scale networks, power plants and other centralised energy supply technologies.

The utilisation of passive solar energy can be achieved primarily by optimising the design of buildings in particular ways to:

- achieve high solar heating gains which can be supported by special translucent insulation of walls;
- make optimal use of sunlight for lighting purposes through the orientation and sizing of windows, shades and light transportation systems (mirrors, glass fibres), and
- prevent high thermal loads of buildings by shading, and natural and night cooling.

The above passive optimisation of buildings can be supplemented by the following active renewable energy technologies:

- Direct use of solar thermal energy for warm water and heating, and solar cooling;
- Integration of photovoltaic cells into the façades of buildings and possibly into efficient low-voltage in-house electricity grids;
- Use of biomass for heating and, with micro-scale combined heat and power (CHP) devices, for electricity generation, and
- Exploitation of local thermal energy potential (particularly geothermal and waste heat) using highly efficient heat pump technology.

Numerous examples show that, by intelligent planning, high insulation levels and optimisation of windows, the energy use of new residential and office buildings can be reduced to almost zero at a reasonable cost – even under central European climate conditions. By
integrating photovoltaics (PV), buildings can produce more energy than they consume over the course of the year. Almost the same level of efficiency can be achieved by retrofitting existing buildings. Solar radiation can provide, in moderate climates, more than 50% of sanitary hot water and meet up to 20% of space heating demand with the current available technologies. Under warmer conditions, up to 100% of hot water can be provided by solar energy. Examples of daylight use, and passive and active solar cooling systems show that the energy demand in intelligent office buildings can be mostly met by renewable energy.

2.3.2 Priorities and challenges

As the passive solar use and many options for active solar use are predetermined during the design and construction phase of buildings, integrated building planning must be promoted among planners, architects and developers. Specialised tools for solar optimisation of buildings and bigger developments need to become standard.

Effective legal instruments to foster solar and renewable development include:

- Inclusion of provisions for passive solar use and prevention of high summer heat loads in spatial planning and building codes;
- Financial support for the installation of solar collectors and other renewable heat generation systems, and
- Making renewable energy use mandatory in building codes as in Spain, or imposing quotas of renewable energy supply in new buildings or developments (e.g. the eligibility criteria for the demonstration scheme of 50 solar settlements in North Rhine-Westphalia, Germany).
3 Current Status of Policies

On the EU level, the following existing or planned policies can be assumed to have considerable effects on demand-side energy efficiency and on-site renewable energy:

• The Directive on the Overall Energy Performance of Buildings
• The Framework Directive on the Eco-Design of Energy-using Products (EuP)
• The forthcoming Directive on Energy End-use Efficiency and Energy Services
• A revised Energy Labelling Framework Directive has been proposed in the report of the European Climate Change Programme. It would widen the scope of the existing implementing directives on energy labelling.
• The European Parliament has called for a Directive on Renewable Heat and Cold.

In the current 25 EU Member States and the accession countries, as well as in the EEA countries, these EU directives form the framework for national energy efficiency and renewable energy policies.

The EU also provides programmes in the areas of communication and research to promote energy efficiency and sustainable energy sources across Europe as well as developing countries. The Intelligent Energy – Europe (IEE) programme co-finances international projects, events, and the start-up of local or regional agencies relating to energy efficiency, renewable energy and alternative fuels. The Sustainable Energy Europe 2005-2008 Campaign was launched in the framework of IEE, aiming to raise public awareness and promote sustainable energy production and consumption among individuals and public and private organisations.

Many good practice examples from European and other countries demonstrate how a supportive framework with adequate policy instruments can increase energy efficiency in the final energy demand. The following examples are particularly notable:

• The Danish Electricity Saving Trust finances innovative energy efficiency programmes. Those programmes are expected to save around 7% of the electricity use in the household and public sectors by 2008, whilst achieving net economic savings for consumers and society.

• Building codes in countries such as the Netherlands and Germany were taken into consideration in the development of the EU Directive on the Overall Energy Performance of Buildings. Due to the progressive standard introduced in 1996, energy efficiency improvement of residential buildings in the Netherlands accelerated to more than 5% per annum.
• The energy efficiency programmes of electricity and gas suppliers under the Energy Efficiency Commitment scheme in the UK will save 7% of private consumers’ energy use between 2002 and 2008. The economic benefits of the programmes have been proven to be four times higher than their cost.

