UNITED NATIONS
Economic and Social Commission for Western Asia

UN-ESCWA

# Renewable Energy and Energy Efficiency Technologies

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**Expert Group Meeting on: «Promotion of South-South Cooperation in Technology Transfer »**
**Amman – Jordan, 20 – 21 April 2011**



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UN-ESCWA

- Overview of the energy sector in the ESCWA Region
- RE and EE Objectives
- Renewable Energy Technologies
- Energy Efficiency Technologies
- Challenges
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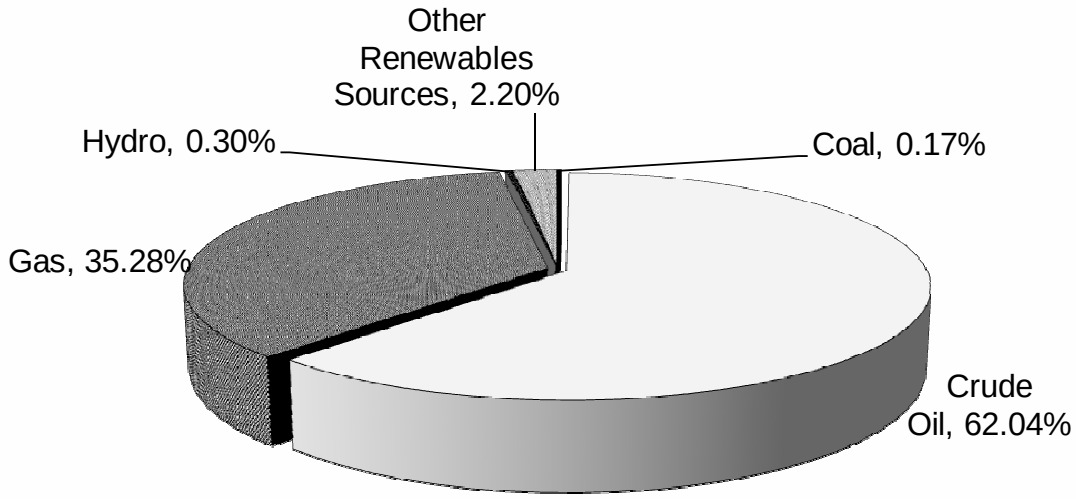
# Overview of the energy sector in the ESCWA Region

- Oil and gas sector: the largest economic sector is the Region.
- Proved reserves: oil 53% and NG 27% of the world reserves.
- Energy access: more than 20% of the population do not have access to energy services, especially in the electricity sector: (Sudan: 70% and Yemen 53%).
- Electricity consumption per capita: ranges from 144 Kwh/capita in Sudan and 202 Kwh/capita in Yemen to 13,142 Kwh/capita in Kuwait in 2008.
- The electric power sector: dominated by thermal power generation (more than 95%).
- Large subsidies exist on the energy prices



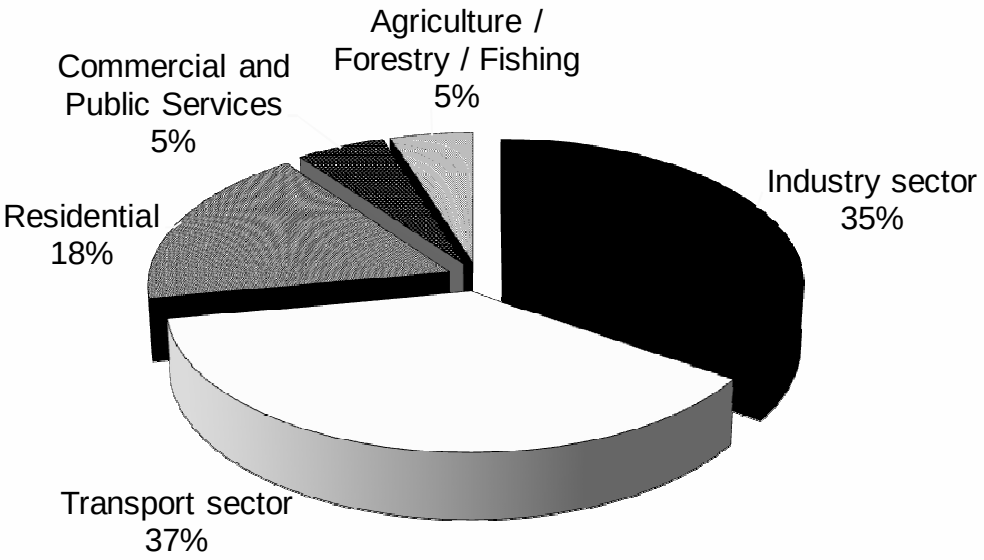
# Total Primary Energy Supply (TPES) in the ESCWA Region






Source: ESCWA, Calculated based on IEA data 2010

# Total Energy Final Consumption by Sector in the ESCWA Region






Source: ESCWA, Calculated based on IEA data 2010

# RE and EE Objectives

- Long term sustainability
- Security of supply
- Remote energy supply
- Fuel imports decrease for energy importing countries (Lebanon – Jordan – Palestine –….).
- Fuel exports increase for oil & gas producing countries (GCC …).
- Energy invoice reduction
- Subsidies reduction in energy products
- Climate change mitigation

