1 Sustainability Goals in Europe and MENA

The Brundtland Commission defined sustainable development as – "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" /Brundtland 1987/. This definition is the starting point of almost all sustainability definition attempt in the different sectors of the economy. Nowadays countries and groups of countries attempt to define sustainable development criteria and make effort to implemente them. Energy plays a crucial role in sustainable development - its availability influences all fields of social, economical and political activities; it affects the state of the environment and the climate.

Sustainable development in the energy sector can be operationalised by the following guidelines (Table 1-1), which were derived using the Sustainable Development (SusDev) concept from /Kopfmüller et al. 2001/, /Coenen, Grunwald 2003/, and /Kopfmüller 2004/ and formulated for energy systems in /HGF 2001/.

(1)	**Equality of access:** Equal opportunities in accessing energy resources and energy services shall be assured for all.
(2)	**Conservation of resources**: The different energy resources shall be maintained for the generations to follow, or there shall be comparable options created at time to provide sufficient energy services for future generations.
(3)	**Compatibility with environment, climate and health**: The adaptability and the ability for regeneration of natural systems (the "environment") may not be exceeded by energy-related emissions and waste. Risks for human health – by e.g. the accumulation of problematical pollutants and harmful substances – shall be avoided.
(4)	**Social compatibility**: It shall be assured when designing the energy supply systems that all people affected by the system are able to participate in the particular decision-making processes. The scope of economic players and communities in acting and designing may not be restricted by these systems, but shall be expanded wherever possible.
(5)	**Low risk and high error tolerance**: The unavoidable risks and hazards that arise from the generation and use of energy shall be minimised and limited in their propagation in space and time. Human errors, improper handling, wilful damage and incorrect use shall also be taken into consideration in the assessment.
(6)	**Comprehensive economic efficiency**: Energy services shall - in relation to other costs in the economy and of consumption – be made available at costs which are acceptable. The criterion of "acceptability" on the one hand refers to the individual economic costs arising in conjunction with the generation and use of the energy and, on the other hand, refers to the overall economic costs while taking also into consideration the external ecological and social costs.
(7)	**Meet the need of supply at any time:** The energy required to satisfy the human needs must be available in line with demand at all times and in sufficient quantities in terms of time and space. This calls for an adequately diversified energy supply so as to be able to react to crises and to have sufficient scope for the future and room for expansion as required. Efficient and flexible supply systems that shall harmonise efficiently with existing settlement structures shall be created and maintained.
(8)	**International co-operation**: Developing the energy systems shall reduce or eliminate conflict potentials between states from a shortage of resources and also promote the peaceful co-existence of states by a joint use of capabilities and potentials.

Table 1-1: Guidelines for Sustainability in the Energy Sector. Source: /Kopfmüller et al. 2001/, /Coenen, Grunwald 2003/, /BMU 2004/ and /Kopfmüller 2004/.

From Table 1-1, it is clear that a deeper understanding of the fundamentals is required if the path towards sustainability shall be successful. Despite the certainly progressive status in environmental policies in certain areas such as pollution abatement in electricity generation, the the world is today still far away from a sustainable path.

1.1 Deficits of the Energy Sector

If today's energy supply is measured on the basis of these guidelines, then major deficits can be seen, that are:

- Excessive consumption of limited energy resources
- Induced global climate change
- Extremely large differences in energy consumption between the industrialised countries and developing countries
- Risks associated with using nuclear power

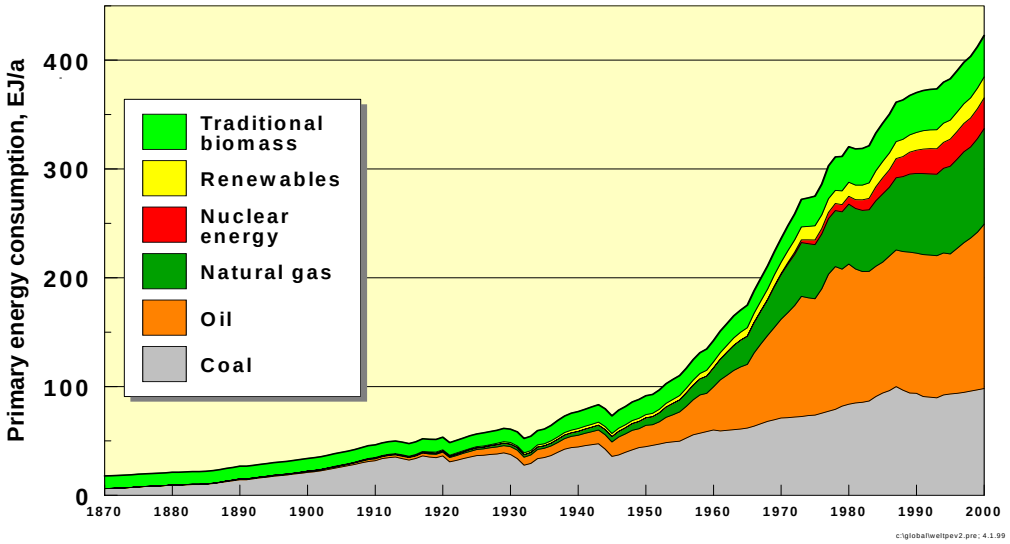
Limitation of Fossil Fuels

Since the beginning of industrialisation, the energy consumption has increased considerably more rapidly than has the number of people on the planet. Whereas the world population has quadrupled since 1870 to 6 billion at present, the world-wide energy consumption, and by this the consumption of fossil resources in the form of coal, oil and natural gas, has increased by a factor of sixty to the present level of 423 EJ/a (2000; EJ = Exajoule). Thus, the average person today consumes fifteen times more energy than a person 130 years ago. The actual rapid increase in the consumption of energy started about 1950 and the world-wide consumption of energy has doubled between 1970 and 2000. Moreover, left on its own no fundamental change of this growth trend can be foreseen in the future.

At the present time, the traditional use of biomass in the form of non-commercial applications of firewood constitutes 9% of the world-wide consumption of primary energy in many of the less-developed countries. The other renewables, first and foremost hydropower, have together a share of 4.5%. Nuclear power contributes 6.7% to the primary energy supply. Thus, some 80% of the world's energy supply is based on oil, gas, and coal. In commercial applications this Figure 1-is as high as 88%. This means that the world-wide energy supply is based primarily on finite fossil energy carriers. Thus it is clear that even in the event of a very rapid change in the energy supply structure, fossil-based energy will still be needed for the decades to come, and this possibly even to a greater extent than today. Therefore, how many resources are still available and how long these resources will last is an issue of central importance. The reserves of fossil sources of energy still remaining amount to some 34,000 EJ (status 2001). This is equivalent to approximately eighty times the present consumption of energy in the world today but only 2.4-times the total quantity of fossil energy that has already been consumed.