• Industrial and commercial enterprises and public administrations in Finland have implemented 50-70% of the energy-saving potential identified by detailed energy analyses subsidised by the government.

• Energy management and benchmarking networks in Norway will contribute to saving around 1% of the total energy use in the industrial and commercial sectors each year.

• The Czech Republic has been particularly successful in promoting energy performance contracting.

• The Spanish government announced that it would spend 8 billion euros between 2005 and 2006 on measures to limit energy demand.

Non-European examples include Japan’s Top-Runner programme, energy labels for appliances in Thailand and energy efficiency legislation in India.

It would be appropriate for goods traded worldwide to have a global policy on their energy efficiency so as to harmonise product standards. For example, a performance target for the stand-by power consumption of electrical appliances can be universally set below 1 watt to encourage energy efficiency innovations. For goods which are traded only on a regional or national scale, and for buildings and production facilities, the exchange of knowledge on energy efficiency and renewable energy policy should be firmly promoted by the UN and governments. One of the first tools in this area of development is the Collaborative Labeling and Appliance Standards Program (CLASP) that promotes efficiency standards and labels in developing countries.

Under the framework of the Global Environmental Facility (GEF), relatively few energy efficiency and on-site renewable energy projects have been funded so far, although the multi-country Efficient Lighting Initiative is a good example. Only 4% of the first 202 CDM projects that were approved, or are close to approval, by the CDM Executive Board target energy efficiency. Although 75% of the projects relate to renewable energy, these would only generate around 20% of the total amount of certificates acquired from all projects. The difficulties and a possible way forward have been mentioned in Chapter 2.
4 Challenges for the Working Groups

As discussed in Chapter 2, energy end-use efficiency and on-site renewable energy use in households, offices and industry comprise many different technologies for numerous energy uses in different sectors, involving a large number of decision-makers. The decision-makers include component suppliers, manufacturers, architects, designers/planners, wholesale and retail traders, installation contractors, specialised energy efficiency consultants, specialised energy service companies, energy companies, building owners and other investors, tenants, and users of energy-efficient equipment.

Four topics – energy savings in households (WG1), eco-design and life cycle assessment (WG 2), renewable energy (WG 3), and public procurement (WG 4) – have been chosen to facilitate discussions to unravel these complex relationships. The challenges for the working groups will be to:

- acquire an overview of the current debate;
- discuss forthcoming challenges;
- identify areas for concrete measures, and
- identify potential areas for exchange and co-operation between participating countries.
Notes to the Working Groups
Working Group 1: Energy Savings in Households – A utopia?

Scope
This working group will discuss the consumption phase of energy using products. The issues cover all sectors except transport, ranging from technical solutions such as the use of stand-by modes for electronic appliances and the thermal insulation of buildings, to soft approaches for changing household behaviour, such as communication strategies. The main objectives are to:

• highlight the potential for energy efficiency in European households;
• share experiences and best practices (what works, what doesn’t);
• demonstrate framework conditions for energy-efficient household consumption;
• identify solutions which make it easier and more convenient to choose energy-efficient goods and to adopt behaviour which focuses on the efficient use of energy;
• identify communication strategies or other methods to make households behave in more energy-efficient ways, and,
• if possible, initiate concrete implementation measures.

Current status of discussion

• Around 90% of the energy use of products throughout their life cycles stems from their consumption phase. However, 80% of the energy use in the consumption phase is determined at the time of the initial investment or reinvestment in the products. Alternative energy-efficient choices often require more investment at the point of the initial decision-making. Supporting the choice of energy-efficient buildings and goods is, therefore, highly significant.

• The remaining 20% of energy use can be influenced by the behaviour of households; for example, by turning off lights and turning down thermostats when rooms are not in use, and only using washing machines and dryers at full load.

• Space heating accounts for 66% of household energy consumption in the EU. The most effective means of increasing energy efficiency in households is, therefore, the thermal insulation of existing and new buildings. Passive houses can make energy savings of up to 90%. Optimisation of the heating system – boilers, hydraulic setting of
pipes and thermostats, and pumps – can also produce energy savings of 10-30% of heat and up to 80% of electricity.

- Almost one third of all electricity in OECD countries is consumed by home appliances. Energy-efficient lighting and electronic equipment offer a similar saving potential. A++ refrigerators and freezers can reduce electricity consumption by around 50%.