# CO2 Emissions From Fuel Combustion

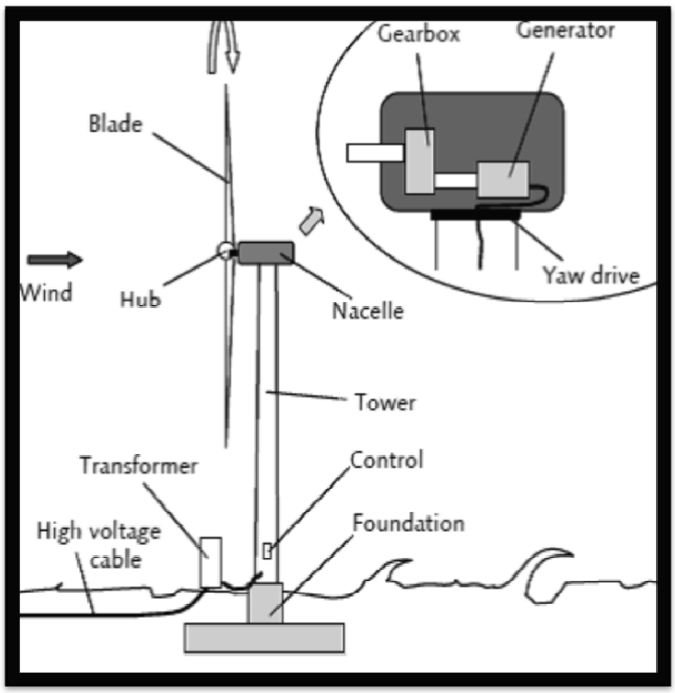
| Country | Total Emissions from Fuel Combustion MtCO2 | % of World Total | Electricity & Heat Production MtCO2 |
|---|---|---|---|
| Saudi Arabia | 389.2 | 1.32% | 154.0 |
| Egypt | 174.0 | 0.59% | 60.2 |
| United Arab Emirates | 146.9 | 0.50% | 72.6 |
| Iraq | 97.4 | 0.33% | 29.9 |
| Algeria | 88.1 | 0.30% | 24.0 |
| Kuwait | 69.5 | 0.24% | 31.8 |
| Syria | 54.4 | 0.19% | 25.1 |
| Qatar | 53.9 | 0.18% | 11.5 |
| Libya | 44.8 | 0.15% | 25.4 |
| Morocco | 42.1 | 0.14% | 14.9 |
| Oman | 34.9 | 0.12% | 13.5 |
| Bahrain | 22.3 | 0.08% | 7.8 |
| Yemen | 21.9 | 0.07% | 4.2 |
| Tunisia | 20.7 | 0.07% | 8.0 |
| Jordan | 18.4 | 0.06% | 8.2 |
| Lebanon | 15.2 | 0.05% | 7.5 |
| Sudan | 12.1 | 0.04% | 2.8 |
| **Total** | **1 306.0** | **4.44%** | **501.3** |

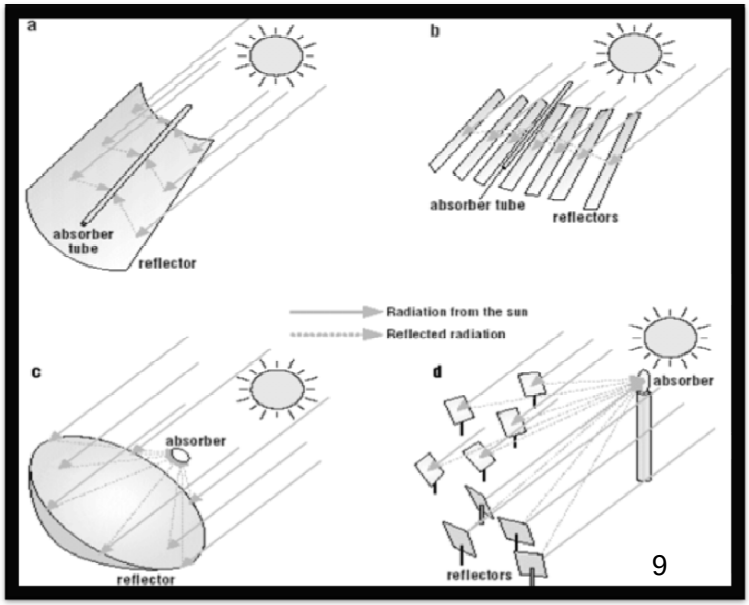
Source: IEA

# Renewable Energy Technologies

- Hydro Energy
- Wind Energy
- Solar Energy
  - Concentrated Solar Power (CSP)
  - Photovoltaic (PV)
- Other Renewable Energy
  - Geothermal
  - Biomass (including biofuel, energy from waste)