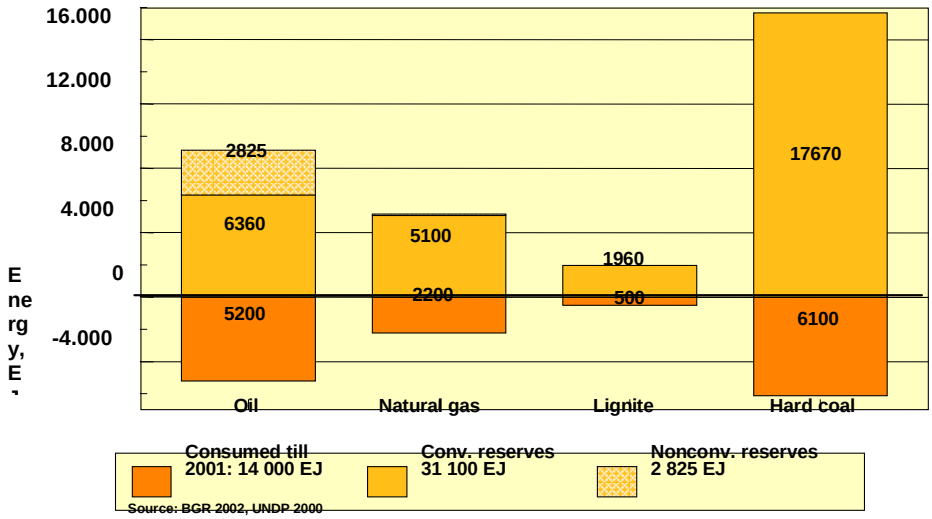
Coal constitutes more than 60% of these reserves. Conventional mineral oil is, with 20% of the reserves still left, the energy carrier which has been exploited the most in comparison with the other fossil energy sources. Comparing this with the major significance assigned to mineral oil of a 35%-share of the global energy supply, then it becomes clear that the supply will have to fall back here - in the foreseeable future - to the non-conventional oil reserves (heavy oil, oil shale,

oil sands) and to the resources as well, in order to meet the (still increasing) demand in the future. Including natural gas - without taking into account the very uncertain data about aquifers and gas hydrates - the resources of hydrocarbons with some 28,200 EJ make up the present reserves from all fossil-type energy carriers. Large resources to the extent of 116,000 EJ are being presumed for coal.



Source: /IEA 2003/

Figure 1-1: Development of the world-wide primary energy consumption and coverage of the demand by the various sources of energy including the non-commercial usage of bio-masses (firewood)



Sources: BGR 2003

Figure 1-2: Reserves per 2001 of fossil sources of energy in comparison with the quantities of energy already consumed in Exa-Joule (EJ)

These trends, indicating shortages in the reserves of oil and natural gas, are also reflected in the "static lifetime" of these energy sources. This term describes the time left until these reserves will be completely exhausted at the present rate of consumption. The shortest static lifetime - 43 years (2001) - is that of conventional mineral oil. Adding unconventional mineral oil – that is to say heavy oils, oil sands and oil shale –will increase the static lifetime to 62 years. For an unchanged rate of consumption, natural gas will last for approximately another 64 years, whereas the reserves of coal will be available for about another 200 years. Uranium, another finite source of energy, will only last for another 40 years, using light-water reactors without conditioning the nuclear fuel. It would appear that there are considerable amounts of resources still available which in principal can also be used. Such considerations however do not include the following aspects:

Very unequal distribution of oil and gas: On the one hand, the world-wide maximum in producing mineral oil – the so-called "mid-depletion point" - is expected within the next 10 to 20 years. Considerable increases in the price of crude oil are then likely as of this point in time at the latest. Natural gas alone cannot compensate for the expected shortage, and the usage of reserves of unconventional oil is expensive. Assured access to cost-favourable energy resources is already of such major significance today for the industrial countries.

The just distribution of resources amongst present and future generations – a major principle of sustainability – is not ensured. Even if today's generation were to come to the conclusion that an appropriate basis for acting shall be left for future generations despite the exploitation of the reserves of fossil and nuclear energy carriers, then in the light of the long time needed to develop and introduce new energy technologies, the minimum requirement has to be to begin now to introduce forcefully these new technologies not dependent on using fossil or nuclear fuels and not to lay down any structures today which might make future changes impossible or impede changes significantly in this context.

The Global Climate

Presumably not the depletion of the fossil energy resources will be the reason, which will force a change in the use of energy. In fact it will be the limited capacity of the environment to absorb the waste-products of energy consumption, which demands resolute actions towards a more sustainable energy economy. This applies mainly for the products which are released into the atmosphere. During the combustion of fossil energy carriers pollutants like sulphur dioxide and nitrogen oxide are formed, which contribute to the formation of acid rain. An incomplete combustion causes the emission of carbon monoxide, unburned hydrocarbons and sooty particles; moreover the combustion of solid fuel will produce considerable amounts of dust. These emissions along with a number of others do not only affect the environment, but they also are directly injurious to human health. Indeed, an improved combustion and the use of catalysts and filters can reduce those emissions considerably. Large progress has been made in this respect in numerous industrialised countries within the last three decades, driven by an effective environmental policy and by significant financial resources. As a consequence, the air has become cleaner, particularly in congested urban areas. One severe problem has remained – the formation of nitrogen oxide by the growing individual transport, which shall be reduced by tightened exhaust regulations for new vehicles. But in less developed countries the burdens from these emissions are quickly growing.

Besides these "classical" air pollutants, carbon dioxide (CO_2) is always emitted from the combustion of fossil fuels. This gas is not toxic, but it boosts the greenhouse effect, thus rising the mean global temperature in the lower atmosphere. Since the beginning of industrialisation, the concentration of CO_2 in the atmosphere has risen by one fourth and has thus caused an increase of the mean temperature near ground by 0.6 ± 0.2 °C. If no counter measures are undertaken to reduce these emissions and those of other greenhouse gases, a further increase of the mean temperature is expected from scenarios of the IPCC (2001)[1] in the range of 1.4°C to 5.8 °C until the year 2100. Besides the increase of temperature, changes in the distribution of rainfall, an increase in the frequency of extreme weather conditions such as storms, displacement of climate and vegetation zones and degradation of soils with fatal results for the strained global nutritional situation are expected. Changes of the climate are natural phenomena and have often happened in the geological history of the earth. However, the present changes are extraordinarily fast and abrupt. Human civilisations and the environment may not have enough time to adapt to the quickly changing conditions.

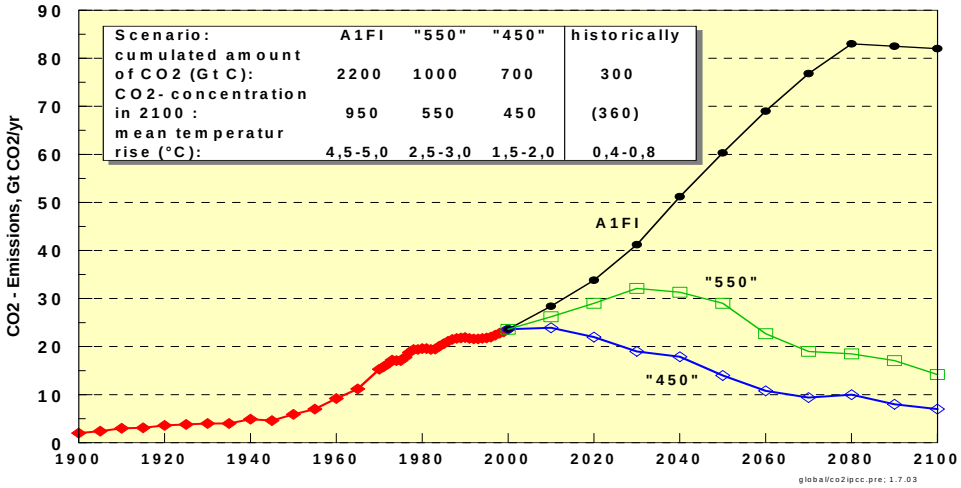
Energy related CO_2-emissions contribute about half to the man-made greenhouse effect. Therefore, efforts to reduce them are in the centre of climate protection activities. The increase of these emissions with currently 24.7 billion tons of CO_2/yr (2002), resulting from steadily growing global energy consumption, has led to a total of additional 1000 billion tons of CO_2 which have been emitted into the atmosphere since the beginning of industrialisation. 80% of that has been emitted in the last 50 years. Because the growth took place mainly in the industrialised countries, they are responsible for about 90 % of the CO_2-emissions generated from energy consumption. Actually they generate two third of the global CO_2-emissions.