- A policy package to assist households in making it easier to choose energy-efficient goods includes: mandatory/voluntary energy labelling (e.g. Energy Star programme), minimum energy performance standards (e.g. Japan’s Top-Runner programme, new EU Framework Directive on the Eco-Design of Energy-using Products), databases of energy-efficient products (e.g. www.topten.info website initiated in Switzerland), individual advice, financial incentives to attract households to energy-efficient alternatives and information and awareness campaigns.

- It is also critical to make energy efficiency easy and attractive for the players in the market chain of the supply of energy-efficient buildings, products, and services (manufacturers, retailers and sales staff, planners, installation and service contractors). They need to understand the market and the profitability of energy-efficient solutions so that these technologies can be applied within households. Additional policies in this area include professional training and co-operative or public procurement.

- Some good policy examples were referred to in Chapter 3 of the overview. Those examples prove that it would be possible to achieve energy savings of 1.0-1.5% per year in the household sector, while at the same time bringing net economic savings to households and society.

**Forthcoming challenges**

- Very few countries have, as yet, formulated and implemented a coherent policy strategy to harness the energy efficiency potential in households. By identifying the size and cost-effectiveness of the potential, an optimal package of instruments can be developed. The forthcoming EU Directive on Energy End-use Efficiency and Energy Services, which has as its target a 1% energy saving per annum in households, will offer a good opportunity for EU Member States to develop such a strategy.

- An example of such a strategy is the UK’s Action Plan on Energy Efficiency. For the household sector, the action plan includes the Energy Efficiency Commitments (mentioned in Chapter 3 of the overview), tax incentives for private landlords to invest in more energy-efficient buildings, a network of energy advice centres, special funding for insulation and improved heating systems for low-income households, and a revision of the building code to implement the EU Directive on the Overall Energy Performance of Buildings.
• Studies often find that households are primarily concerned with the purchase cost and are only prepared to pay extra for energy-efficient products if there will be a rapid return on this investment. Where there is little market incentive for producers to invest in energy-efficient features (e.g. new buildings), regulatory policies such as building codes have been more effective. For other products, economic incentives and further guidance such as Germany’s Sustainable Shopping Basket would help consumers’ decision-making. Innovative market-based instruments such as energy performance contracting (EPC) also need to be developed and tested. It is important to set a framework strategy and a policy package according to product types and replacement cycles, taking social and cultural conditions into account.

• Research and development (R&D) efforts on energy efficiency, therefore, should not only relate to technical improvements, but also focus more on understanding markets, market barriers, the policy instruments and energy services that can overcome those barriers, and how to measure their effects in terms of energy and cost savings.

Some questions for discussions

• Which technical solutions make energy efficiency in households easy and convenient, and have the greatest potential to be cost-effective?

• What approaches and policy instruments can support households in making more energy-efficient investment choices and make the players in the market chain offer energy-efficient options to households?

• What role should the producers and energy companies play in promoting energy saving in households?

• What could be the role of R&D in technologies and in the implementation of energy efficiency, and what are the most important R&D needs?

• Is it possible to identify concrete implementation measures that could be initiated?
Working Group 2: Eco-design and Life Cycle Assessment – The road to energy-efficient products

Scope
This working group will focus on the design and production of products. Initiatives such as the EU Framework Directive on the Eco-Design of Energy-using Products, Integrated Product Policies (IPP), the UNEP/SETAC Life Cycle Initiative, and Japan’s Top-Runner programme will be referred to in the discussion. The main objectives are to:

- share practical experiences (including industry presentations);
- discuss the role of the above initiatives and approaches;
- identify priority areas for future implementation work, and,
- if possible, initiate concrete implementation measures (e.g. voluntary commitments).

Current status of discussion
- Energy-using products consume about 30% of primary energy in the EU and are responsible for 40% of CO2 emissions.
- The analysis of regional priorities prepared for the 2nd International Expert Meeting in Costa Rica names eco-design and product-service systems (PSS) as approaches for business actions for sustainable development. The Asia-Pacific region emphasised the importance of tools such as life cycle assessment (LCA).
- Promoting a shift to more sustainable consumption requires the increase of both supply and demand for sustainable products. Demand-side energy efficiency measures are an important option for improving the sustainability performance in households, offices and industry, and products play an important role here. Most of the impacts arising from the consumption of products are, however, determined at the design stage. Consumers are often “locked in” to unsustainable patterns of consumption by the availability and affordability of products.
- Policy makers are recognising the need for policies that address the impacts which occur beyond the production phase, especially with regard to the use and disposal of products. For example:
  - Policy measures such as extended producer responsibility (EPR) are being used to promote the recycling of electronics and other products. The EU’s new Directive
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on Waste from Electrical and Electronic Equipment (WEEE) aims to increase the re-use, recycling and recovery of waste from a variety of consumer products.