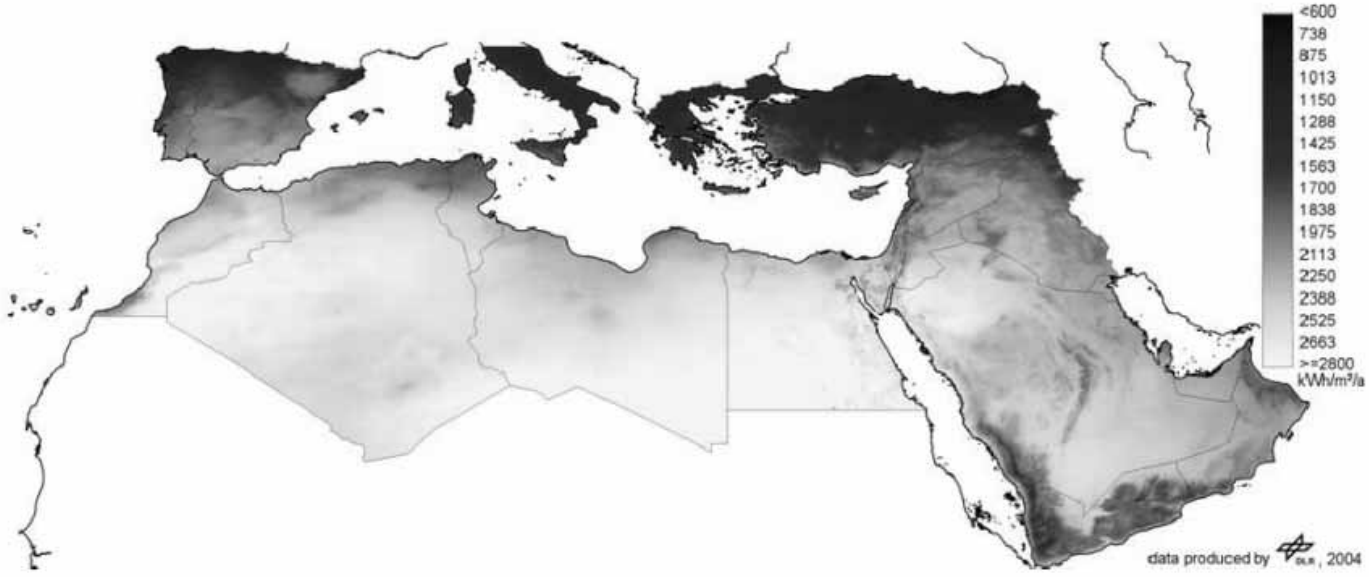
# Renewable Energy Technologies





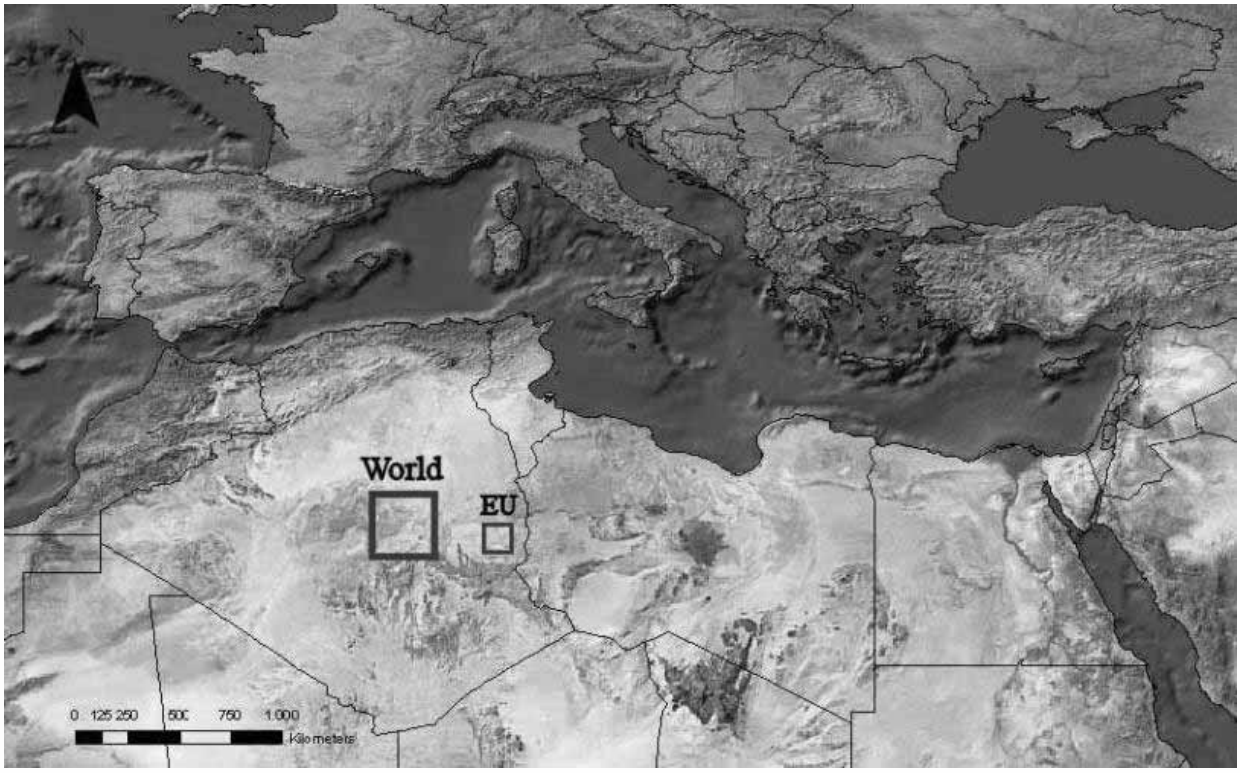

# Solar Energy Potentials: Direct Normal Irradiance






Source: "Concentrating Solar Power for the Mediterranean Region",
DLR for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany (2005)

