MIRA Energy Workshop

March 23-24, 2009. Marriott Hotel, Cairo Egypt

D. 32-2 Workshop Final Report

The MIRA workshop to discuss the Energy Research Priorities in the EU-MPC was conducted in Cairo, Egypt on March 23-24, 2009. The workshop was organized by the Ministry of Higher Education and Scientific Research in Egypt, which is the MIRA WP4 leader.

The two-days workshop was attended by 98 Participants from 16 Countries, representing 9 EU member states and 7 MPC. The EC was strongly represented by 10 participants (five from DG-RTD and 5 from the EC delegation in Cairo).

The workshop agenda commenced by plenary sessions with several presentations focusing on the EU Strategic Energy Technology Plan (Set-Plan), the Mediterranean Solar Plan (MSP), an overview of Energy Research landscape and Priorities in the MPC and an overview of the International Cooperation Dimension of the EU Energy Research.

The Invited experts were divided into four working groups (Experts lists attached), namely, Photovoltaic, CSP, Wind Energy and Energy Efficiency. The working groups discussions focused on considering common EU-MPC research priorities, identifying research capacities and exploring potential networks of cooperation. In addition, on the second day, a working group convened to discuss the Set-Plan with the participation of the experts from both the PV and the CSP groups.

In a plenary session at the end of day two, the working groups conclusions were presented by the groups' reporters, discussed by the audience and the final workshop's conclusions and the identified priority areas for each group were reached.

Working Groups Identified Priorities

WG 1: CSP

Priority Topic 1 (Joint Research):

Local manufacturing of components

Objective

•Develop and produce key components based on local research and manufacturing capacities and benchmark them against state-of-the art technology in terms of cost, performance and durability

Rationale

•Establish the basis to increase local supply share, to strenghten a a new sector , to increase employment and to reduce dependence of fossil fuel resources

Need

• A high fraction of key components need to be imported in today's CSP power plants, the appropriate exchange rate risks are penalizing the cost of renewable electricity

Impact

•Positive impact on cost of electricity, employment, sector development

Priority Topic 2 (Joint Research):

Advanced materials and surfaces

Objective

•Develop advanced materials for the next generation power plant technology operating at higher temperatures. Special focus is given to new selective coatings and new storage materials with high energy density

Rationale

•High temperature processes with an efficient thermal energy storage are considered to be the key for improved performance and cost reduction. Advanced materials and new surfaces adapted to the higher temperatures needs to be developed for a successful transfer

Need

• Today's commercial project are limited to temperature below 400°C. Higher temperature requieres advanced materials and surfaces

Impact

•Positive impact on performance of plant and cost of electricity

Priority Topic 3 (Joint Research):

Improved weather forecasts models for direct normal irradiation

Objective

•Develop new models for weather forecast of DNI and integrate them ***in*** CSP power plant simulation to optimize operation and maximize revenues. Special focus is given on the development of local correlations for sites in the MENA region

Rationale

•CSP power plants with thermal energy storage can provide dispatchable power supply. To optimize the scheduling and ensure high availability figures, weather forecast information need to be considered to identify the appropriate operation strategy

Need

•High share of low-cost wind energy needs to be stabilized by dispatchable CSP power

Impact

•High shares of renewable electricity in the grid become feasible

Priority Topic 4 (Infrastructure):

New joint test facilities for CSP in the MENA region co-located to pilot power plants

Objective

•Set-up new joint research facilities for CSP co-located existing pilot power plants

Rationale

•Newly developed products and components needs to be tested under real conditions. Test facilities co-loacted to pilot plants CSP power plants can be ste-up with marginal additional effort as they can benefit from some of the existing infrastructure and personal. A cost-shared approach among several partner countries can bundle the efforts.

Need

•There is no large scale test facility available today in MENA countries

Impact

Increase in development and local capacity building

Priority Topic 5 (Coordination Action):

CSP Dissemination and Education Program

"Educate the Educators"

Objective

•Set-up a dissemination and education program on CSP with the focus on the education of educators like teachers and professors. Provide appropriate learning material (in Arabic) and train the educators

Rationale

•Application and adaptation of existing education programs in Europe to the education systems in MENA generates high multiplier effects and ensures and efficient capacity building.

Need

•No specific education programs on CSP are available

Impact

•Local capacity building

Priority Topic 6 (Coordination Action):

Evaluation of Hybrid Concepts

Objective

•Set-up a a fair methodology to asses the value and impact solar hybrid (fossil/biomass) concepts, that takes aspects like time of

delivery as well as CO2 avoidance into account. Benchmark different hybrid concepts with this methodology

Rationale

•Hybrid concept promise low solar electricity cost vs full dispatchability. However some concepts only have very limited impact on CO2 reduction. A selection of different hybrid concepts is therefore necessary

Need

•A fair assessment methodology is lacking

Impact

Low cost CSP electricity through efficient hybrid concepts

WG2: Wind Energy

Priority Topic 1:

Wind Energy Conversion Systems in Desert "extreme" Conditions (industrial aspects)

Scope: Design an adapted wind power conversion system to local conditions taking into account the extreme climatic conditions found in Southern Mediterranean Partner countries. The design will take into account the experiences conducted so far in the region (Zafarana Egypt, Morocco…). The dedicated design will have to take in consideration local industrial capacities to ensure appropriate industrial integration, leading to a higher local economic impact and enhanced operation and maintenance.