Global climate change due to the combustion of fossil energy carriers, to the exhaustive use of forests and to an industrialised agriculture (emissions of the greenhouse gas N_2O) is a predominantly assured fact. To keep the temperature rise within low limits (<2°C), the concentration of CO_2 in the atmosphere, which is actually 360 ppm, must not rise beyond 450 ppm until the end of this century. To reach this value, a world-wide reduction of the energy related CO_2-emissions of more than half of the present amount before 2100 is indispensable. Bearing in mind the further growing population, each of the prospective 9-10 billion humans must not emit more than one ton of CO_2 per year. If a rather unlimited coverage of the growing energy consumption predominantly by fossil energies is assumed, the CO_2-emissions will rise considerably and the resulting temperature changes very likely will cause huge, irreversible, and uncontrollable damages. The scenario A1FI of the IPCC with a far reaching consumption of all fossil resources is such a non-sustainable example. Therefore, within only few decades, an effective combination of technologies for a more efficient energy use in all sectors and CO_2-free or CO_2-poor energy conversion technologies are required to keep the already existing climate change within tolerable limits.

In contrast to the "classical" air pollutants the negative impacts of the CO_2-emissions solely have a global character. A reduction of emissions does not lead directly to local advantages for the energy consumer. Only if actions are taken world-wide, the CO_2-emissions can be reduced to the necessary size. Single states or groups of states can only lead the way to a certain extent. The

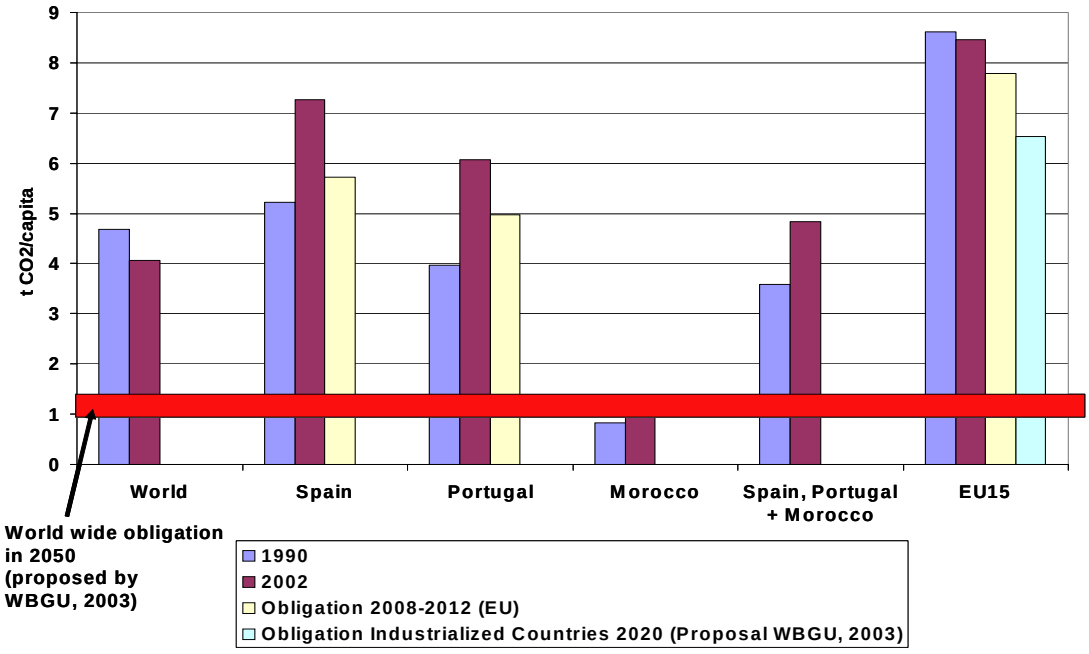
1 IPCC (ed.), Climate Change 2001: The Scientific Basis. IPCC Third Assessment Report. Summary for Policy Makers. Cambridge, New York: Cambridge University Press.

global dimension of the greenhouse effect, therefore, demands a broader way of political actions as it is the case with national problems. In view of the far reaching dangers of the greenhouse effect climate protection is one of the essential rationales for introducing a sustainable energy economy /WBGU 2003/.



Source: /IPCC 2002/

Figure 1-3: Development of the energy related CO_2–emissions in different IPCC-scenarios compared to the historical process and their impacts on CO_2-concentration and temperature in the atmosphere (A1FI = Meeting growing energy demand mainly by fossil energies; „450“ and „550“ = average values of scenarios which result in a stable concentration of CO_2 in the atmosphere)



Source : Adapted from /WBGU 2003/, /Statistisches Bundesamt 2003/, p.187f

Figure 1-4: CO2 emissions per capita in the World, EU15, Morocco, Portugal, and Spain and proposals for future obligations

The 2050-threshold of per capita emissions was calculated using the population data for 2050 from middle variant of UN's World Population Prospect, Revision 2002 (/Stat. BA 2003/ p.188f.). The worldwide CO_2 emission boundary stem from the judgement that a stabilisation of CO_2 concentration at 450 ppm is necessary to restrict the temperature increase to 2°C until 2100 and taken into account that a path which underestimates the temperature sensitivity to an increase of CO_2 concentration will be very difficult to correct. Whether the maximal increase of 0.2°C per decade will be observed depends on the exact path of reduction, however[1]. The resulting CO_2 emissions in 2050 are 9,300-12,500 Mt/a and 1.0-1.4 t/(capita*a), which equals 37-51% respective 25-34% of the current values. To reach this ambitious goal without risking serious negative secondary effects a world wide emission trading system is mandatory. An equal allocation of emission rights per capita in 2050 is proposed, to meet SusDev criteria on intragenerational justice. Additionally, a better renewable energy cooperation between regions and sub-regions and massive support to renewable energy sources, combined with a world wide emission trading system, should be of great contribution.

The world wide per capital goal as measuring criteria (Figure 1-4), which implies a reduction of the current emission per capita to a third or a fourth, approximately equals the current per capita emissions in Morocco. This implies that the Moroccan emissions must maximally increase with the rate of population growth. Allowing trade in CO_2 certificates and assuming equal allocation of emissions rights, the emission-goal of 2050, and the current emissions per capita, Morocco's net trading position in CO_2 certificates would be zero. Because an increase in energy use per capita seems mandatory to reach the social SusDev goals and ineviTable 1-if the world wide income distribution should become more equal, Morocco should increase its CO_2 intensity of energy use approximately simultaneously to the growth rate of energy use. If this is not reached it seems unlikely that selling CO_2-certificates will contribute to the Moroccan income in the long run and Morocco might end up demanding certificates.