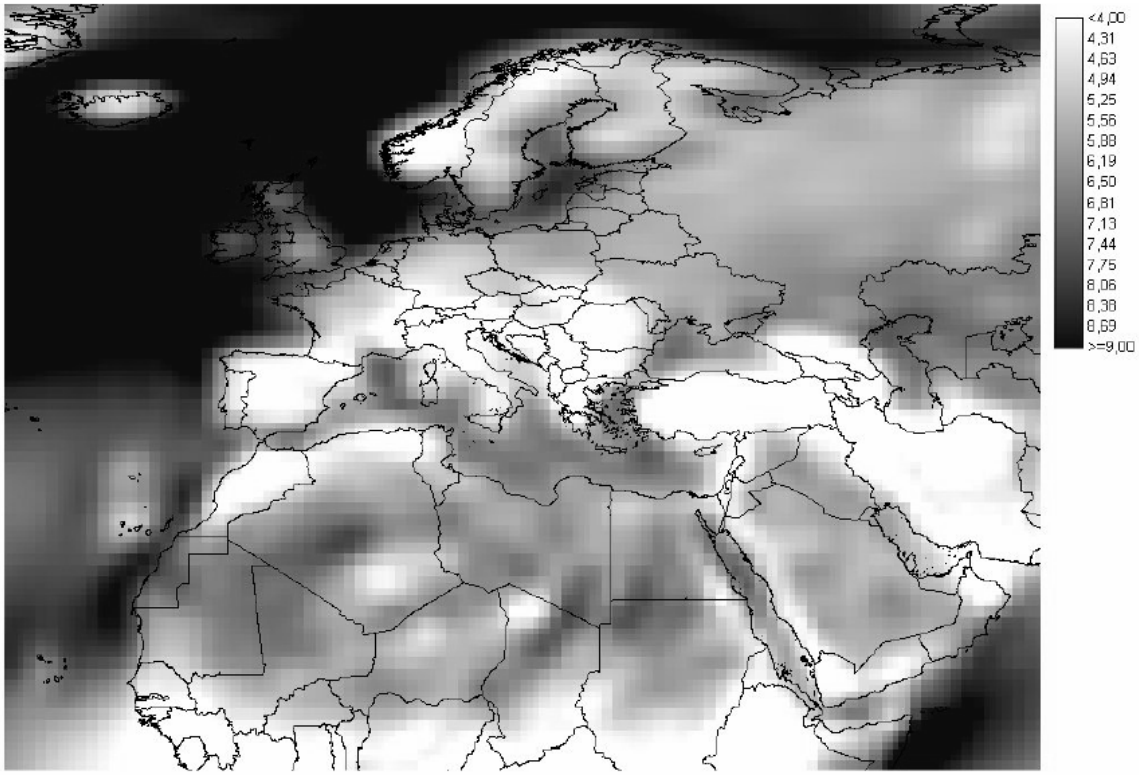
# Solar Energy Potentials






source: http://www.trec-uk.org.uk/press/brussels/prince_hassan_presentation.html

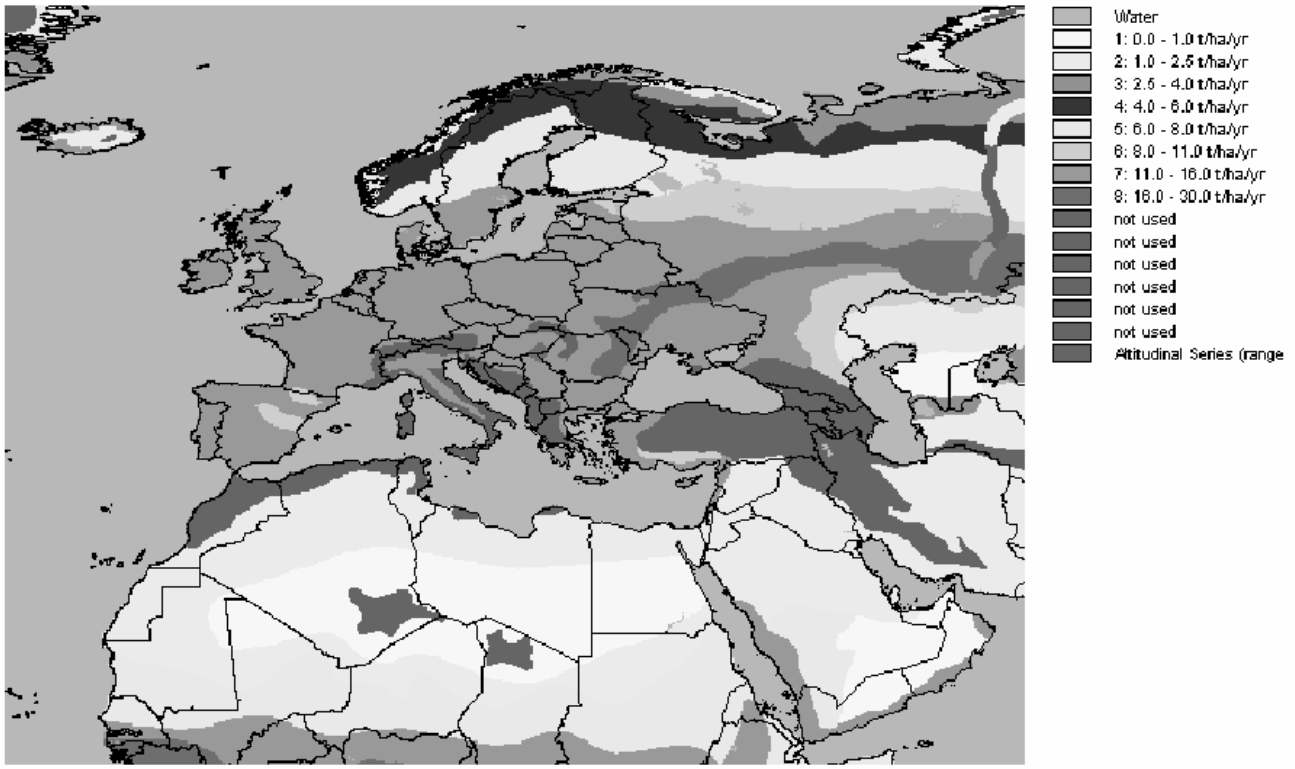
# Wind Energy Potentials: Annual Average Wind Speed






Source: "Concentrating Solar Power for the Mediterranean Region",
DLR for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany (2005)

# Biomass Productivity






Source: "Concentrating Solar Power for the Mediterranean Region",
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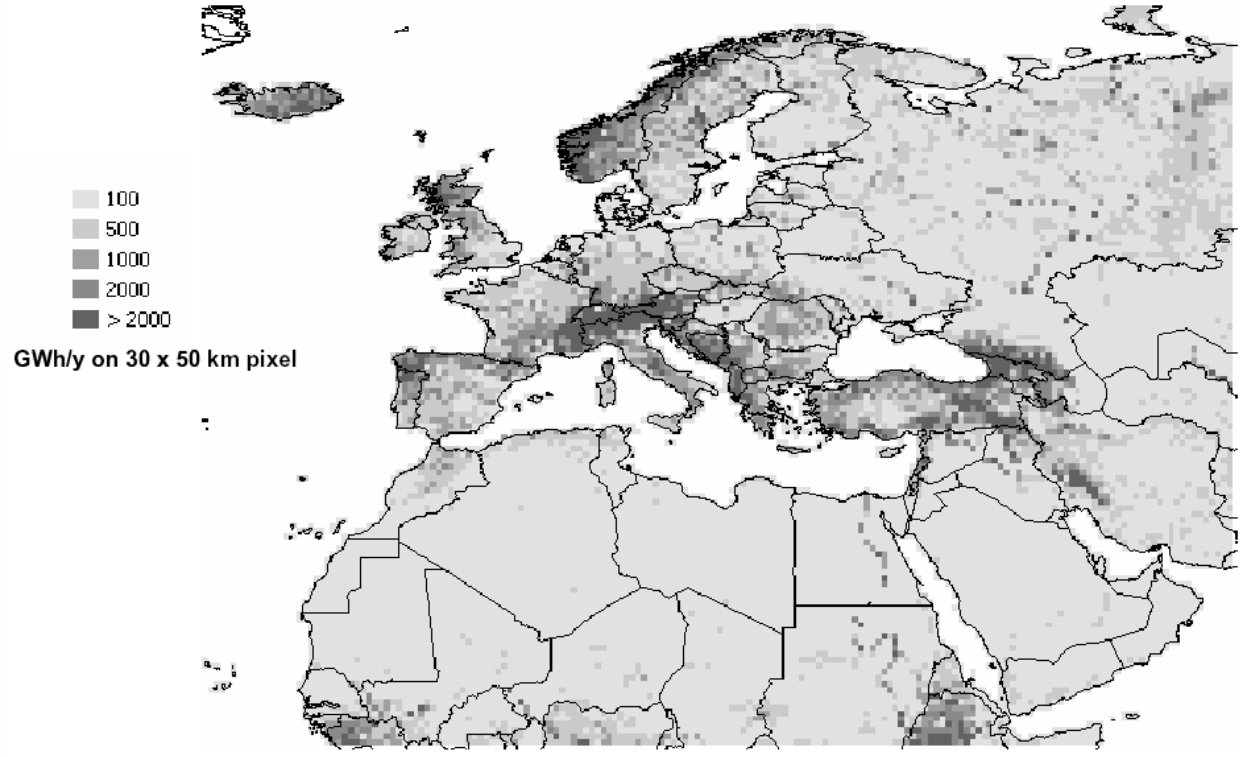
# Hydropower Potentials






