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Progress Achieved on Energy for Sustainable Development In the Arab Region

The Joint Technical Secretariat is composed of the League of Arab States, the United Nations Economic and Social Commission for Western Asia and the United Nations Environment Programme, Regional Office for West Asia

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I. Introduction

The energy sector in the Arab countries plays a vital role in achieving social and economic development through satisfying the energy needs of the different economic sectors, and in contributing to the Gross Domestic Product (GDP). In spite of such vital role, the sector has several limitations that affect its contribution to the achievement of sustainable development in the region, mainly:

- the sector is still suffering from unsustainable energy production and consumption patterns, particularly in the end use sectors,
- limited energy access since more than 20 percent of the region's population still suffer from absence of electrical energy services, in addition to an equal ratio that suffer from the weakness or instability of these supplies, and
- the sector has its adverse environmental impacts on air, water and soil resources [1].

Table 1 gives comparative statistics of energy production and consumption for years 1999 and 2003, for the ESCWA and Arab region, compared to the world figures [2]. Based on these data, energy consumption in the Arab region has increased from 1168 kgoe/capita/year in 1999 to 1197 kgoe/capita/year, with an increase of 2.48 percent compared to a world increase of 3.68 percent. The Arab and ESCWA natural gas reserves have substantial increases of 47.39 percent and 51.17 percent, respectively, compared to a world average increase of 15.93 percent. Also significant increase in the electricity consumption of 11.69 percent has been recorded, compared to a world average of 4.85 percent during the same period.

Table 1: Energy- related statistics for ESCWA, the Arab region and the world.

Index	**ESCWA**		**Arab countries**		**World**	
	1999	**2003**	**1999**	**2003**	**1999**	**2003**
Population [10^3]	159204	176656	276898	303723	6034417	6392425
Oil reserves [billion barrels]	588.40	602.24	631.5	650.5	1042.85	1138
Natural gas reserves [billion m^3]	30642	46323	35453	52255	155081	179789
Production of oil and petroleum products [10^3 barrels/day]	19095	19466	21671	22300	72063	76777
Natural gas production [billion m^3]	210.88	279.45	401.1	442	2938.75	3272.5
Hydro power [GWh]	28643	27116	30893	29366	2694557	2697089
Generated electric power [TWh]	348	444	413	509	14023	15780
Consumed electric power [TWh]	307	389	360	441	13071	14521
Primary energy consumption [kgoe/capita/year]	1797	1834	1168	1197	1469	1523
Electricity consumption [kWh/capita/year]	1929	2200	1300	1452	2166	2271
Energy intensity [goe/$]	644	593	544	503	324	267

Source: ESCWA's clean fuels study

II. Energy Access

A key distinguishing feature of the world's poor is inadequate access to cleaner energy services. Some 1.6 billion people have no access to electricity and significant portion have limited or no access to cleaner and more modern fuels such as kerosene, LPG and natural gas.

The poor in developing countries face three key energy challenges [3]:
- Reliance on bio-fuels that harm human health and the environment.
- Inadequate access to cleaner energy services, such as electricity and gas for cooking and heating, and for institutional applications.
- Incomes being too low to allow the poor to procure cleaner and more sustainable, but more expensive energy services.

2.1. Current Trends in Energy Access in Developing Countries

The following key policy options/recommendations emerged from a large number of studies conducted in developing nations for enhancing energy access [3]:

- *Ring-fencing (protecting) funds for the electrification of the poor:* This refers to ensuring that the funds for electrifying the poor are protected. Measures include enacting laws that ascertain better access to electricity, and ensuring that the relevant legislation explicitly defines the poor and establishes provisions for increased access and at affordable electricity prices.

- *Sequencing of reforms to prioritize the needs of the poor:* The context in which the country embarks on wide scale electrification of the poor prior to privatization of the power sector.

- *Measures to support low-cost technology options that lower the cost of electrifying the poor:* Examples include, amongst others, revision of grid electricity standards and codes of practice to ensure the inclusion of the use of low-cost technology options, implementation of energy efficiency and demand-side management policies and measures (e.g. use of efficient appliances, improved housekeeping) that can lower electricity consumption.

- *Explicit focus on the poor in the reform process:* There are several ways in which reforms could ensure that the poor become a central target group of the reform process, such as establishing dedicated institutions for the electrification of the poor.

- *Participation of the poor/local communities in electrification initiatives:* There are several key approaches that could encourage the involvement of the poor/local communities in electrification initiatives. The most common approach is through the establishment of Rural Electricity Cooperative, through which local communities actively participate in the installation, operations, maintenance and expansion of the local electricity infrastructure.

Several studies, funded by the Global Network on Energy for Sustainable Development, have been carried out to assess the energy access to the poor [3], in some regional countries, namely Lebanon, Palestine and Syria. Appropriate policies have been also highlighted.

2.2. Energy Access and Poverty in the Region

The electrification rates in the Arab countries in 2000 varied from 100 percent in Kuwait to 7.7 percent in Comoros, Djibouti, Mauritania and Somalia with an average of about 79% compared to a world average of about 72.8 percent and developing countries average of 64.2 percent.

In 2002, about 65 million people in the Arab countries (21.4 percent), mostly in rural areas, have no access to electricity; a further of 60 million are severely undersupplied, both in rural and poor urban areas. They are totaling almost 41.6 percent of the Arab population, and include more than 29 percent of the total population that are below the poverty level of 2 US$/day and they have no or limited access to modern energy services.

Almost one-fifth of the Arab population rely on non-commercial fuels like wood, dung and agricultural residues – to meet their daily heating and cooking needs, particularly in Comoros, Djibouti, Sudan, Yemen and Somalia, as well as 5 to 10 percent in Algeria, Egypt, Morocco and Syria. Moreover, the percentages of population that use solid fuels vary between 5 percent in North African region, and 12 percent in Western Asian Arab nations, in 2003 [8]. The scarcity of wood sources in the majority of Arab countries makes the wood usage regional average much lower than the world average of around 54 percent. It should be noted that the wood usage average of developed nations is around 5 percent, whereas the least developing nations have averages as high as 89 percent.