Turning to Portugal and Spain, both countries currently show CO_2 emissions per capita well above the world but below the EU15 average. Without determined measures both countries will hardly reach the binding CO_2 goals in 2008-2012, which requires a turn around of the emission trend although the goal already had allowed a significant increase in emissions[2]. Spain's emissions have already passed a proposed intermediate goal for industrialized countries in 2020. So both countries have to reduce their per capita emissions significantly within the next half century.

Large Differences in Energy Consumption

A severe sustainable development problem is the disparity of energy consumption between industrialised and developing countries, which has increased rather than decreased over the recent years. Actually, 15% of the world population in high income countries consume 74% of conventional energy carriers and 63% of electricity. In contrast, 41% of the world population living in the low income countries have access to only 12% of economic wealth and 6% of energy. They are responsible only for 11% of the global CO_2 emissions. Moreover, as many developing countries consider the structure and level of energy supply in the industrialised countries as a means for achieving economic prosperity, they follow the resource-consuming

1 For a full discussion including uncertainties see WBGU (2003, 2003a).

2 Looking at the basket of all GHG-Emissions does not change the description (s. DIW, 2003, p.579)

development path of these countries, and thus further increase the already existing sustainability problems. Only if a fundamental restructuring of the energy supply system is achieved, there is a chance to limit the expected global increase in energy consumption and then a chance for a stabilisation of CO_2 concentration in the atmosphere. To this ends, in the developing countries a combination of decentralised and central energy supply technologies as good as possible should be created right from the start. From the point of view of sustainability, i.e. also under the precondition that in the long run a share of renewables as high as possible has to be mobilised, the alternative is not "centralised" or "decentralised" but rather getting the most efficient and most practical connection of plants of different sizes and performances.

Nuclear Power and the Environmental Risks

Since electricity generation from nuclear fission is close to CO_2-free, many people considered nuclear power as indispensable for achieving our CO_2 abatement targets. But taking into consideration, the fact that climate protection requires the abatement of large quantities of CO_2 over a long time period, the increase in risk stemming from each new nuclear power plant (especially, the social and managerial requirements and their time horizon for save nuclear material flows should be considered), the limited availability of resources prevents nuclear energy from fulfilling these requirements. Even at today's level of nuclear energy use, the availability of cheap uranium for light water reactors is expected to last for only 40 years. The long term supply of a large amount of electricity requires the use of reprocessing and breeding technologies, which are not only more costly, but also more risky than today's reactors.

Furthermore, the different risks liked to nuclear energy are in conflict with the basic requirements of a sustainable energy supply. Thus, the exclusion of nuclear energy could be based on the following reasons:

- Accidents in nuclear reactors, leading to unacceptable human health risks, cannot be ruled out. The regions affected by such an accident would suffer from extreme consequential damages.
- All processes of the nuclear fuel cycle, including fuel preparation, processing and waste disposal generate radioactive material, which is partly emitted. Up to now, the technical feasibility of a safe and long term separation of radioactive material from the ecosphere has not been proven in spite of considerable expenditures in research and development.
- Total protection against proliferation of plutonium as a side product of nuclear fission seems to be impossible, in particular if plutonium has to be handled within an international breeding economy. A misuse of weapon-grade plutonium is a continuous threat for humanity.
- A full scope protection of nuclear facilities against external forces and sabotage is impossible or at least would lead to extremely high costs and a limitation of civic liberties.
- A limitation of the use of nuclear power to the industrialised countries only in order to reduce the risks described above would hinder a peaceful global co-operation and thus, is not viable for policy reasons.

Therefore, the benefits of electricity supply from nuclear power, although it's CO_2 free, seem to be small compared to the risks which are inherently related to the continuous use or even further expansion of nuclear power.

1.2 Efforts for Energy Sustainability

Today, a bundle of policies deals with the promotion of renewable energy sources and the transformation of the energy mix in the European Union.

One of the most relevant legislations for renewable energies is the **European Directive on renewable electricity (2001/77/EG):** By the year 2010, the EU is willing to cover 22% of the grid mix by renewable energies. The energy sector needs to be sufficiently liberalized and not be characterized by market distortions. The Transmission Operators and the Distribution Network Operators are required to guarantee an undiscriminatory access to the grid to the power producers. This includes giving priority access to renewable energy whenever possible, i.e. without compromising the maintenance and reliability of the system. However, not all Member States are likely to achieve their target. The Newly Associated States (NAS) face the challenge to quickly comply with the growth targets for renewable energies in the generation mix.

Apart from this, the **European Directive on the energy performance of buildings** provides incentives for the use of renewable energies in the building sector: 4 January 2006 is the deadline for compliance, regulation in force, updating their energy performance regulations in order to improve energy efficiency of their buildings, requirements on the integral energy performance of new and renovated buildings, on energy certification for all buildings when sold or rented out, inspection schemes for heating and cooling installations, minimum standard for each country, production of energy performance certificates when buildings are constructed, sold or rented, regular inspection of boilers and air-conditioning systems.

Currently, biofuels are still more expensive than the alternatives, i.e. petrol or diesel. The **European Directive on biofuels (2003/30/EG)** stands for a progressive introduction of biofuels derived from agricultural, forestry and organic waste products. The targets are a 2% market share by December 2005 and a 5.75% market share by December 2010. Lower shares have to be justified. Until 31st December 2004, the directive must be transposed into national law by the Member States.

And finally, the **European Directive on Cogeneration** postulates a share of at least 18% of the whole electricity production as a target of the EU by 2012.

Sustainable development is not limited to country boundaries. It is a global challenge and the EU wants to play a key role in attaining worldwide sustainable development.

On the World Summit on Sustainable Development (WSSD) during September 2002 in Johannesburg, the EU committed itself together with other signatories of the UNFCCC to elaborate strategies for a sustainable development worldwide.

As a key objective, the linking of globalization to sustainable development was pointed out. To fulfill this vision, developing countries need to equitably take part in the world economy in order to be able to benefit from the liberalization of the markets and the global competition. Structural changes are required regarding the financial markets which have to become more transparent and less volatile with the aim to provide incentives for environmentally and socially sustainable

production and trade. But first of all, sources of financing have to be provided for developing countries. In this context especially the private sector has to be involved which may for instance be achieved through CDM project activities. In spite of its focus on climate change prevention, the CDM shows opportunities to achieve sustainable development in the host country through projects meanwhile reducing GHG emissions. For instance, the provision of the population with energy is the key to wealth and influences most of the economic and social areas of a country.

During the WSSD, the EU presented its strategy "Sustainable development in Europe for a better world" also known as the "Strategy for Sustainable Development" which had passed the European Counsel in Gothenburg in 2001. The strategy deals both with EU-internal and EU-external aspects of the subject.

The comprehensive objective of the EU Strategy for Sustainable Development is to improve the life quality for current and future generations. Economic growth, protection of environment and social integration are no more considered as conflicting objectives, on the contrary, it is envisaged to achieve them simultaneously.

The Strategy for Sustainable Development completes the Lisbon Strategy, which consists of measures to be taken to achieve economical, social and ecological renewal within the EU, by an environmental dimension. Environmental protection is a precondition for sustainable development contributing to the achievement of the other objectives of the Lisbon Strategy such as competitiveness and innovation.

As a first step, the Strategy for Sustainable Development deals with four subject areas which are significant for a sustainable development:

The first is the mitigation of the climate change. This may be achieved through energy efficiency measures, capture of fugitive emissions as well as by increasing the use of renewable energy. The second area relates to the transport system and land use. Under aspects of emission reductions, transportation systems and the construction of cities may be optimized e.g. by shortening the routes in order to produce fewer emissions. Third, sustainable development is intended to protect public health. And finally, natural resources shall be managed more responsibly.