Source: "Concentrating Solar Power for the Mediterranean Region",
DLR for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany (2005)

# Renewable Energy in the Region: Countries Strategies

| Country | Country Strategy |
|---|---|
| **Algeria** | 10% of electricity from RE by 2030 |
| **Egypt** | 20% of electricity from RE by 2020 |
| **Jordan** | 10% of primary energy from RE by 2020. |
| **Kuwait** | 5% of electricity RE by 2020 |
| **Lebanon** | 12% of electrical and thermal generation from RE by 2020 |
| **Libya** | 10% electricity by 2020, and 25% by 2030 from RE |
| **Morocco** | 21 % of primary energy and 42 % of electricity from RE by 2020 |
| **Sudan** | 1% of electricity from RE by 2011 (Not including hydro power that made up 29% of total electric energy generated in 2007) |
| **Syria** | 4.3% of primary energy from RE by 2030 |
| **Tunisia** | 4% of primary energy from RE by 2014 |
| **UAE** | 7% of electricity in Abu Dhabi from RE by 2030 |



# Renewable Energy in the Region: Wind Energy

| Country | Existing & under Construction Wind Power | Planned Wind Power |
|---|---|---|
| **Algeria** | | 10 |
| **Egypt** | 430 | 6670 |
| **Jordan** | 1.5 | >300 |
| **Lebanon** | | >50 |
| **Libya** | - | 1110 |
| **Morocco** | 210 | 1440 |
| **Saudi Arabia** | - | 50 |
| **Syria** | 6 | 150 |
| **Tunisia** | 55 | 190 |
| **UAE** | - | >100 |
| **Yemen** | 60 | 460 |

# Renewable Energy in the Region: Solar Energy

| Country | Existing & under Construction Solar | Planned Solar (CSP/PV) | Comment |
|---|---|---|---|
| **Algeria** | 25 (CSP in 150 MW ISCC)<br>1.1 (PV) | 2x70 CSP | |
| **Egypt** | 20 (CSP in 140 MW ISCC)<br>5.2 (PV) | 240 (CSP)<br>20 (PV) | |
| **Jordan** | 0.5 (PV) | 8.5 (CSP) | |
| **Kuwait** | - | 60 (CSP in 280 MW ISCC) | Technical feasibility study for a ISCC project of 280 MW including 60 MW solar component, has been completed |
| **Lebanon** | 3 (PV) | 50 (PV) | |
| **Libya** | 0.218 (PV) | 100 (CSP)<br>17.5 (PV) | |
| **Morocco** | 20 (CSP in 470 MW ISCC) | 2000 (CSP) | A plan for a 2000MW CSP has been declared |
| **Qatar** | - | 100MW | A 100 MW solar power plant in Qatar Science and Technology Park (QSTP) within the next five years. |
| **Saudi Arabia** | - | 10 (PV) | 10 MW PV systems are expected for water desalination by 2012 |
| **Sudan** | 0.5 (PV) | | |
| **Syria** | 0.08 (PV) | | PV cells to be manufactured and put in the market (expected 15 MW PV yearly) |
| **Tunisia** | 1 (PV) | 200 | |
| **UAE** | 10 (PV) | 1100 | Masdar has already connected a 10 MW PV plant to the grid, and expects the 100 MW Shams 1 CSP plant to be on line by late 2011, and the Shams 2 plant in mid-2013. |
| **Yemen** | 0.44 (PV) | 1 (PV) | 60MW wind farm is in the development phase. |

# Investment and Electricity Generation Costs

| | 2008 | | 2030 | |
|---|---|---|---|---|
| Energy Source | kW Investment (US $) | kWh Generation Cost (US cents) | kW Investment (US $) | kWh Generation Cost (US cents) |
| Hydro | 1970-2600 | 4.5-10.5 | 1940-2570 | 4-10 |
| On-Shore Wind | 1770-1960 | 9-10.5 | 1440-1600 | 7-8.5 |
| Off-Shore Wind | 2890-3200 | 10-12 | 2280-2530 | 8-9.5 |
| Biomass | 2960-3670 | 5-14 | 2550-3150 | 3.5-12 |
| Grid Connected PV | 5730-6800 | 36-75.5 | 2010-2400 | 14-30.5 |
| Solar Thermal | 3470-4500 | 13.5-37 | 1730-2160 | 7-22 |
| Geothermal | 3470-4060 | 6.5-8 | 3020-3540 | 5.5-7 |
| Tidal | 5150-5420 | 19.5-22 | 2240-2390 | 10-11.5 |

# Energy Efficiency Technologies: Audits

- Surveys and field visits
- Data collection
- Measurement
- Analysis
- Audit reports



# Energy Efficiency Technologies: Actions

- Installations (new high efficient equipment)
- Retrofitting (lighting, boiler, furnace, A/C…. etc)
- Replacement (fuel oil burner with natural gas burner)
- Modification (process and equipment)
- Measurement, monitoring the performance of energy equipment/consumption