2.3. Post WSSD Measures

1. The Abu Dhabi Declaration on Environment and Energy '2003'

To activate the WSSD recommendations on energy sector sustainability, the follow-up joint Arab secretariat on summit resolutions, joined hands with the concerned authorities in the UAE to organize a meeting for the Arab ministers of energy and environment in Abu Dhabi in February 2003, to stimulate political commitment and formulate a framework for following-up on WSSD plan of implementation, regarding energy issues [1]. The ministers issued the **Abu Dhabi Declaration on Environment and Energy '2003'**, with a set of commitments, objectives and measures including:

- The right of Arab countries to undertake the development and use of their energy resources, while securing oil and gas flows to international markets, particularly for countries depending on oil and gas revenues.
- The importance of achieving sustainable development and alleviating poverty in the region, through increasing access to affordable, reliable energy services particularly to rural and remote areas using a mix of available conventional and renewable energy resources.
- The need for developing national strategies for promoting the sustainability of the Arab energy sector and reducing GHG emissions from it. However, while responding to the requirements of international agreements and protocols for GHG abatement from the sector, the Arab countries should not be binded by any reduction figures for the emissions within a specific time frame.
- The importance of promoting regional energy integration projects, particularly electric grids interconnections and natural gas networks.
- Calling on Developed Countries to adopt measures, programs and financial resources to support the transfer of sustainable energy technologies to developing countries.
- Calling on Arab countries to develop and implement policies and programs to change the current un-sustainable energy production and consumption patterns, through improving energy efficiencies in all sectors, particularly the highest energy consuming sectors, as well as promoting the use of cleaner fuels and renewable energy resources.
- Calling on Arab countries to support R&D, technology transfer and industrial development of sustainable energy technologies, utilizing the available bilateral, regional, and international technical cooperation and funding mechanisms.
- Calling on Arab countries and regional organizations to put more emphasis on developing and implementing educational, capacity building and public awareness programs on energy for Sustainable Development.

Furthermore, the CSD-11 held on 28 April – 9 May 2003 has re-affirmed among other issues that poverty alleviation, changing unsustainable energy production and consumption patterns, protection of natural resources and their sustainable management will remain the main issues during the Johannesburg Decade (2002-2012).

In view of the above, CAMRE in its 30th meeting in Beirut, dated 4 June 2003, has decided to formulate a taskforce from its technical secretariat, UNEP, ESCWA and OAPEC, to review and reformulate on the basis of measures and concerns expressed in Abu-Dhabi Declaration.

2. The Damascus Declaration

The ESCWA 23rd Ministerial Session held in Damascus, Syria, on May 12, 2005 issued a declaration [7] including a number of issues related to the energy sector sustainability such as:

- Affirming the importance of increasing economic growth and with a view to realizing MDGs, linking that growth to the formulation of strategies for the eradication of poverty and unemployment and the achievement of social integration, including by adopting the general policies necessary in respect of labour, social security, the improvement of living conditions, particularly for vulnerable persons, the eradication of corruption and the strengthening of accountability.

- Requesting the Executive Secretary to produce a detailed study on the establishment of a technology center that would undertake activities aimed at building national technological capacities and harness those capacities in achieving MDGs and strengthening economic and social development and regional and international cooperation in technological fields.

- Requesting the Executive Secretary to take all necessary measures to implement the ESCWA Technical Cooperation Strategy, and to establish a technical cooperation information and knowledge-sharing network with member countries, with a view to strengthening and coordinating technical cooperation activities.

- Calling for a strategic partnership to be forged between ESCWA and the League of Arab States based on the comparative advantages enjoyed by each organization.

- Urging Governments and donor agencies, international financial institutions, members of the UN system and the private sector to support joint projects between ESCWA and the League of Arab States in the economic and social development fields.

- Requesting member countries to adopt policies that take into consideration **gender** issues and to put in place national strategies for the empowerment of women and the institutional frameworks for their implementation, with a view to mainstreaming women's issues into activities, policies and programs, in keeping with the relevant Arab and international agreements, including the Convention on the Elimination of All Forms of Discrimination against Women.

3. The ESCWA Center for Women

The ESCWA Center for Women was established on October 1, 2003, following the Commission's adoption of Resolution 240 that called for the creation of a Committee on Women comprising the member countries, and for the establishment of a women's center.

The center focuses on three main areas of empowerment: economic (poverty alleviation), social (gender roles and partnership in the family) and political (sharing in decision-making and political participation). Its

activity includes, amongst others, providing substantive support to member countries in formulating action-oriented measures and gender-sensitive legislation, policies and strategies and in coordinating a common region-specific position vis-à-vis global issues of concern. A decision was taken, in 2003, to produce the report on Arab women biennially with a thematic approach to highlight emerging issues of concern to the empowerment of Arab women.

In October 2003, the Center hosted the Arab regional follow-up to the International Year of the Family, and in July 2004, it convened the Arab regional follow-up to Beijing. In the fall of 2004, it launched a new website to accommodate its growing projects and publications.

4. ESCWA Activities in the Field of Sustainable Development and Use of Regional Sources

ESCWA, through the SDPD, has directed its efforts in recent years towards increasing the number of institutions in the region that adopt policies for the sector sustainability, and encourage policy- makers to develop sustainable national strategies [9,10]. A number of meetings, seminars, and workshops have been organized with a view to improving stakeholder capacities and increasing awareness on issues such as private sector involvement, clean fuel and energy efficiency, (Details are given later). As a result, some member states have undertaken, in 2004, measures in this direction:

- Lebanon: Private sector involvement in the power sector
- Yemen: Development of renewable energy strategy in rural areas, in collaboration with ESCWA, GEF, and WB, and adopted policies for improving the energy sector sustainability.
- UAE: A wind farm pilot project, policies for improving the energy sector sustainability, and private sector involvement.
- Qatar: Program for energy efficiency and private sector involvement in the electric power sector.
- Syria: Plan to introduce compressed gas technology for land transport.
- Egypt and Oman: Private sector involvement in generation and management of power sector.