However, these concepts are still very general and need to be further elaborated to internalize external effects, i.e. the ecological and social costs; clear environmental standards are indispensable.

Between August and October 2004, the European Commission has conducted a broadly designed public consultation. On the outcome of this process the European Commission will elaborate an evaluation report for the EU Strategy for Sustainable Development, which will be the basis for the planned examination/ reconsideration of the strategy by the European Council.

As a result, the EU has now created three different policies related to the Sixth Environmental Action Programme (6th EAP) without clarifying how these relate to each other:

- The Strategy for Sustainable Development (EU SDS), which rests on the basis defined at the European Council in Gothenburg (June 2001);
- The "Cardiff Process" describing the sectoral strategies for the integration of the environmental dimension into other policies;

- The "Lisbon Strategy" for employment, economic reform and social cohesion, to which the environmental dimension was added at the Stockholm European Summit (Spring 2001).

Although these strategy papers illustrate which overall path to take, so far no consensus could be achieved on how to harmonize and exactly put them into practice through sectoral policies. In addition, it has been criticized that this approach narrows sustainable development down to environmental concerns. The review of the European Commission is expected for January 2005 /Hinterberger et al. 2003/.

Some sustainability criteria for developing countries were developed within the Clean Development Mechanism (CDM). Apart form generating additional emission reductions, the CDM is intended to contribute to the sustainable development in the Non-Annex I countries. Each project activity is examined by the DNA against the set of sustainability criteria of the host country. In addition to the very general sustainability goals outlined by the Millennium Decision, the host countries are required to formulate their own specific sustainability goals, because priorities may considerably change from country to country. It lies in the responsibility of the host country to decide whether a proposed project complies with the country's criteria, because it disposes of the most detailed knowledge on the country-specific needs. Project participants have to specify the influence of the project on the sustainable development of the country in their PDD. If the host country has published a framework, it gives the project participants a guidance, which aspects need to be dealt with. Further, national development strategies, energy and environmental strategies as well as social and economic plans have to be consulted in order to put the criteria into concrete terms. Without defined national criteria for sustainable development, project participants face difficulties in providing the required information to demonstrate project worthiness.

DNAs have already been set up in Egypt, Israel, Jordan, Lebanon, Morocco, the Syrian Arab Republic and Yemen, but only Morocco has published its national criteria for sustainable development which are available at the DNA's website www.mdpmaroc.com. Morocco has been the leading African country regarding CDM especially in capacity building. This is partly due to the UNDP capacity building project initiated in 1994 and later supplemented by a CDM component. The country disposes of negligible domestic fossil energy sources, but at the same time of a large potential of renewable energy. The national sustainability criteria require a CDM project activity to comply with the following issues:

- The project shall integrate into the principal orientations of development of the country and has to be part of the defined priorities of the national strategy for sustainable development.
- The project shall be conforming to different laws in place in the country particularly those regarding the environment and its preservation. It is particularly indispensable that an environmental impact analysis of the project is realized conforming to the national law on environmental impact analysis.
- The project shall serve the reinforcement of national the energy potential and / or its diversification and its extension concerning renewable energies and / or the optimization of its different uses.

- The project shall permit the use of effective and clean technologies and prevent any import of outmoded technologies.
- The project shall have a tangible positive impact on the local population: Job creation, wealth creation, improvement of live quality, strengthening of sustainable development and clean development capacities.
- The project shall create competitive incentives for private enterprises involved in the activity.
- The project might improve the capacity of the country to combat the fatal effects of the climate change and to adapt to them.

If a DNA has not set up its own catalogue of sustainability criteria, it may fall back on the criteria developed by Sutter /Sutter 2003/

	Criterion
Social Criteria	Stakeholder Participation
	Improved Service Availability
	Capacity Development
	Equal Distribution of Project Return
Environmental Criteria	Fossil Energy Resources
	Air Quality
	Water Quality
	Land Resources
Economic Criteria	Microeconomic Efficiency
	Technology Transfer
	Regional Economy
	Employment Generation

Source: Adapted from /Sutter 2003/.

Table 1-2: Suggested criteria for sustainable development design

1.3 The Kyoto Mechanisms

The Kyoto Protocol is the first internationally agreed policy measure that deals with the stabilisation and the reduction of the greenhouse gases in the atmosphere. With its flexible mechanisms, the Kyoto Protocol adopted in Kyoto at the COP3 in 1997 should contribute to the greenhouse gas emissions reduction though projects activities based as well in industrialised countries as in the developing countries.

It sets differentiated, legally binding emission targets for the industrialised countries and countries in transition (Annex B countries). Each Annex B country disposes of the right to generate an assigned amount of emissions based on varying proportions of 1990 levels. Basically, Annex B countries are required to reduce their emissions to approximately 95% of

1990 levels. The emission targets can be reached via domestic action, by investment in emission reduction projects abroad or the acquisition of emission rights from another country. The latter two options are feasible due to the three "Kyoto Mechanisms" set up, witch allow transboundary co-operation in mitigation activities.

Since the Kyoto Protocol had only given a general framework on the emission reduction options, it has to be waited untill 2001 for clarification and agreements on the mechanisms rules contained in the Marrakech Accords. The ratification of the Kyoto Protocol and the fulfilment of certain reporting requirements are a prerequisite for countries participating in the mechanisms.

As for the three mechanisms, there exist the Clean Development Mechanism (CDM), the Joint Implementation (JI), and the International Emission Trading (IET) with the possibility to build bubbles. The latter mechanism concerns the transfer of parts of the national emission budgets whereas the CDM and the JI are project-based mechanisms.

As far as the IET is concerned, it could only take place between Annex B countries and consists just of a transfer from one country to another, after 2008. Countries forming a bubble can distribute their target internally ex-ante as long as the total of the targets is not exceeded. In effect, the EU is the only country group forming a bubble; it has redistributed its target of –8% in a way that Portugal is allowed to increase its emissions by 25%, while Luxembourg has to reduce its ones by 28%, to mention the extremes /Michaelowa et al. 2004/.

In addition, the Joint Implementation concerns Annex B countries that are countries with binding targets. Emission credits ("Emission Reduction Units", ERUs) can only accrue from 2008. The ERUs have to be certified by "independent entities" and the JI will probably use the rules developed by the CDM Executive Board /Michaelowa et al 2004/. Important here to notice is that the ERUs are deduced from the budget of the host country. Hence, JI does not increase the overall emission budget at a global level.

As for the Clean Development Mechanism (CDM), it accounts for emission reductions which take place in Non-Annex I countries. Thereby, the CDM is the only market mechanism in the Kyoto Protocol that is open to the participation of developing countries. By enhancing cooperation between developed and developing countries, Annex I countries shall assist Non-Annex I countries in achieving sustainable development providing technology transfer. It is the objective of the CDM to help developing countries to contribute to the stabilization of the GHG concentration in the atmosphere, the ultimate goal of the UNFCCC while opening a way of sustainable growth to them. Meanwhile, the CDM assists industrialized countries in achieving compliance with their emissions reductions commitments under the Kyoto Protocol.