# Energy Efficiency Measures: Transport

- Improving the Infrastructure
- Using cleaner fuel
- Improving vehicles efficiency and maintenance
- Implementing inspection and tuning up programmes
- Improving traffic management
- Using public transport
- Urban planning

# Energy Efficiency Measures: Industry

- Improving/controlling combustion efficiency (boilers & furnaces)
- Improving steam efficiency (steam traps, leaks and insulation)
- Enhancing heat loss recovery and improving insulation
- Using high efficient motors , pumps, drives and compressors
- Improving the power factor
- Introducing adjustable speed drives
- Introducing high efficient lighting
- Managing the electrical load
- Controlling and metering equipment
- Enhancing housekeeping
- Modifying processes/equipment
- Using cogeneration/combined heat and power

# Energy Efficiency Measures: Household/Building

- Using high efficient lighting
- Improving power factor
- Improving HVAC efficiency
- Using high efficient motors, pumps, boilers, compressors and household appliances
- Retrofitting inefficient equipment
- Using building management systems (BMS)
- Improving thermal insulation
- Using windows film solar reflectors and double glazing
- Controlling and monitoring equipment operation

# Challenges: Administrative

- Vision
- Strategic planning
- Positioning
- Innovative ideas
- Cultural challenges
- Uncertainties

# Challenges: Financial

- Financing availability
- Financial planning
- Building financial expertise
- Access to financial resources
- Quantifying economic values of technologies and services
- Risk mitigation



# Challenges: Market

- Customer needs and awareness
- Effective and innovative market oriented solutions
- Branding, benchmarking and evaluating initiatives
- Competing/Complementing the international business
- Marketing and sales
- Customer orientation

# Challenges: Technical

- Capacity building
- Competencies
- Lack of government and industry standards
- Product and services range identification
- Technologies
- Operations
- Knowledge transfer
- Research & development



# Other Challenges

- Bureaucracy
- Lack of recognition schemes
- Lack of support from the governments, banking sector, financial institutions
- Small market size

# Regional Technology Know-how Build up

- Remote electrification
  - (example of Ka'awa, Yemen)
- Large-scale renewable energy
  - (example of Egypt)
- Manufacturing
  - (example of Syria, Sudan)
- Research & development
  - (example of Masdar, UAE)
- Energy Efficiency



# South-South Technology Sharing: Governments Role

- Political vision and will
- Policies and mechanisms
- Promote renewable technologies
- Improve access to finance
- Establish customized lending guidelines
- Provide credit risks coverage for lenders
- Encourage firms to reinvest revenues
- Lower revenue and profit taxes
- Provide direct subsidies that lower production costs
- Incentive schemes to promote manufacturing of new and renewable energy equipments

# South-South Technology Sharing: Private Sector Role

- Localizing added value
- Building capacity through the localization of supply chains
- Improving standards
- Facilitating access to finance
- Partnering across segments and with other development actors to facilitate local development
- Training on business planning skills, including training in financial management
- Helping in building capacity and encourage environmental stewardship



# South-South Technology Sharing: Inter. / Regional Organizations

- Economic impact analysis studies
- Market analysis studies
- Pilot projects
- Pilot projects evaluation and follow-up
- Awareness
- Liaise with financial instruments / lenders
- Feasibility studies

# ESCWA Activities:

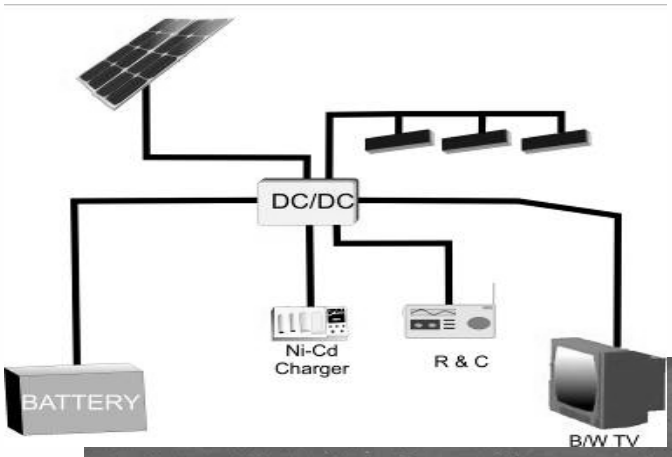
- Regional Studies and Publications
- Promotional Material & Fact Sheets
- Expert Group Meetings (EGMs)
- Capacity Building Activities
- Technical Cooperation Projects
- Field Projects

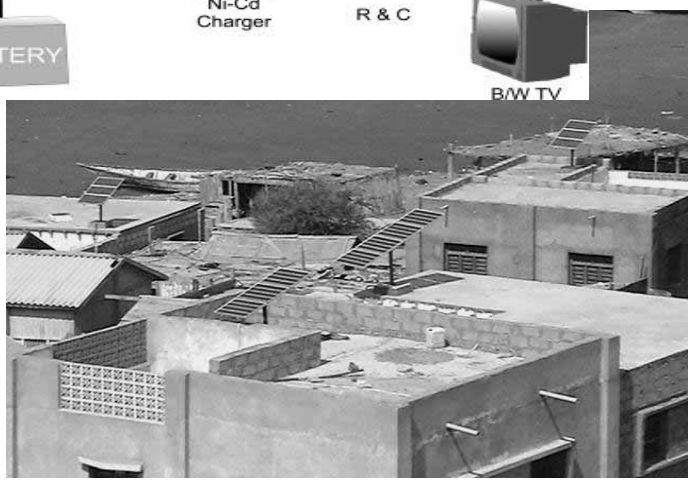


# ESCWA Activities:
# Kawaa PV Electrification

- Partners: OFID and the Ministry of Electricity and Energy – Yemen
- Completion Date: 2010
- Total Installed Capacity: 11.4 KW
- Total installed Systems: 93 Solar PV systems
  - (87 houses, 3 Street lighting, Mosque, School and health center
- Basic maintenance training for villagers
- “On the Job” Technical Training for Technicians