- Japan’s Top-Runner programme aims to develop the world’s best energy-efficient appliances. The programme sets energy standards for each type of product equal to, or more stringent than, the level of the best available technologies on the market.

- The EU’s Framework Directive on the Eco-Design of Energy-using Products aims at increasing energy savings from all electrical appliances. Measures for priority areas – heating, electric motors, lighting, domestic appliances, office equipment, consumer electronics, air conditioning, and stand-by losses – will be decided on in the next two years. They will define energy performance for each product and implement related labelling to enable to consumers to make informed choices. They will also encourage consumer responsibility in contributing to energy savings.

- There have been efforts to develop policies for particular products covering the whole life cycle. The EU’s IPP calls for an approach that integrates three main areas – influencing prices, promoting green production and stimulating demand for green products.

- The most effective measures for improving the efficiency of appliances have generally been mandatory energy-efficiency standards. In the US, mandatory standards for a number of appliances, such as refrigerators and air conditioners, have been established. In the EU, voluntary agreements have been negotiated with manufacturers to improve the energy efficiency of a range of consumer appliances, including power supply units, televisions and DVD players. It is estimated that, in the EU, further measures of this kind could reduce total energy consumption by 10% by 2020.

- Not only energy-using products but also all other kinds of products need to be considered, since energy consumption is an issue throughout a product’s life cycle. Improving the resource efficiency during production could, therefore, also be an effective strategy to reduce the product’s “energy rucksack”.

- Technological leapfrogging in energy efficiency may enable developing countries to accelerate improvements in living standards and bypass unsustainable patterns of consumption and production.

Forthcoming challenges

- Developing incentives for energy-efficient design that addresses the full life cycle and promoting skills in the private sector for LCA and eco-design remain as challenges.

- Increasing the awareness of the contribution that resource-efficiency strategies can make in improving the energy efficiency of products.
• An important issue for consideration is consumer preference and behaviour, how this influences what is produced, and how consumer preference and behaviour can be shaped in ways that promote more energy-efficient products.

• Increased product efficiency has generally been offset by even greater increases in overall consumption. In addition, the “rebound effect”, by which increased efficiency reduces prices and stimulates greater demand, has been observed. In order to reduce absolute energy consumption by 1% per annum, taking into account economic growth, a yearly average growth rate of energy efficiency by 3% has yet to be realised. If the replacement cycles of products are taken into account, this requires new products that improve their energy efficiency by 4.7% per annum on average.

• Various research shows such efficiency improvement rates are technologically feasible. To achieve this, however, governments need not only to fund traditional R&D but also to help create markets for the deployment of energy efficiency innovations.

Some questions for discussions

• What is the role of governments in promoting concepts such as eco-design and instruments like LCA for energy-efficient products, in particular during the R&D phase? What are the roles and effectiveness of different instruments? How can best practice policies and programmes be disseminated and supported?

• How can industry be persuaded to take responsibility during the R&D, marketing, sales and after-sales phases for the impacts of consumption and disposal of the products?

• What kinds of communication, information and eco-labelling are most effective in influencing consumer choice?

• How have consumers’ preferences been reflected in product design? How can consumers and producers (and designers) best interact in order to mainstream eco-design?

• How can eco-design and LCA be promoted in developing countries? What kind of support will be most effective?
Working Group 3: Renewable Energy – New energy sources, new consumption modes?

Scope
This working group will address the question of whether new energy sources lead to new consumption modes. Can renewable energy be regarded as an inexhaustible energy source and, therefore, will energy efficiency no longer be an issue of concern? Or should the use of renewable energy go hand-in-hand with energy efficiency? The main objectives are to:

• share practical experiences relating to these questions;
• develop strategies and projects that link the use of renewable energy and energy-efficient behaviours, and
• identify priority areas for future work.