One important characteristic of the CDM is that the emission credits are added to the overall emissions budget of Annex B countries. For this reason the quality of the credits has to be guaranteed. Thereby, emission credits only accrue after independent verification through the "Operational Entities" (OEs), which basically are commercial certification companies. Then, these emissions are called Certified Emission Reductions (CERs). An elaborated "project cycle" was defined in the Marrakech Accords which leads to high transaction costs. Of course, it was a concern that transaction costs can prevent small projects from taking place (Michaelowa et al. 2003). For these reasons, some clement rules have been settled for renewable energy projects below 15 MW capacity, energy efficiency projects that save less than 15 GWh per year and other

projects that annually emit less than 15,000 t CO_2[1]. For this specific project size, the so-called "standardised baselines" can be used in order to reduce transaction costs. However, even with these clement rules it is unpredicTable 1-whether small projects will be competitive (Michaelowa et al. 2004).

An important feature of the CDM is that since CERs are generated in countries without emission targets, adding the issued CERs to the investor budget increase the overall emission budget at the global level. But these increasing global budget will stop when each country of the globe disposes of its emission reduction target. At this time of course no morew CERs will be issued.

In order to smoothly carry out the CDM, the necessary institutions have to be built in the developed as well as in the developing countries. Due to very restricted financial resources and organizational deficiencies, the institutional network in many Non-Annex I countries is still uncompleted or entirely missing. A lot of capacity building is needed to enable developing countries to seize/take the opportunities the CDM offers. The Marrakech Accords (2001) require each country which wants to take part in the CDM to set up a Designated National Authority (DNA). The mandatory role of the DNA is the approval of CDM project activities. Therefore, the DNA has to define criteria for sustainable development in order to specify for instance the additionality requirements, the foreign currency requirements and the criteria for job loss prevention. Further, the DNA has to clarify the sectoral and technological priorities and has to organize the sharing of CERs.

Further, the DNA is encouraged to engage in capacity building. The aim is to promote competitiveness of national CDM project proponents and to market the national CDM program to investors. In detail the DNA can improve the informational situation by creating an information database, engaging in the dissemination of information and by organizing trainings for technicians. At the same time, the DNA can support the policy development of the host country government, as well as provide support to (potential) CDM project activities and to the Designated Operational Entities (DOEs) which carry out validations and certifications of projects. In addition, the DNA is responsible of carrying out marketing activities for the CDM. Due to this central position, the DNA has a big influence on the working of the CDM in the host country.

The costs linked to the CDM institutions building and running consist in the start-up funding of about US$ 150,000 for donor seed funding (Indonesia case (Michaelowa, et all, 2004)), fixed costs of about US$ 115,000 per year, and variable costs of US$ 70,000 per year (assumed 10 projects submitted per year). This leads to a total sum of US$ 185,000 per year. The variable costs differ from country to country on the basis of the salaries for officials or experts.

In view of avoiding danger of the greenhouse effect climate protection is one of the essential rationales for introducing a sustainable energy economy. Hence a paradigm changing towards an accelerated utilisation of renewables and a steady decrease in the use of fossil energy carriers is an ultimate task. Of course, it is highly likely that renewable energy projects will play a lead role in the CDM and the JI in terms of number of projects carried through. But taking into consideration the total emission reductions, the average size of renewable energy projects was much smaller than the size of other project categories. Moreover, at the moment no study has

1 These three project categories are the so-called small scale projects (UNFCCC).

been carried out which exactly defines the amount of GHG to be reduced with the Kyoto Mechanisms /Michaelowa et al. 2004/. Nevertheless, their proper use will contribute to the emissions reduction. With the ratification of Russia, the Kyoto Protocol will enter into force and the first climate friendly projects that are linked to it will subsequently be implemented.

Status and Prospects of the Kyoto Instruments in Europe

The Kyoto Mechanisms are already quite developed in Europe and play an important role in its climate policy. Above all the Southern Member States of the EU are strongly interested in the CDM in MENA (Italy, Portugal, Monaco, Spain). The sub-region offers a huge potential in renewable energies, although not yet exploited due to many reasons. One reason is the lack of knowledge on region specific parameters which have to be taken into account when implementing renewable energies in the sub-region. Researchers are actively taking these parameters into account by designing renewable energy projects for the MENA. This is the case of the Trans-Mediterranean Renewable Energy Cooperation, whitch links water supply and poverty alleviation issues to energy production. Therefore, the EU is willing to support research in this area. Potential CDM project activities are as appealing for the EU, as they form an alternative solution for the EU Member States to meet their emission reduction targets. Moreover, the geographic situation of the sub-region (proximity to Europe) offers a cost efficient renewable energy import to Europe. This of course should contribute to the achievement of the European Directive on renewable electricity (2001/77/EG), witch states that by the year 2010, the EU should cover 22% of the grid mix by renewable energies.

The EU wants to dedicate a budget of about 19 million Euro for CDM awareness-building worldwide, with MENA countries having a share of about 26%, that are 5 million Euro /Michaelowa et al., 2004/.

The EU is widely considered as a leader in the development of the CDM. In April 2004, the European Parliament agreed on the “Linking directive”, which allows CERs to be used in the EU trading scheme starting from January 2005. In the approaches of this vote, it had been discussed to limit the CER import to the EU market for emission trading. However, the European Parliament decided not to fix a common CER import limit, as this implementation would have come under the member state competence and thus would have been unlikely to be put into practice. Even if the Kyoto Protocol would not enter into force in early 2005, the survival of the Kyoto Mechanisms would be guaranteed.

The market impact the CDM will exercise is difficult to predict. The private demand for CERs depends on the design of the national allocation plans. As most published plans are weak, the EU Commission is very likely to refuse some. A tendency to shift the demand from companies to governments is noticeable. The impact further depends on CER or ERU import regulations and fees of the governments of the Member States.

Status and Prospects of the Kyoto Instruments in MENA

The following figures provide an overview on the current status of the Kyoto institution building in MENA. The national CDM projects of selected MENA countries are shown in Annex 8.

In Egypt, all CDM institutions have been set up and the country has 21 projects in the pipeline. The donors and investors mainly consist of UNEP, Japan, Italy, Switzerland, the World Bank and the GEF. Regarding the Kyoto Protocol, the Egyptian government is willing to ratify. The CDM will be used as a vehicle to gain additional investment and to reduce energy insecurity.

The Kyoto Mechanism thus plays also an important role in Egypt's national climate change mitigation strategy. Egypt is the second most advanced in the sub-region after Morocco regarding the Kyoto Protocol issues.

In Morocco, too, all CDM institutions have been set up with Morocco offering a suitable environment for CDM projects. The official CDM web site of the country provides all information about the CDM (www.mdpmaroc.com). Further, Morocco benefits from a PNUD-GEF capacity building programme in the Maghreb countries to develop his project portfolio. The main investors in Morocco are the World Bank, UNEP, Germany, France, Italy, and the Netherlands.

Although the country disposes of a huge potential in solar and wind energy, 97% of the energy imported in 2000, this equals about 17.8 MUS$. To change this unfavourable situation, Morocco places the renewable energy sources and the CDM in the central point of his national energy supply strategy and it turns out to be the most developed country in the region as far as CDM institutions are concerned. Morocco has 34 projects in its pipeline. The overall GHG emission reduction potential reaches about 3.5 million t/annum. Already in January 2003, the project pipeline contained ten projects out of which three Project Design Documents (PDD) developed by Ecosecurities were approved by the DNA in November of the same year. A fourth project got the DNA approval in 2004.