# ESCWA Activities: Kawaa PV Electrification

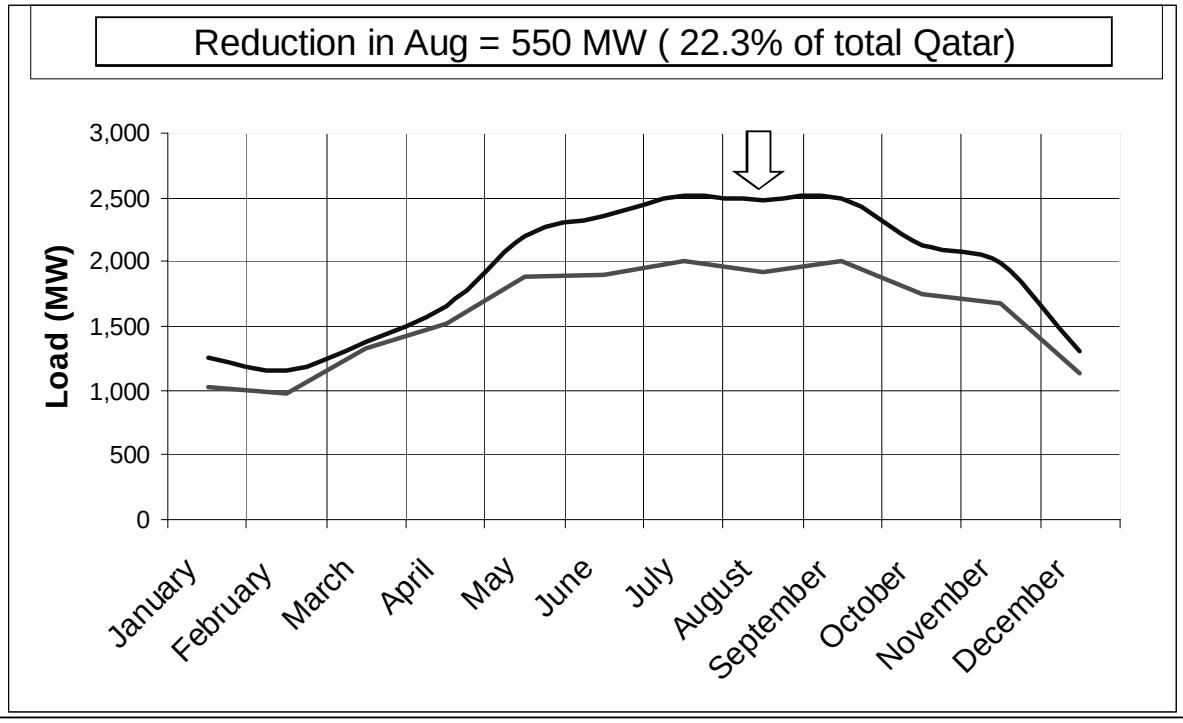


# ESCWA Activities: KAHRAMAA DSM

- Partners: KAHRAMAA
- Completion Date: 2008
- Study the impacts of energy efficiency and demand side management measures on the utility

# ESCWA Activities: KAHRAMAA DSM

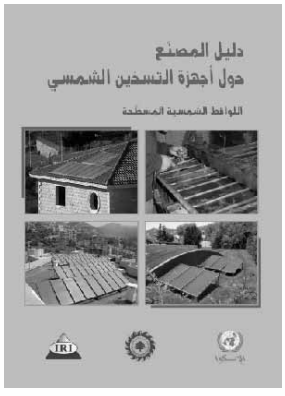



**Load Reduction (MW) in the State of Qatar (EE/DSM for Building + Industry)**



# ESCWA Activities: Solar Water Heaters Training

- Partners: Lebanese Solar Energy Society (LSES) and the Industrial Research Institute (IRI)
- Dates: 2 training sessions in 2009 and 2 in 2010
- Participants: 57 in total
- More sessions planned in 2011
- Beneficiaries: Small enterprises and service providers (plumbers, electrical, etc.)
- A permanent facility providing practical, hands-on training in manufacturing, installation and maintenance, with emphasis on quality




# ESCWA Activities:

## Development Account Energy Project

- Project on “Capacity-building on climate change mitigation for poverty alleviation in Western Asia”
- Project’s Partners: Economic Commission for Africa (ECA), and Economic and Social Commission for Asia and the Pacific (ESCAP) in addition to UNESCO’s regional office in Cairo.
- Objectives:
  - To build the capacity of policymakers, civil society and the private sector in the field of renewable energy technologies.
  - To enhance energy security and improve access to energy services in the poor rural areas:
    - Alleviating poverty
    - Enhancing productivity and social and economic conditions.

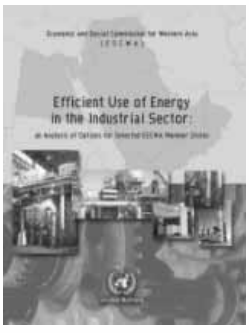


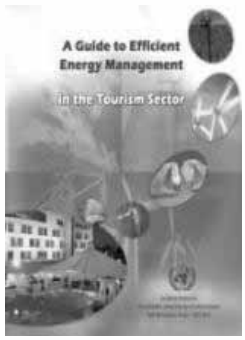
# ESCWA Activities:

## Regional Studies and Publications

### Energy Efficiency

**Improving Energy Efficiency in the Building Sector**



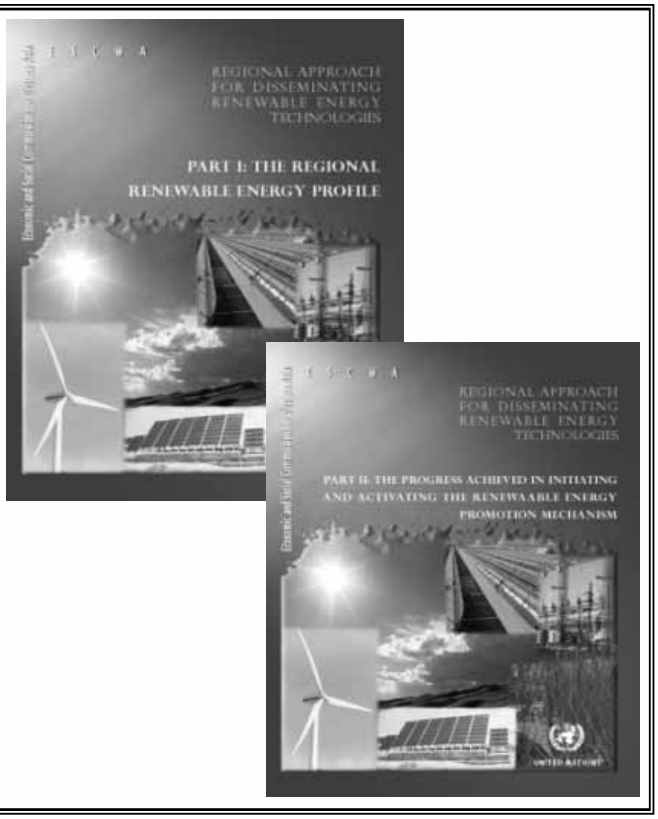

Energy Efficiency & Cleaner Fossile Fuels Uses in Selected Sectors in Selected ESCWA Member Countries.

**Vol.I: Energy Efficiency in Selected Energy-Intensive Industries**

**Energy Conservation and Efficiency in the Upstream Energy Sectors in Selected ESCWA Member Countries.**

# ESCWA Activities:
# Regional Studies and Publications

## Renewable Energy




**Vol.I Wind & Biomass Systems**

**Vol.II Solar Thermal Systems**

**Vol.III Solar PV Systems**


# ESCWA Activities:
# Regional Studies and Publications

## Clean Fuels



Energy Efficiency & Cleaner Fossile Fuels Uses in Selected Sectors in Selected ESCWA Member Countries.

**Vol.II: Applications of Cleaner Fossil Fuels**

# ESCWA Activities:
# Regional Studies and Publications

## Energy for Sustainable Development

**Updating the Study on The Current Status of Selected Energy Sectors in ESCWA Member Countries.**

Vol. I

Natural Gas Sector

Vol. II

Electricity Sector

**Capacity Building in Sustainable Energy Systems: An Approach to Poverty Alleviation and Inclusion of Gender Issues in the main Social Interests**

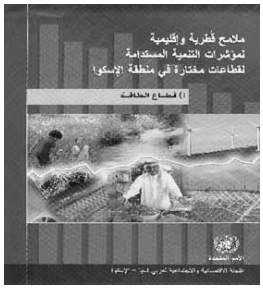
Vol. I

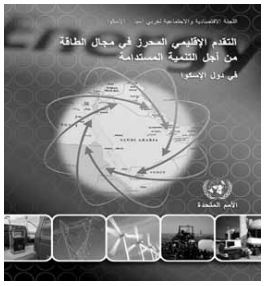
Energy for SD

Vol. II

Progress Achieved

**Energy Indicators**; Development of Sustainable Development Indicators and Country and Regional Profiles in selected sectors of ESCWA Member Countries.





**Progress Achieved on Energy for Sustainable Development in ESCWA Member Countries**



# ESCWA Activities:
# Regional Studies and Publications

- Technical paper on Small and Medium Enterprises Opportunities in Energy Services (E/ESCWA/SDPD/2010/Technical paper. 5)
- Technical Paper on Improving Energy Efficiency in the Electric Power Sector in the ESCWA Region (E/ESCWA/SDPD/2010/Technical Paper.4)
- Working Paper on Promoting Large Scale Renewable Energy Applications in the Arab Region (E/ESCWA/SDPD/2010/WP.2)
- Working Paper on SCP Patterns in the Energy and Water Sectors in the ESCWA Region (under printing)
- Study on Policies and Measures Promoting Sustainable Energy Use in the Transport Sector in ESCWA Region (to be completed in September 2011)

# ESCWA Activities: Meetings

- EGM on Promoting SMEs Sector Participation in Implementing Energy Efficiency/ Renewable Energy Projects (Beirut, 28-29 April 2010)
- The 8th Session of ESCWA's Committee on Energy
- Third Roundtable Meeting on Sustainable Consumption and Production (SCP)
- EGM on Promoting Emissions Reductions in the Transport Sector
- Panel on Sustainable Transport in the Arab Region
- Conference on Green Industries and their Role in Enhancing the Social and Economic Development in Arab Countries



# ESCWA Activities: Cooperation with LAS

- Elaboration of the Arab Strategy for Improving the Use of Renewable Energy (2010-2030)
- Elaboration of the Arab Guiding Framework for Improving Energy Efficiency in the Electricity Sector at End Users Level (NEEAP for 3 years during 2011-2020)
- Elaboration of the Arab Regional Strategy on SCP (six priority areas, among which is using energy for sustainable development purposes with a focus on energy efficiency and renewable energy)
- Elaboration of the Guide on the Potentials of Arab Countries in the Area of Renewable Energy and Improving the Efficiency of Energy Production and Consumption
- Elaboration of the draft Arab Action Plan for Dealing with Climate Change Issues (including mitigation plan/activities for all sectors including increasing energy efficiency)
- Declaration of 21 June as the Energy Efficiency day in the Arab region

# Final Note

**Needs for the Developing Countries (the South)**

- - Access to energy with a reasonable price for the social and economic development
- - Avoidance of the increase in CO2 emissions to reduce the adverse impacts of global warming and climate change

Requires the adoption of some solutions where renewable energy and energy efficiency measures can play a major

But Lacks:

- - Availability of adequate funding for the capital investments
- - Support and advice on the technical solutions and options (Green buildings, PV, CSP …)
- - Adaptation of solutions to local conditions



# Final Note

**Needs for the Developed Countries (the North)**

- Reduce CO2 emissions
- Secure oil and gas supply with reasonable prices
- Avoid migration from the south
- Benefit from their advanced research and development (R&D) programmes

- The North shall not regard the South as only a market place.
- The South would not accept to be treated as a client and a market place only.
- Real cooperation and partnership shall be developed.
- Cooperation schemes need to be simple.
- Knowledge and technical transfer shall be addressed.
- Adaptation to local conditions shall be made.
- South-South cooperation and technology / experience sharing shall be enhanced