Current status of discussion
• As the total impact from energy use results from both the amount of energy consumed and the mode of energy supply, we need to look at the two issues combined. It is important for policy makers to consider different energy options in order to minimise the impact at the lowest cost, whether renewables or non-renewables.
• Renewable energy (RE) sources, even though these include large hydropower, account for around only 5% of total energy production and consumption.
• Even though most of the sources for RE are inexhaustible, its generation and distribution still involves the input of materials. On-site RE systems require storage batteries that reduce environmental benefits. Energy use further causes consumption of electrical and other energy appliances, which involve material use.
• Assuming that a considerable greenhouse gas reduction of 60-80% by 2050 is required, energy efficiency (EE) and RE should be regarded as complementary. With a rate of 1% energy efficiency improvement per annum in the business-as-usual scenario, RE will have to grow by at least 14% per annum in the coming decades. If efficiency were to improve by 3% per annum, RE would have to grow by only 8% per annum. An improvement in EE makes a significant increase in the share of RE in the energy mix more achievable and cost-effective.
• The complementary use of RE and EE technologies can improve the security of the energy supply. Recent trends in oil prices would encourage countries to develop local energy sources and diversify energy portfolios as well as to improve energy efficiency.

• In the discussion about the harmonisation of RE and EE policies, it is important to take into account the differences between: 1) actors dealing with energy production and consumption; 2) motivations, experiences and behaviour patterns; 3) countries.

• Early movers for RE produced their own energy mostly as private individuals. They were motivated by the will to have green energy and/or to become independent from big suppliers. Those pioneers are generally sensitive to the interdependences between energy production/use and environmental issues. A survey shows that Bavarian solar thermal energy households had a better understanding of energy policies and supply systems while they, at the same time, had lower energy consumption than others.

• Due to the liberalisation of the European electricity market in 1998, consumers gained an opportunity to choose green electricity. Most RE in OECD countries is now generated or purchased by utilities and sold together with electricity generated from fossil-fuel sources. Furthermore, the investment in RE technologies either by private installations (e.g. PV), by joining operation companies (e.g. wind parks) or even by buying shares in a joint-stock company can create a return with interest subject to special conditions. In contrast to the original movers, these consumers and investors are not essentially sensitive to the efficient use of energy. They might even regard their commitment to RE as a justification for their energy consuming lifestyles.

• In some parts of the world, particularly in developing countries, the installation cost of on-site RE systems (e.g. PV in remote villages) can be significantly smaller than EE technologies, while the link of energy consumption and production is clearly observed. For example, using fluorescent lamps or LEDs instead of conventional light bulbs can reduce the power output of a PV-installed home by a factor of five.

**Forthcoming challenges**

• The existing policies and programmes often promote either RE or EE, not both, asking whether one or the other is a better (or the only) way to reduce energy consumption. How to make informed decisions about whether to focus on RE or EE in a specific case is not obvious. There is a need for a more system-integrated approach that links RE projects with an obligatory application of EE technologies. One good example is the Solar & Save programme in North Rhine-Westphalia, Germany, which encourages investment for climate protection projects in public schools among ordinary citizens using energy performance contracting (EPC).

• To attain the right mix of RE and EE, prices need to reflect the environmental and social costs of energy production.
• Public awareness of the interdependency between RE and EE is a very important factor in the promotion of the integrated approach. The communication of this issue in both expert circles and amongst the public is of as much importance as bringing different stakeholders together.

• A more innovative approach that integrates RE and EE technologies in product development should be encouraged, including the development of buildings and motor vehicles that combine EE features with RE sources.

• Significant financial resources for investment in RE and EE are needed, including the use of innovative financial mechanisms such as loan guarantees and the Clean Development Mechanism (CDM), and market-based instruments and public-private partnerships that can leverage scarce public funds. In Germany, the guaranteed purchase price of electricity from private PV installations has been about 50 eurocents per kWh for 20 years, far higher than the price of conventional power, which has created a considerable incentive for private investment in solar power.

Some questions for discussions

• How can policy makers and experts be motivated to integrate RE and EE? Is setting a combined target for RE and EE possible?

• Should the system-integrated approach become imperative for future programmes? Or should there be any exceptions?

• What kind of public support, communication, capacity building and financial mechanism will be required to achieve the approach and the accompanying processes?

• What should the roles of renewable energy equipment manufacturers and energy companies be in integrating EE in RE technologies? How can R&D for such integrated innovations be encouraged?

• How can RE consumers be motivated to use their energy efficiently? Is a new approach, different from that for conventional energy consumers, needed?
Working Group 4: Public Procurement – Setting efficiency incentives?

Scope
Governments can play a catalytic role in shaping consumption patterns, both through public policies and through their own procurement practices. Public procurement has huge potential to enable the market to provide more energy-efficient products and services, due to both its position as one of the principal buyers and also its influence over the private sector and consumer.