The first project is a wind power plant in Essaouira, which would generate an average of 162,000 CERs over 10 years. The second project is an energy efficiency project in the chemical industry, with an average potential of 100,000 CERs over 10 years. The third project deals with the collection and flaring of landfill gas on Rabat landfill, with an average 72,000 CERs over 21 years /ONE 2003/.

Even though Morocco is very advanced in the CDM process, so far no project has been submitted to the Executive Board for several reasons. For instance, in the case of a wind power project proposal near Tangiers and Tarfaya with a capacity of 200 MW and a potential generation of 450,000 CERs per year, it was the Moroccan electricity utility ONE which prevented the project to go further.

Apart from the DNA-approved projects, there have been submitted three Project Idea Notes (PIN) to the DNA in June 2004 for examination. For convenience the other projects in pipeline which are at different levels of development will not be discussed[1].

In Tunisia, the CDM is considered as an important source of additional investment and as an opportunity to enhance sustainable development. For local policy, the CDM plays an important role and is included into the national GHG emissions reduction strategy. The Tunisian government, too, is preparing to ratify the Kyoto Protocol. There are factors which are favorable for the successful adoption of the CDM: as Morocco, Tunisia benefits from the PNUD-GEF capacity building program in the Maghreb countries to develop a project portfolio. To finally implement the activities of this portfolio, i.e. a 16 million tons reduction in CO_2-eq, Tunisia needs a total of 248 MUS$ from which 49 – 81 MUS$ could be obtained from the CDM

1 The full project pipeline is about 34 CDM projects in forestry, waste management, renewable energy, energy efficiency, industrial process field (For more details see Secretary of State for the Environment. Climate Change Unit. CDM permanent Secretariat, CDM projects. Moroccan preliminary portfolio. June 2004).

investors and 167- 199 MUS$ have to be procured from other sources of investment during the period 2002- 2010.

So far, the OPEC countries have not ratified the Kyoto Protocol, because it would be detriment to their primary market interest. Nevertheless, they are very active in the international climate negotiations due to the strategic role of oil and gas in their economic activities. Several OPEC countries even have completed their internal ratification procedures. After Russia's ratification, rapid notification of the ratification is expected from them.

With exception of Indonesia and Algeria, no CDM institution building has been undertaken so far in the OPEC countries. Nevertheless, renewable energy is increasingly seen as a building block of the future OPEC economy due to the continuous diminishment of the reserves.

The present energy demand is expected to rise considerably in future due to the expected economic growth of the MENA. Therefore, the main objective has to be to further uncouple growth from energy consumption. The solution is to promote energy efficiency measures in combination with increased use of renewable energies.

Enhanced energy efficiency and a shift to renewable energy sources is the key for sustainable development of the energy sector in the MENA. However, the adoption of new technology takes its time and the MENA are lacking of skilled manpower and financial means. Therefore, they are dependent on technology transfer from industrial countries. Here, the CDM may bring some contributions.

Taking into consideration the discussion on sustainability illustrated earlier, and a ton per capita emission, it is obvious that Morocco with its actual economic growth will get in a near future an emission reduction target. These coupled with the high energy import dependence may justify the efforts of the country to make use of the CDM.

Generally, MENA countries are in favour of the idea of exporting renewable to Europe under a Trans-Mediterranean Renewable Energy Cooperation /TREC 2004/. Hence technology transfer and development through CDM could be one step towards this constellation.

	National focal point	1st National Communi-cation	Kyoto Protocol ratification	DNA	CDM projects in pipeline	Donors / Investors
Algeria	Ministry of Foreign Affairs	30/04/01	No	No	**Yes**	World bank, UNDP, GEF
Cyprus	Ministry of Agriculture, Natural Resources and Environment	No	16/07/99	No	-	-
Egypt	Egyptian Environmental Affairs Agency	19/07/99	No	**Yes** **Environmental Affairs Agency (EEAA)**	**Yes**	UNEP, Japan, Italy, Switzerland WB/GEF, EEAA
Israel	Ministry of the Environment	18/11/00	15/03/04	**Yes** **Ministry of the Environment**	-	-
Jordan	Ministry of the Environment	06/03/97	17/01/03	**Yes** **Ministry of the Environment**	AIJ E7	UNEP, Netherlands
Lebanon	Organisation of Arab Petroleum Exporting Countries (OAPEC)	02/11/99	No	**Yes** **Ministry of the Environment**		
Libyan Arab Jamahiriya	National Committee for Climate Change		No	No	-	
Morocco	Ministry of Local Administration and Environment	01/11/01	25/01/02	**Yes** **Ministry of the Environment**	**Yes**	WB,UNEP Germany, France, Italy, Netherlands,
Oman	Ministry of Regional Municipalities, Environment and Water Resources	No	No	No	-	
Saudi Arabia	Ministry of Petroleum and Mineral Resources	No	No	No	-	
Sudan	Ministry of the Environment	07/06/03	02/11/04	No	-	
Syrian Arab Republic	Ministry of Local Administration and Environment	No	No	**Yes** **Ministry of the Environment**	-	
Tunisia	Ministry of Environment and Water Resources	27/10/01	22/01/03	No	**Yes**	
United Arab Emirates	No	No	No	No	-	UNEP, Japan
Yemen	Environment Protection Authority (EPA)	29/10/0	No	**Yes** **Environment Protection Authority (EPA)**	-	

Source: Kyoto Protocol Status ratification, (UNFCCC, 25/11/2004).

Table 1-3: The development of the Kyoto institutions in the MENA region

1.4 Limits of Existing Instruments to Achieve Sustainability Goals

Society is forced to move towards a sustainable energy system not only because the fossil energy carriers are limited but specially due to the fact that our environment has limited capacity to absorb the waste-products of energy consumption. Thereby, efforts to reduce them are the focus of the climate policies. In effect, society is still far away from the sustainability goals and strong policy supporting the development of renewable energy technologies is needed in order to achieve an important contribution of renewable energy sources to the world energy consumption mix that at the end lead to a low-greenhouse gas energy system.

As for policy measures, the Kyoto Protocol is supposed to foster the introduction of more renewable energies into the worldwide energy system. The Emission Trading (ET) which enables countries to trade carbon credits at an international market for emissions allows Annex I countries to buy or sell AAUs (Assigned Amount Units) at a market price. Due to the fact that emissions will be reduced where there reduction is the cheapest, the ET will lead to a big cost reduction in achieving the Kyoto targets. The second mechanism, JI, and the third, CDM, should generate emission reductions as was already explained in the last section.

Those emission reductions will be used to supply the ET system so that the Kyoto instruments are well combined. Moreover, a reasonable use of the instruments should lead to a contribution of Annex I and Non-Annex I countries to the global emission reductions and the achievement of the ultimate objective of the Protocol.

Although the Kyoto Protocol offers an emission reduction possibility, it is clear that it is not a panacea for large-scale renewable promotion at the current market price of the greenhouse gas reduction credits. Therefore,supplementary policy measures are required. The tendency is that, at regional and sub-regional level, specific policies are adopted.

Since the European Union is the pioneer in climate policy regarding the greenhouse gas emission reductions, the analysis will be limited to the supplementary climate policy at the European Union level.

Generally, the challenge in the support of the renewable energies are the price gap between their price and those of the fossil energy carriers, as well as the dependency from financing for research and development.