Priority Areas for Energy Integration

Four priority areas of actions are identified to integrate energy for sustainable development into national and regional policies in the ESCWA and Arab countries [1]. Each of these priority areas has to be considered within the framework of the energy resources, needs and sector's status in each country. These priority areas include:

- Poverty alleviation through enhancing access to modern energy services to foster economic and social development in rural and poor urban areas, in line with the MDG's of reducing people living in extreme poverty be half.
- Improving energy production and consumption efficiencies in all sectors, particularly the highest energy consuming sectors, to enhance the economic return on energy consumption.
- Diversifying energy resources between conventional and renewable resources and using locally available resources and expertise to secure affordable and environmentally- sound energy services.
- Developing and increasing the use of cleaner fuels and development of advanced fossil fuel technologies, particularly in the transport and power sectors, as well as enhancing oil and gas exploration activities in the region.

2.4. Capital Investment Needs/Sources

Regulatory and financing mechanisms serve as the foundation to encourage the adoption of clean fossil and energy efficient technologies. Developing and industrial countries can cooperate and work together to drive innovation and markets towards cleaner fossil fuels and technologies. A major incentive for industry leadership will be the Kyoto Protocol mechanisms, once it is enforced, including the Clean Development

Mechanism (CDM). Through this, developing countries can rapidly advance their sustainable development objectives while reducing greenhouse gas emissions by stimulating 'technology leapfrogging' to the advanced fossil energy technologies and by generating new investments. Most of the projects related to energy access and sustainable development have been funded by international bodies such as GEF and UNDP, and organizations (German GTZ, Danish DANIDA,…) in developed countries and the European Union. Moreover, regional entities, mainly ESCWA and the Arab league, have facilitated the cooperation between regional countries. Regional governments have as well allocated some funds for projects related to sustainable development in the energy sector.

The New Partnership for Africa's Development (NEPAD) announced at WSSD, provides a framework for sustainable development on the continent. This initiative provides a good opportunity for Arab countries in Africa to get support for increasing energy access to rural poor area, particularly many of them under or just at the poverty limits.

On 28 October 2004, ESCWA signed a grant agreement with the OPEC (Organization for the Petroleum Exporting Countries) Fund for International Development under which the fund would extend US$100,000 to the Commission to pursue a project on "Dissemination of Renewable Energy Services to Rural Areas in ESCWA Member Countries". The project aims to integrate renewable energy resources into the life pattern of poor rural communities, thereby enhancing development opportunities and protecting the environment. The Fund grant will co-finance awareness campaigns, to support local authority efforts in widening access to affordable energy services among rural communities. This four-year project was initiated by ESCWA in 2002, in response to the WSSD anti-poverty and sustainable development Action Plan.

The OPEC Fund grant will also back activities to boost job creation in ESCWA member countries with investment from the private sector in manufacturing and marketing activities. These activities would provide better living conditions for rural women, help preserve the environment and public health and provide better education opportunities.

III- ENERGY ISSUES

The total population of the region in 2005 was estimated at 321 million [4], or 4.8 percent of the world population, and by 2015 the region's total population is projected to reach 395 million or 5.5 percent of the world population. In the last two decades, the Arab population grew at an average rate of 2.6 percent per annum, in comparison to 1.5 percent of the rest of the world. However, the rate of growth is declining and is expected to reach 2.1 percent and 1.9 percent by 2015 and 2025, respectively, still higher than the world average.

The Arab region has around 650 billion barrels of oil reserves, that constitutes around 57 percent of the world reserve. The region also has around 29 percent of the world's natural gas reserve. Recent statistics on energy production and consumption in the region are presented in Table 2.

Table 2: Energy production and consumption in 2003.

	Production			Consumption		
	Oil [10^3barrels/day]	Natural gas* [billion m^3]	Electricity [TWh]	Oil [10^3barrels/day]	Natural gas [billion m^3]	Electricity [TWh]
ESCWA	19466	203.67	444	3494.66	156.6	389
Arab Nations	22300	310.2	509	3989	169.2	441
World	76800	2618	15780	73267.5	2540.1	14521

* Only marketed natural gas

Source: Clean fossil fuels report

Electricity services in most of the Arab countries have been increasingly extended to new groups of consumers. However, the average electrification rate in the region is still 79 percent and goes as low as 7.7 percent in several countries. A high percentage of the rural and remote population are also suffering the lack of reliable liquid fuel supplies, some of the urban poor still lack access to sufficient affordable energy resources and services.

3.1. Energy Policies Integration

In recognition of the above and with current trends towards more economic and sustainable management of the energy sector, the Arab countries have revised their energy policies and included several policies targeting more sustainable management of the sector. In line with such policies varying degrees of progress have been achieved in most regional countries regarding the relevant key energy issues particularly on upgrading energy production and consumption efficiencies, the use of cleaner fuels, diversifying energy resources in oil- importing nations, promoting renewable energy and more importantly on electric grids and natural gas networks.

Currently, there is a clear political commitment towards developing a more sustainable energy sector, and enhancing the sector's contribution to the achievement of sustainable development in the region. This is clearly reflected by the Abu-Dhabi Declaration on Environment and Energy, which addresses the regional concerns, priorities and commitments of the Arab ministers of environment and ministers of energy towards the sector's links to sustainable development.

Many regional countries such as Egypt, UAE, Lebanon, have increased, or are in the process of increasing, the partnership with the private sector in energy- related sectors, mainly in power and in industry.

3.2. Energy Efficiency

Several Arab countries have adopted policies and programs for encouraging energy conservation and efficiency in various economic sectors, particularly the residential, industrial, transport and electric power sectors [1].

3.2.1. Improving Energy Efficiency in the Arab Countries

During recent years, the Arab countries have directed concerned efforts in improving energy efficiency and a number of major initiatives have been or are being implemented by different national organizations and institutes supported by regional and international organizations. The main results of such activities in some of these countries are as follows:

1. Energy audits performed in many public and private industrial facilities and residential areas in Egypt, Syria, Jordan, Tunisia, Lebanon and other Arab countries. The studies revealed that many opportunities exist to improve the efficiency of thermal and electrical energy in industrial facilities. The estimated potential achievable savings are about 13% of the total energy consumed in Egypt, and 40% of the energy bill in the industrial sector in Jordan and 22% of energy consumed by the industrial sector in Syria.

2. The adopted programs (200 audits in Egypt and 120 audits in Syria) for improvement and rationalization of energy efficiency have led to national capacity building and to the increase in expertise and awareness. For example, 7000 trainees from high administration, engineers, technicians, staff of energy service companies (ESCOs) were trained in Egypt, as well as training-the- trainers for the industrial sector. Also, the energy rationalization and planning programs lead to the developing of a database in this area.