This working group will address the opportunities and limitations of public procurement to stimulate energy-efficient consumption. In addition to concentrating on the procurement of electrical appliances and other energy consuming office appliances, the discussion will also focus on the building/housing sector. The main objectives are to:

- share experiences (presentations by procurement departments and other relevant organisations);
- illustrate the potential of public procurement in relation to energy efficiency, particularly in the building/housing sector;
- identify key areas for creating markets for energy-efficient products and services, and
- identify concrete measures to promote the procurement of energy-efficient products and services.

Current status of discussion
- The procurement spending in all public agencies in the EU accounts for 16% of the EU wide GDP or a sum equivalent to half the GDP of Germany. If all public authorities across the EU demanded green electricity, this would represent 18% of the EU’s greenhouse gas reduction commitment under the Kyoto Protocol.
- The Johannesburg Plan of Implementation called upon all countries to ‘promote public procurement policies that encourage development and diffusion of environmentally sound goods and services’ (Chapter 3, para. 19c).
- In 2004, the EU adopted the new Public Procurement Directives that enable public purchasers to integrate environmental considerations into public procurement.
• A number of governments have already introduced public procurement legislation that requires, or encourages, public agencies to adopt green procurement policies and implementation plans and to report the results (Norway, Sweden, Japan, South Korea, etc.), while others take different measures including developing co-ordinated strategies and issuing executive orders and guidelines (e.g. UK’s Sustainable Public Procurement Taskforce).

• A recent study proposes a co-operation of European governments to develop common standards and practical tools on public procurement of energy saving technologies.

• Several international networks have been established in recent years. Among them are the UN Expert Meeting on Sustainable Public Procurement, the International Green Purchasing Network (IGPN), and the Procura+ campaign organised by ICLEI Europe.

• Some developing countries have been rapidly accelerating their efforts for green procurement. In 2004, the Chinese government issued a policy document entitled Implementation of Government Energy Efficiency Procurement that called for a three-year programme to establish energy-efficient purchasing practices at all levels of government.

• The Energy Star label, first introduced in the US in 1992, is considered to be one of the most successful cases of public procurement for promoting energy efficiency. All federal government agencies were required to procure personal computers meeting the criteria. The standard for public procurement became a general standard for the entire market beyond the country.

• Public procurement can also be used to promote renewable energy. The Canadian government has made a commitment to purchase 15-20% of its electricity in the form of green power by 2010.

• The European Commission’s SAVE programme conducted a study on Public Procurement of Energy Saving Technologies in Europe (PROST). The study shows that with additional investments in energy efficiency that have a pay-back time not exceeding five years, annual energy saving in the public sector worth up to 12 billion euros could be achieved in 15 EU Member States by 2020. This year, ICLEI Europe launched a three-year project, Dissemination of Energy Efficiency Measures in the Public Buildings Sector (DEEP).

Forthcoming challenges

• The biggest concern for public agencies in the promotion of green procurement is the extra cost incurred by purchasing sustainable products, since they need to pursue “best value for money”. Striking a balance between conventional tender policies and
environmental criteria is difficult, whilst support from taxpayers is critical to justify the initiatives.

- The definitions of sustainable products as well as eco-labels are very diverse depending on country, sector, company, product and certification body. The lack of a unified approach has made it difficult for public agencies to adopt good practices.

- Adding environmental criteria into the public procurement process may create disadvantages or barriers for small and medium sized enterprises (SMEs) and producers in developing countries. Technology transfer and other support should be the key to promoting energy-efficient products and services among these groups.

- The criteria and practices of green procurement do not always include energy efficiency aspects for all types of products and services. Public procurement tends to look at individual products and services and has yet to be applied in an integrated manner for bigger projects such as the energy-efficient design of buildings and houses.

- For the product categories in which energy efficiency is applied less, public agencies need to co-ordinate their measures to incentivise R&D and procurement policies.

Some questions for discussions

- How can energy efficiency be integrated into public procurement? Should all the purchasing criteria include energy efficiency aspects?

- How can energy-efficient building/housing design be promoted in the context of green procurement?

- Is it possible to develop EU-wide or international common energy efficiency criteria applicable to procurement policies?

- What influence does public procurement have on the private sector’s purchasing behaviours and R&D? How best can the synergies between the public and private sectors be created to expand the markets of energy-efficient products and services? How best can SMEs and developing countries be supported to initiate green procurement?
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