An overview of promotional systems for RES in EU-15 is given in Figure 1-5. A more detailed description is given in Chapter 8. It is apparent that most countries are using either the feed-in tariff model (respectively minimum price standards) or the certificate trading model (respectively the quota model). Bidding schemes, originally introduced in UK, are used in Ireland only. The feed-in model turned out to be the most successful instrument in terms of installed RES-capacity, but an increasing number of countries are considering the certificate trading model as the future winner. Possibly a mixture of both will be used in the future because “green” certificates also can be combined with feed-in models.

Graphically, a tendency of the EU-15 greenhouse gas emissions until 2002 and a projection up to 2010 can be seen in Figure 1-6 under the actual policy measures.

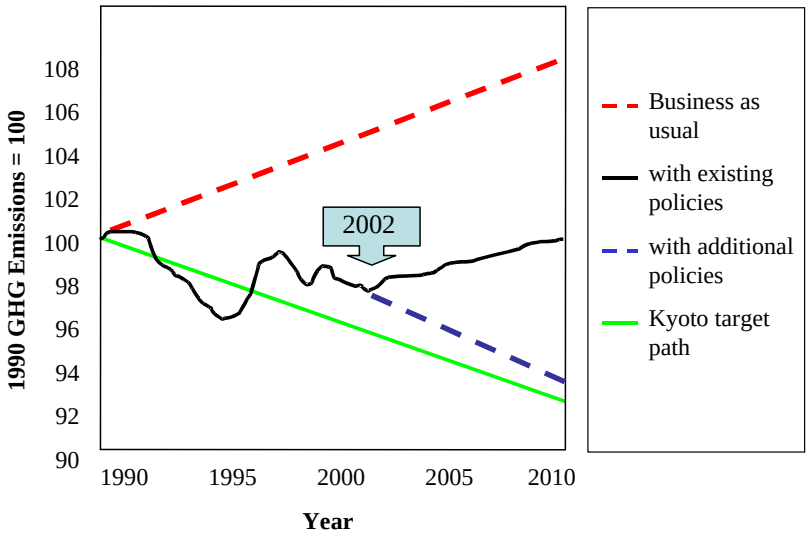
It is noteworthy that with existing policies in the community, the emission path is bellow the ones of the of the business as usual. Still, these policies are not enough to bring the emission curb in the direction of the reductions suggested under the Kyoto Protocol. With the help of

supplementary policies the emission path of the community is hoped to change considerably and follow the Kyoto target path. These means that only with deliberate policy assistance to the renewable energy sources, one can still hope to cut down the emissions and finally find the path traced by the Kyoto Protocol. For that, let's examine the weakness of the actual policies.

	AU	BE	DK	FI	FR	GE	GR	IR	IT	LU	NL	PO	SP	SW	UK
FIT	X		(X)		X	X	X			X		X	X		
BID								X							
SUB			(X)	X		(X)	(X)	(X)		(X)	X			(X)	
CTM	(X)	X	Xp						X		(X)			Xp	X

FIT = Feed-in tariffs; BID = Bidding System; SUB = Subsidies, Tax relief; CTM = Certificate trading model; X = Main instrument; (X) = Additional instrument or combination with main instrument; p = proposed.

Figure 1-5: Overview of promotional systems for RES in the countries of EU-15 by 2002



Source: Adapted from J. Lefevere, 2004, European Commission: DG Environment Directorate.

Figure 1-6: UE-15 greenhouse gas emissions until 2002 and projections until 2010 /Lefevere 2004/

The European community has done a lot in environmental policy to tackle the major challenges for a massive introduction of renewable energy sources. Albeit the contribution of renewable energies to the total energy consumption is growing in the community, society is still far away from reaching the goals. This situation could to some extend be explained by the weaknesses in the policy measures. In effect, as was shown in chapter 3, the desired targets will not be reached with the present policy instruments and measures.

The CDM and the JI which have the potential to foster renewable energies are market mechanisms that are not designed to finance the projects as a whole but only their carbon component. Moreover, the change in the internal rate of return due to incorporation of the carbon

revenues with current CO_2 prices is not that much high to give incentive to the CDM project developers. Therefore, one could not expect a large contribution of the CDM regarding the market share of renewable energies. In reality, CDM activities are driven by the profits on the carbon component of the projects. For that reason, a lot of environmental friendly projects will not be implemented. Moreover, the sustainable development definition, which in the frame of the CDM is let to the hosts countries, could lead to a competition between different host countries and finally decrease the projects quality because the project developers are not willing to finance sustainable development that they considere to be public goods. As the Kyoto Protocol will enter into force in the coming month it will turn out how far these speculations stand to the reality.

Furthermore, as the experiences in the different Member States of the EU has shown, a specific support instrument for the renewable energies is crucial. In effect, the levels of RES electricity premium tariffs are generally insufficient. Moreover, a wide range of policies to promote renewable energy technologies fails in supporting the most cost effective ones. The different design of the national renewable portfolio standards hinder rather than enable the free trade of renewable certificates between different countries. It is evident that renewable energies characterised by decentralised and dispersed application are disadvantaged by the present political framework that supports only the fossil energy carriers. A successful RES policy needs to address also non-economic barriers for RES. This includes a fair access to the electricity grid, adapted building permission procedures for wind power plants or consideration of solar thermal collectors in building codes. Policy measures addressing these issues are not clear enough at the EU level.

A comprehensive education program does not exist at the EU level. In fact, workmen, tradesmen and engineers need to be educated comprehensively about RES technologies and their applications. Moreover, in schools and universities RES subjects are not incorporated enough in their curricula. Last but not least, there is an ongoing demand for R&D to exploit the cost reduction potential through technical progress.

In addition to what has been discussed so far, the weaknesses of the support instruments to the RES at the financial level are obvious. There is not enough funding to foster the R&D likewise to support market introduction to the renewable energy. For example the EU had a program of spreading and financing research on RES in 1998. The program was not successful because the EU's own financial means allocated to the campaign were rather limited with 74 million US-$ over 5 years compared to the total required investment of 20 billion US-$.

It was the objective of this chapter to show whether the existing mechanisms and measures are sufficient to direct the society towards a sustainable development path in good time. The analysis has demonstrated that with the current policies and measures the sustainability development goals of the EU will not be achievable, and even to a lesser extent those of MENA.

Additional effort is indispensable to increase investment in renewable energy technologies so that a significant share of RES in the energy system may be reached in time. Although the Kyoto Protocol and its flexibility mechanisms form an adequate framework and could become a very successful means to promote RES in the long run, the putting into practice takes time, transaction costs are still high and prices for certificates are low. Therefore, it will probably not lead to the desired increase in RES in the recent future. Also the EU and their Member States have been very active to promote RES by setting themselves ambitious emission reduction targets and

implementing a wide set of policies and measures. Nevertheless, even they are very likely to fail their targets by 2010 and 2050.

In order to expect some fundamental changes in the energy mix until 2050, early actions promoting renewable energy technologies are required such as special policy measures and the creation of a renewable energy funds. Moreover to make use of the huge renewable energy potential in MENA, demonstration renewable energy projects are needed to show the reliability of the exiting technologies. In addition, R&D are indispensable to improve and spread existing technologies.

To make use of the Kyoto mechanisms the MENA countries which have not yet ratified the Kyoto Protocol have to ratify und set up their national authorities.

Finally, realistic energy scenarios are needed to give an indication of a realistic sustainable energy path our societies should follow. This will be the attempt of the following work packages.