3. The audits revealed the needs to improve the combustion efficiency, thermal insulation, waste heat recovery, combined heat and power generation, power factor improvement, use of high- efficiency motors, adopt energy efficiency standards for the domestic electrical appliances, and use of energy- efficient lighting in the industrial, commercial, and residential sectors.

4. Energy certificates and energy labeling are being adopted in a number of the regional countries like Egypt, Syria, Tunisia, Palestine, and some GCC countries.

5. Projects in most regional countries were implemented in the fields of combined heat and power generation (cogeneration), waste heat recovery, and improvement of combustion efficiency and power factor. Moreover, use of energy saving lighting was among the executed programs for rationalizing energy consumption and improving the efficiency of its usage.

6. Several codes of practice for efficient energy use in commercial and residential buildings and for energy appliances were issued. In Tunisia, a new set of regulations adopted in 2004 for efficient use of energy [11].

7. Awareness campaigns and capacity building in most of the above- mentioned countries.

These adopted measures have resulted in:

- Slight reduction in the growth rates of primary energy consumption to reach about 3.5 percent in year 2003 compared to 2.6 percent of world average.

- Energy intensities were reduced from 544 goe/US$ in 1999 to about 503 goe/US$ in 2003, but still much higher than the world average of 267 goe/US$. This indicates that there is a wide scope and opportunities for further increases in energy efficiencies in the region.
- The efficiency of electric power plants was improved leading to reduction in the specific fuel consumption from about 340g/kWh in 1992 to an average of around (200-230) g/kWh in year 2001.

3.2.2. Energy consumption indicators

The residential sector comes first in energy consumption representing around 55.5 percent of total electricity consumption and 17.9 percent of total consumption of petroleum products in the region. By contrast, the industrial sector consumes only 26 percent of generated electricity, but close to the same quantity of petroleum products as the residential sector by consuming 16.7 percent of regional consumption. However, the transport sector remains the largest consumer of petroleum products, representing 43 percent of total regional petroleum consumption..

The following energy consumption indicators are noted:

(1) The per- capita annual primary energy consumption rate recorded in 2003 in the region of 1197 kgoe is still lower than the world average of 1523. At the national level this average varied between as low as 27, 82, 190 kgoe per capita in Somalia, Sudan and Yemen to as high as 17336, 14097, 9651 kgoe per capita in Qatar, Kuwait and U.A.E. Moreover, the increase in this index has increased merely by 2.48 percent between 1999 and 2003, compared to a world increase of 3.68 percent.

(2) The average electricity consumption rate reached has witnessed a percentage increase of 11.69 percent between 1999 and 2003, higher than the world recorded increase of 4.85 percent over the same period. This may reflect better energy access, with different levels in various regional countries.

(3) The primary energy intensity reached 503 goe/$, compared to the world average of 267 goe/$. Although the energy intensity has dropped by around 7.5% in the region, it still reflects the low- efficient use of energy, and hence the low economic return on consumed energy in the region. Moreover the recorded drop is still lower than the world average of 17.59 percent.

(4) The reliance on hydropower has dropped by around 4.94 percent between 1999 and 2003, while the world average has remained almost unchanged over the same period.

The Arab energy sector has adverse environmental impacts on air, water and land resources. CO_2 emissions from the energy use is estimated at about around 900 million tons, with an average per capita share of 3.1 t/year, compared to a world average, of 3.87 t/year. However, although the regional average is low but it is due to the highly diversified situation in the region.

3.2.3. Capacity Building on Energy Conservation

Within the framework of the Regional Promotional Mechanism for Sustainable Energy Systems, ESCWA organized a training workshop on energy efficiency and conservation in the Arab countries. The workshop was organized in Cairo in collaboration with the New and Renewable Energy Authority (NREA) of Egypt and with joint funding with UNESCO Cairo Office from 27 March – 1 April 2004.

The workshop was aimed at training participants on the current technologies and methods for energy conservation in the different economic sectors (industry, building, tourism and electricity) to achieve a more

sustainable energy sector in the region. Participants that attended the workshop represented concerned authorities such as ministries of energy, electricity and petroleum companies, industries and research centers and universities.

3.3. The Electric Power Sector

3.3.1. Consumption Figures

The total installed capacities in the Arab region in 2003 reached 115,688 MW, with an increase of around 19803 MW compared to 1999. This generation capacity is dominated by thermal power stations counting for more than 92 percent. The highest installed electric power capacities are in Saudi Arabia (23,230 MW), Egypt (15,286 MW), Kuwait (9,298 MW), and the UAE (8,611 MW). An added value of the electric power sector in the region is its reasonably strong industrial base for electric transformers, cables, switch-boards, etc., which in addition to the contracting companies in the sector, create reasonable job opportunities and contributes to the GDP of several countries in the region.

The region has a growth rate of electricity consumption of around 5.99 percent between 1999 and 2003. The per- capita electricity consumption varies very significantly amongst regional countries. It reaches around 18034 kWh/capita in Qatar, whereas it drops to around 137 kWh/capita in Yemen.

Energy policies, in most of the Arab countries, during the last three decades were directed mainly towards satisfying the electricity needs of the development programs and upgrading the sector's infrastructure and capabilities. However, the management of the sector has not been always based on economic principles, given the highly susbsidized nature of energy prices in most parts of the region. This has led to economic losses, accelerated demand growth rates, and an increase in the need for tremendous investments. In addition to the low energy use efficiencies, environmental impacts, and very limited energy access to many rural areas in the region.

Therefore, in recognition of the above and with current trends towards more economic and sustainable management of the sector, countries in the region have revised their energy policies and included one or several of the following sector sustainability policies:

- To increase energy access for all communities mainly in rural and remote areas (Egypt, Jordan, Palestine, Syria, Algeria, Morocco, Yemen)
- To review existing tariffs so as to support the economic management of the sector while maintaining energy subsidies for the poor (Egypt, Lebanon, Saudi Arabia)
- To enhance investments in oil and gas exploration and production activities, using cleaner technologies, and to adopt measures for reducing the sector's environmental impacts. (all Arab oil and gas exporting countries)
- To study and implement intra-regional electric grid interconnections and natural gas networks projects, to enhance the efficiency and increase revenues of the available resources. (GCC, Egypt, Jordan, Lebanon, Palestine, Syria, Iraq, Tunisia, Algeria, Morocco)
- To encourage private sector participation in the establishment and management of energy facilities, including power plants and distribution networks. (all countries)
- To upgrade generation efficiencies using combined cycles systems, CHP, and through deployment of large units with increased efficiencies. (GCC, Syria, Egypt, Lebanon)
- To adopt measures and programs for upgrading the energy production and consumption efficiencies, particularly in energy intensive industries, transport, and power [2,5]. (Egypt, GCC, Lebanon, Syria)

- To increase the use of cleaner fuels, particularly the use of natural gas, in the electric power and transport sectors. (all countries)
- To consider developing renewable energy technologies and promoting its application, as appropriate. (Egypt, Jordan, Syria, Yemen)

3.3.2. Regional Initiatives and Achievements

Numerous cooperation and integration projects exist between Arab countries in the sphere of energy, including joint projects to link electricity networks, projects to establish oil and natural gas pipelines and networks. There are also numerous bilateral cooperation agreements in fields related to the production of energy equipment, renewable energy utilization, and rationalization of energy consumption.

i. Electrical Grid Interconnections

Electrical grid interconnection projects between the Arab countries have made considerable progress in recent years. Several phases of the project for electrical grid connections have been implemented between the countries of the six party grid projects, namely Egypt, Jordan, Syria, Lebanon, Iraq and Turkey. Broad steps have been taken to study and initiate the implementation of a project to connect the electrical grids of Gulf countries. The Arab Maghreb countries are already connected since 1997, the connection between Egypt and Libya has been completed and is currently operating. The connection between Libyan and Tunisia has been completed and is close to being operational, by which the connection between Arab Mashreq and the Arab Maghreb will be made.
Electrical grid projects bring considerable technical, economic and environmental benefits of which the following are the most important:

a) Making possible the exchange of electrical energy supplies.
b) Strategic provision of electrical power reserves serving these countries.
c) Reduction of the reserve circuit of each participating country, which contributes to reducing the total required installed capacities of electrical systems, as well as operating and maintenance costs.
d) Making possible the construction of high capacity efficient generating units at a lower capital cost.
e) Reduction of the amount of fuel used and environmentally polluting emissions.

ii. Natural Gas Projects

There are several natural gas pipeline projects under implementation or consideration among the Arab countries. These are:

1. Regional gas network, between Egypt, Jordan, Lebanon and Syria, with future expansion to include Cyprus, Turkey and eventually Europe. The project has a nominal transport capacity of ten billion cubic meters of gas annually. The first phase of the pipeline was officially inaugurated in July 2003, by transporting one billion cubic meters annually to Jordan, to be increased progressively to 2 billion cubic meters in 2008.
2. Dolphin Project (between Qatar & UAE), an underwater pipeline, with a maximum daily capacity of 2.9 billion cubic feet is being constructed. Qatari gas is expected to flow into UAE starting 2005.
3. Between Qatar and Kuwait, an underwater pipeline is under construction to transport gas with a capacity of 1 billion cubic feet per day.

4. Between Qatar and Bahrain, to provide Bahrain with 500 million cubic feet of Qatari gas per day.
5. Between Oman and UAE, signed in July 2002, and accordingly Oman will provide gas to the Emirate of Fujairah in 2003 at a capacity of 120 million cubic feet per day.
6. Egyptian / Libyan agreement, signed in August 2001 for the establishment of a twin pipeline. One pipeline transports gas from Egypt to Libyan sites while the other transports crude oil to the northern Egyptian oil refineries.
7. Between Algeria and Europe via a network of gas pipelines that pass through Tunisia and Morocco.

3.4. Renewable Energy

The Arab region enjoys tremendous renewable energy resources with 8967 MW of installed hydro- electric capacity and solar resources varying between 1700 and 2800 kWh/m^2/year. Wind resources are available in several Arab countries mainly at the Gulf of Suez in Egypt at average speed of (8-11) m/sec, Jordan (5-7 m/sec), and in sufficient speeds in Syria, Morocco and Mauritania. In addition, large potentials of oil shale are proven in Jordan, Syria, Morocco and Palestine. Biomass contribution as an energy resource is limited to around 5%.

Apart from solar water heaters applications in the domestic sector limited progress has been achieved in promoting the use of renewable energy technologies in the Arab countries. However, some countries have achieved reasonable success and built capacities in the field such as Egypt (145MW), Tunis (160 MW), Morocco (100 MW), and Jordan. In addition, Egypt and Morocco have taken serious steps for building, combined cycle solar thermal power plants, (of about 150 MW each). However, to promote renewable energy applications, there is a need to raise awareness on the application potentials of its different technologies and to include it as an integral part of the national energy planning.

Adopted Measures

1. Increasing the installed generation capacity of hydropower (Egypt, Jordan, Lebanon, Syria)
2. New wind farms installed, and wind atlases being developed or updated (Egypt, Jordan, Morocco, Saudi Arabia, Syria, Tunisia, UAE).
3. Solar power deployment in desalination plants (Saudi Arabia).
4. Research and development and pilot projects (Jordan, Saudi Arabia, Syria).
5. Further consolidation and continuation of the Renewable Energy Promotion Mechanism (REPM) initiated in 1999 in the ESCWA region [6].
6. Solar water heating projects (Egypt, Jordan, Lebanon, Morocco, Palestine, Saudi Arabia, Tunisia, Yemen).
7. Solar thermal power plants (31MW in Egypt).
8. PV cells deployment, mainly in rural areas (Egypt, Jordan, Oman, Morocco, Saudi Arabia, Sudan, Syria).
9. Limited biomass applications (Egypt, Jordan, Lebanon, Palestine, Syria, Yemen).

The renewable energy applications in the region in 2001 were saving about 1.0 million toe/year of fossil fuels (20,000 barrel/day). In Egypt alone, the saving is estimated to reach 490000 toe/year in 2007, and 2.4 million toe/year in 2017.

3.5. Advanced Fossil Fuel Systems

The Arab countries can be classified into three groups: The first one consisting of countries where considerable efforts have been made to improve fuel quality in order to match international norms (GCC states), another group where fuel enhancements are in process, (Egypt, Jordan, Lebanon, Syria, Tunisia), and

a group where clear plans are yet to be adopted, mostly due to internal situations (Palestine, Yemen, Mauritania, Iraq).

Current fuel specifications, in the regional countries, related to sulphur and lead concentrations are in considerable deviation with international norms. The sulphur content in diesel in many member countries still exceeds 5000 ppm, compared to 500 ppm in the USA in 1993 and in Europe in 1996, and 15 ppm in some EU countries and Japan. Also, the sulfur content in gasoline in many member countries exceeds 160 ppm, where the international norm recommends 40 ppm. Moreover, fuel specifications among member countries are not unified, each country has its own specifications and standards, the Gulf countries have started unifying their norms.

The share of unleaded gasoline has been increasing in the world market from 43 percent in 1990, to 60 percent in 2000, and reached about 85 percent in 2003. The cost of lead elimination depends on the refining technologies. It is estimated [2] that the lead elimination cost in ESCWA member countries is around 197 million US$ with a pay back period of less than one year.

On the other hand, the cost of sulfur reduction to 3000 ppm in transport diesel in ESCWA member countries is estimated at around 83.5 million US$, 151 million US$ for 1000 ppm, 175 US$ for 500 ppm, and 475 million US$ for 50 ppm, and the cost of sulfur reduction from 350 ppm to 30 ppm in gasoline is around 226.7 million US$

3.5.1. Measures Adopted for Improving Fuel Quality

Fossil fuels will remain the main energy resource for the region as well as for the world for a long time through the 21st century. Efforts are therefore, focused on improving the quality of these fuels so as to increase the combustion efficiency, and reduce their effluents into the atmosphere.

Measures adopted in the region to improve fuel qualities include:

1. Upgrading the technologies of oil refineries, where increasing the capacity of treatment and conversion processes is an indicator of potential of a refinery to produce high quality fuels. (GCC, Jordan, Algeria, Syria). In the Arab countries, this capacity ranges between 95 percent of the total refined crude oil in Kuwait and 10.2 percent in Yemen, with an average of 64 percent in region.

2. New adopted standards for fuels and fuel additives (Egypt, GCC, Jordan, Lebanon, Morocco, Syria).

3. Switching to natural gas, in stationary combustion systems is more feasible compared to motor vehicles. In Egypt, there is a project to transform more than 40 bakeries to use natural gas instead of traditional fuels. In the transport sector, over 60,000 vehicles were switched from regular fuel to natural gas. In GCC natural gas currently covers around 70% of the market demand.[13].

4. Adopting vehicles inspection and maintenance programs and upgrading the status of the fleet through financial incentives (Bahrain, Egypt, Jordan, Morocco, Lebanon, Saudi Arabia). In Egypt, for example, according to a program implemented on 13 thousands vehicles, the fuel saving reached up to 15 percent.

5. Improving gasoline specifications/shifting to unleaded fuel. Fuel savings as a result of improving gasoline specifications in the transport sector in the region are estimated to be 2.3 million ton/year, which is equivalent to 6.7% of total gasoline consumption in transport. Saving in diesel due to improving its specifications is estimated to be 2.4 million ton/year, which is equivalent to 14.4% of total diesel consumption in transport [2]. Fuel savings in the industrial sector in Jordan, Syria, Lebanon, and Egypt due to improving diesel and fuel oil specifications are estimated to be 0.749 million toe/year, and the savings in the electric power sector in Jordan, Lebanon, and Egypt are

about 0.266 million toe/year. Expected net savings in vehicle maintenance cost for using unleaded gasoline in Syria, Iraq, Egypt and Yemen are around 207 million US$/year.

Using cleaner fossil fuel reduces emissions directly by improving fuel specifications and fuel saving, and indirectly due to enhancing catalytic converter efficiency. For gasoline used in the transport sector, the reduction in CO_2, NO_x, CO, PM, and HC emissions are expected to be about 6.8%, 17.2%, 39,2%, 35%, and 22.7%, respectively. For diesel, the reduction of CO_2, NO_x, CO, PM, HC, and VOC can reach 14.7%, 16%, 54%, 42.3%, 56.5% and 38.7%, respectively. The Egyptian experience indicated that using natural gas in diesel vehicles reduces maintenance by 35%, and that savings in fuel cost due to conversion from diesel and fuel oil to natural gas are around 71.6% and 5.1%, respectively, with pay back periods of 0.31 and 3.19 years, respectively.

3.5.2. Barriers Facing Production and Utilization of Cleaner Fossil Fuels

Barriers facing the production and utilization of cleaner fossil fuels include, amongst others, lack of investments required for implementing cleaner fuel projects; difficulties in upgrading existing oil refineries; lack or shortage in regulations & legislations and difficulty in law enforcement; lack or shortage in local technologies and expertise related to cleaner fossil fuels; weak coordination between stakeholders, age of the fleet, and lack or shortage in awareness programs related to cleaner fuels and their importance in environment protection.

3.6. The Transport Sector

The share of transport in the Arab regions in primary energy consumption has recorded a level of around 26.3 percent by the end of 2003. This sector is also the main cause of air quality degradation in major Arab cities and urbanized areas. A wide scope of plans and measures to solve transportation problems has been adopted in many regional countries. The main objectives of these plans are to reduce traffic jams in major cities, reduce air and noise pollution, save energy, and cut on trip duration inside these cities. Most major cities have witnessed large- scale projects for developing modern transport infrastructure such as highways, new circular roads, bridges, tunnels, computerized traffic control, etc…

3.6.1. Trends and Achievements

In Egypt, many projects have been conducted in the transportation sector including: (1) The Metro: which is one of the biggest projects concerning mass transportation that helps in solving the transportation problems in Cairo, (2) the instating of I&M programs and (3) Switch to compressed natural gas in vehicles, a national policy was developed with a pilot program in Cairo; More than 60,000 of such vehicles (mainly buses) are already in use with over 70 gas fuelling stations. Egypt currently ranks six in the world in natural gas usage in transport. Pilot projects to use fuel cells for buses are also under consideration in some countries of the region.

In Jordan, the government has taken a number of measures aimed at technically upgrading the fleet and promoting public transport. A leading project has been implemented in the city of Irbid by the National Center for Energy Studies where maps for public transport have been issued illustrating the schedules of different bus routes to encourage citizens to use it instead of using their own cars. Measures have also been taken to promote the use of unleaded fuel and catalytic converters.

In the Syrian Arab Republic, many technical and economic studies have been prepared to implement an experimental project in Damascus where 5000 taxi cars were modified to run on natural gas instead of liquefied fuel. The project also includes importing 400 buses for internal transport operating on compressed natural gas (CNG). Many gas stations will be built in the suburbs of Damascus in addition to establishing technical workshops to prepare engines of small cars to work on gas.

In Tunisia, a major urbanized transport project has been initiated in 2004 for the capital city as well as for other populated areas. I&M programs have been adopted to reduce consumption.

In Lebanon, the government banned, starting 2003, the use of diesel and leaded fuel in most public transport cars and vans. The financial incentive has led to a rapid shift to unleaded fuel where the percentage of drivers using unleaded has increased, within 3 months, from 22 percent up to 80 percent. The I&M program has been re- instated in 2004 as a measure to upgrade and modernize the fleet. The upgrading of diesel specifications is currently discussed, and a wide- scale project for traffic management in Greater Beirut area is being finalized.

In Morocco, an air quality national monitoring network has been established in Casablanca, and other major cities. Low- octane leaded fuel has been banned in 2005 [12], and measures have also been taken to upgrade the fleet and promote the use of small economic vehicles for personal travel. Also, an I&M program has been adopted.

In Yemen, a major urban transport management plan for the capital city of Sanaa is underway.

In most GCC countries, I&M programs have been adopted to control the emissions and maintain a good technical status for the transport sector.

3.6.2. Overarching issues

In addition the activities and projects that lead to the above-described achievements have also resulted on several other valuable achievements on the different overarching issues, relevant to energy for SD, particularly on institutional and capacity-building, raising awareness, information sharing and technology transfer in the field. These include but not limited to:

1. Building specialized national bodies of expertise in the sustainable energy planning and systems.
2. Developing different databases of information on potentials and performance of the field experiences gained.
3. Raising public awareness on the importance of appropriate energy consumption and production for sustainable development, as well as on sustainable energy technologies.
4. Some, but not remarkable, technology transfer activities have been undertaken.

IV- Regional Initiatives and Activities on Energy for SD

A partnership on energy for SD is already established by the Council of Arab Ministers Responsible for the Environment (CAMRE), and in close cooperation with concerned regional organizations, including OAPEC, UNEP and ESCWA. These organizations have initiated activities and achieved progress in fields related to energy and sustainable development. Examples are:

4.1. The Abu Dhabi Declaration on Environment and Energy 2001

The Abu Dhabi Declaration on Environment and Energy “2001” issued by CAMRE recognised the rapid development of the Arab region in terms of human health, education, socio-economic standards and the environment. It also recognised the importance of ensuring that this development is sustained through a number of measures such as achieving optimum linkage between development imperatives, eradicating poverty and protecting the environment. It emphasised the importance of the rational use of resources and the adoption of Cleaner Production strategies. The Declaration called on the Arab countries to become active partners in the efforts to develop advanced technologies related to improving the state of the environment. This includes use of natural resources, use of renewable resources and reduction in pollution during production, use and disposal.

4.2. Energy and the Arab Initiative for Sustainable Development

The Arab Initiative for Sustainable Development was a key outcome of the preparatory process for WSSD in the region, which was developed by regional experts through coordination by CAMRE, ESCWA and UNEP. The initiative aims at addressing the challenges faced by Arab countries in achieving sustainable development. The initiative emphasizes the importance of the transfer and adaptation of appropriate technologies in the region and the development of capacities to meet the challenges faced. It supports the promotion of mechanisms for cleaner and safer production and technologies for the cleaner and more efficient utilization of oil and natural gas, as well as the development of carbon sinks through reforestation.

Other energy-related issues emphasized in the Initiative include:

- Support the efforts of Arab countries to cope with the deterioration of the quality of the air in many Arab cities, including urban planning strategies, the specification of land use areas, programs of control of air emissions and the establishment of regional and sub regional systems and networks for sustainable transport.
- Support the efforts of Arab countries to achieve sound management of chemicals, with special emphasis on hazardous chemicals and waste
- Support Arab capabilities to implement the Multilateral Environmental Agreements and their mechanisms, including technical and financial assistance from the international community.
- Call upon industrial countries to implement their obligations under international environmental agreements through the abolition of all forms of subsidies to the energy sector in their countries, particularly those directed to nuclear energy and coal and the tax bias against petroleum products.
- Promote the concept of sustainable production and consumption in the Arab region and encouraging the use of products that contribute to the protection of the natural resources.

4.3. The Abu-Dhabi Declaration on Environment and Energy 2003

Directly after WSSD, the joint Arab secretariat on Sustainable Development joined hands with the concerned authorities in the UAE to stimulate political commitment and formulate a framework for following up on WSSD plan of implementation, regarding energy issues. The Abu Dhabi Declaration on Environment and Energy '2003' is a major result of such cooperation.

Consequently, CAMRE in its 30th meeting in Beirut, dated 4 June 2003, has decided to establish a taskforce from its technical secretariat, LAS, ESCWA, UNEP and OAPEC, to formulate a document on Energy for SD, a framework for action in the Arab countries, on the basis of concerns and measures expressed in Abu-Dhabi Declaration on Environment and Energy 2003. This document, as formulated by the taskforce, has focused on issues identified by global conferences, particularly Agenda 21, CSD-9 recommendations and JPOI. Meanwhile, the document takes into consideration individual conditions of the Arab countries regarding, the state of development, poverty levels, available resources, the main features of the Arab energy sector and the current progress towards achieving the objectives of energy for SD.

4.4. The ESCWA RPMSES

The ESCWA Regional Promotional Mechanism for Sustainable Energy Systems "RPMSES", was established in October 2000, as to complete the objectives of the ESCWA REPM established in October 2000. The achievements of the mechanism include (1) publishing the Regional Renewable Energy Profile that provides quantitative and qualitative information on available resources, programs and potentials for renewable energy in member countries; (2) implementing a regional program on building national capacities in the field of renewable energy and energy systems; and (3) initiating a regional project on Disseminating Renewable Energy Applications for Poverty Alleviation.

In October 2002, following the WSSD, member countries agreed to extend the mandate of the mechanism to cover the five key sustainable energy issues that were identified by the Commission of Sustainable Development and rename the mechanism to be the Regional Promotional Mechanism for Sustainable Energy Systems (RPMSES). Therefore, the mechanism became the first of its kind in the Arab region that is concerned with regional cooperation in the field of energy and sustainable development. The Mechanism activities in capacity building on renewable energy and energy efficiency include:

- Wind Energy Capacity Building Training Program: Potentials and prospects of wind energy use and project evaluation,. Cairo, 8 - 20 September 2001.
- Training Workshop on Wind Energy Assessment and Capacity Building, Cairo, 29 June - 4 July 2002.
- Capacity Building Workshop on Solar Electricity, Aleppo – Syria, 11-16 October 2003.
- Capacity Building Workshop on Sectoral Energy Efficiency and Conservation, Cairo, 27 March –1 April 2004.

4.5. Environmental Resolutions

During the last years, many rules, legislations and resolutions in many Arab countries were issued related to the conservation of the environment, either wild or marine, some of them where the importance of completion the studies of the environmental impact of the different projects including energy projects. The latest issued resolution in that manner is of the high council of the GCC in its 25th cycle (Manama, 20-21 December 2004), which concluded the approval of the unified environmental measures and standards related to noise, air quality and wastewater.

4.6. Regional Studies on Energy for Sustainable Development

- Energy for sustainable development in the ESCWA region, 2003.
- Update of the study of the current situation in selected energy sectors in ESCWA countries: The natural gas and electricity sectors, 2003.
- A guide to efficient energy management in the tourism sector, 2004.
- Improving energy efficiency and usage of cleaner fossil fuels in selected sectors in ESCWA member countries, Part II, Cleaner fossil fuels, April 2005.
- Improving energy efficiency and usage of cleaner fossil fuels in selected sectors in ESCWA member countries, Part I, Energy conservation in energy- intensive industries in the ESCWA region, in press.

4.7. Regional Training and Information Exchange on Energy for Sustainable Development

- Expert group meeting on simulating awareness and participation in formulating policies and systems for sustainable development, Abu Dhabi, Feb.2003.
- Expert group meeting on energy sectoral production and consumption statistics and related issues, and workshop on energy statistics with focus on petroleum statistics in the ESCWA region, Beirut, July 2003, in collaboration with UNSD, OPEC.
- Training seminar for national capacity building in the field on solar energy, Aleppo, October 2003, in collaboration with UNESCO Cairo Office,
- The third periodic meeting of the national focal points of the regional mechanism for the development of sustainable energy, Aleppo, Oct.2003.
- Seminar on clean fuels and vehicles, Beirut, March 2004.
- The capacity building on sectoral energy efficiency and conservation, Cairo, March 2004.
- The regional workshop on national sustainable development strategies and indicators of sustainable development for the Arab region, Cairo, Dec.2004.

V- Challenges and Opportunities

5.1. The challenges

Several challenges are still facing the Arab energy sector in formulating and adopting energy policies that might contribute in achieving sustainable development. These challenges are:

1. Rapid population growth and high population density that put further pressure on the environment. The need to respond to the rapidly increased demand on energy, due to the rapid population growth, and the need to increase energy supplies to cover the 21.4 percent of the current populations who do not have access to electricity.
2. The need for further integrating the sustainable energy strategies, plans and objectives within the national development strategies, policies and plans.
3. The need to further develop an economic management of the energy sector, and to replace the heavy subsidies that have led to economic losses and limited rural development opportunities.
4. Authorities overlap and insufficient coordination mechanism.
5. The need for enhancing energy in rural and remote areas, as a tool for poverty alleviation, and economic and social development.
6. Data deficiency and absence of permanent monitoring networks in most regional countries.
7. Technology innovation leading to the development, adoption and adaptation of clean and affordable energy technologies is not happening fast enough to meet the growing demand in the region.
8. To translate the idea of partnership building (between players with potentially conflicting interests) from global or regional-level discussions and advocacy campaigns into local actions. Regional and intergovernmental bodies can have a key role in promoting the processes and activities for energy for SD.
9. The need for strengthening links and promoting regional and international cooperation.
10. The need for mobilizing funds for capacity building and technology transfer required for making energy for sustainable development systems affordable to end-users, while significant investments are needed to meet increasing energy demand.

5.2. The opportunities

In spite of the remarkable challenges that face the targeted objectives in the area of energy for SD, there are some opportunities that can support the realization of these objectives in moving towards more sustainable energy sector in the Arab region. These include:

5.2.1. The supportive global environment

The outcomes of WSSD, the JPOI, and the CSD have created a supportive global environment for the development of sustainable energy systems. Such environment include:

a. The WSSD focus on poverty eradication and the development of sustainable energy patterns, which will prioritize sustainable energy needs and poverty alleviation at all national, regional and international agendas.
b. JPOI and CSD in its follow-up on implementation have called on developed countries and funding agencies to support developing countries in their efforts in the areas of R&D, technology transfer, and capacity building on energy for SD, as well as to allocate funds for such activities. This represents an opportunity for Arab countries to formulate project proposals and request both financial and technical support from DC's, UN agencies and funding agencies, on the basis of the above two main considerations.

c. Available international mechanisms for supporting technology transfer and capacity building in the field, which can be utilized by Arab countries, such as CDM, GEF, ODA and the New Partnership for Africa's Development (NEPAD).

5.2.2. Available national expertise and regional cooperation mechanisms

a. The efforts devoted by the Arab countries during the last two decades to develop and promote the energy sector sustainability although have not been sufficient, but it created massive human expertise and local capabilities in relevant fields. These expertise and capabilities can be a motive power to support energy sector efforts for achieving sector sustainability.
b. The available regional and sub-regional mechanisms, in relevant areas, can join forces for enhancing regional cooperation in the field. Also a new network of relevant institutions can be established and build on the existing ones.

5.2.3. Regional integration, energy programs

The Arab region has developed several regional energy projects on electricity grid interconnection, gas networking, discussed earlier. This will have a positive role in achieving energy sector sustainability.

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