1. Extreme desert aerodynamic and climatic conditions
    a. Meteo, temperature, humidity, Sand, dust, salinity, ozone, other chemicals… Sand+salt compounds)
2. Wind turbine components
    a. Gear Boxes (Analyse failure of gearboxes…)
    b. Direct Drive
    c. Blades
        i. materials
        ii. Coating
        iii.
    d. Rotor
    e. Generator
    f. Power conditioning and Control system
    g. Towers
3. O&M (software, protocols, statistics, meteorological data …)
4. Standards and specifications
5. Verification (Actual performance of wind turbines)
6. Industrial integration / Engineering
7. Logistics

8. Economic analysis

Rationale:

The perspective of wind development in the MPC is very promising as highlighted by the countries specific targets. The systems that have been deployed initially in the region have shown higher rates of failures due to the extreme environmental conditions under which these system are operating. Improving the technological/economical designs of wind energy systems to the MPC's extreme conditions to accommodate more efficient and adapted designs is a mutual challenge that needs to be addressed by EU and Med PC alike. Indeed, the market of wind turbines outside of the EU experiences very high growth worldwide which needs to be met. As the geographical locations of these markets are bound to be more remote, the MPC markets that are linked to EU markets may provide an optimal setting for enabling this industry to expand more comprehensively.

Objectives/Impact:

Economics Impact (local/regional/global)

Industrial

Economic

Social

Energy security

Climate Change

Technical Impacts

Improving technology/Systems Integration / costs reduction

Priority Topic 2:

High penetration of wind energy in electric grid for MPC Countries

Scope:

Although experiencing a higher growth rate, the grid capacities of MPC are smaller than EU countries. The current limited installed wind power capacities have not yet reached a level where grid stability and dispatching problems. Since these countries dispose of significant wind resources, the main limiting factor will remain grid absorption capacities. The targets for 2020 are in fact very difficult to assess in these countries, knowing that the grids will witness expansions which will need to take in consideration the nature and operation of wind energy systems. Hence, the issue of grid integration of wind needs to be assessed, and forecasted in order to determine the most cost-effective ways of ensuring reliability at high wind penetration levels using wind power plant capabilities. Benefits of local and regional dimensions of grid expansions, planning and management for cost-effective and reliable power systems will be assessed, ensuring that higher wind power penetration is compatible with grid stability, operations and grid code requirements.

Objectives:

To manage a large-scale fluctuating production, the grid infrastructure and interconnections should be extended and reinforced through strong planning and the early identification of bottlenecks at local and regional level. Today's curtailment of wind power in-feed experiences in Germany, and Spain for example, show the risks of grid operation when higher wind penetration rates are reached. The objective of this proposal is to plan for the connection of larger wind capacities, at a local level and evaluate the leveling needs of power demand and supply to ensure improved power system operation efficiency. The complementarities of fossil and renewable based power generating systems such as solar energies will be compared.

The impact of the Union for the Mediterranean Solar Plan, involving trans-national exchanges and their effects will be assessed accordingly.

The objectives are supported by three research topics:

Wind power plant capabilities

Grid planning and operation (accelerated/improved extension and reinforcement as well as improved operation of the existing grid)

Energy and power management

Absent that, the MPC wind energy targets for 2020 are very difficult to assess due to the limited grid absorption capacities.

Impact:

Economics Impact (local/regional/global)

Industrial

Economic

Social

Energy security

Regional integration

Climate Change

Technical Impacts

Improving technology

Systems Integration / costs reduction

1. Turbine/grid relationship
    a. Reactive power
    b. Dispatching
    c. Harmonics
    d. Flickers
2. Wind farm size optimization / Prospective and wind planning

3. Plant planning (Optimal Plant size)
    a. Wakes…Shading effects of wind turbines, wind flows… possible law suits with different players…. Modeling of this effect is important. Wakes effects up to 8% evaluated…rules of thumb is not enough)
    b. Turbine arrangements?
4. Grid load / generation matching / dispatching
5. Load Storage, Smoothing, Storage, spinning reserve, integrated applications, Wind desalination (desalination) Storage/ice/air co/district cooling
6. Predictability and grid management
7. Control strategy and planning Integration in MPC's.

Priority Topic 3:

Stand alone Autonomous wind systems

Scope:

Rationale: Many areas of MPC are not covered by the grid. Non-grid connected communities' needs to dispose of adapted systems. Whereas wind energy is available, integrating the wind energy resource into local non-grid connected energy systems represents a challenge that needs to be addressed. Introducing wind energy technologies at an early stage and building up these systems before their integration to a larger grid energy infrastructure where renewables will have a significant impact is important.

Objective/Impact:

1. Analysis, system
2. Local adaptation of technologies (bottom up)
3. Equipment configuration, integration, industrial engineering
4. Integrated applications
5. Storage

WG3: Photovoltaic

Priority Topic 1

Advancement of PV system components including cells, storage devices, inverters, and controllers for micro-grid applications

Content/scope:

The aim is to improve component's efficiency, reduce production costs and material characteristics used in manufacturing of various PV system components including PV cells, modules, and storage devices for micro-grid applications

Expected impact:

Facilitate deployment of PV technology in MENA region

Funding scheme:

Collaborative R&D project

Priority Topic 2

Integration of PV/CPV systems in industrial grid connected applications

Content/scope:

The aim is to develop and demonstrate design and operating principles for cost effective large scale grid integration of PV/CPV systems. Issues to be addressed include the demonstration of electric/electronic components and technologies for grid connection and operation.

Expected impact:

Large scale deployment of PV/CPV for electricity generation

Funding scheme:

Collaborative project with predominant demonstration component

Priority Topic 3

Development of operation and maintenance training programs to support deployment of PV technology

Content/Scope:

The aim is to develop skilled infrastructure in the MENA region capable to support PV deployment. Activities should include educational programs for knowledge transfer.

Expected impact:

Enhancement of personnel skills in MENA region.

Funding Scheme:

Coordination and support action

Priority Topic 4

Policy research and legislation development and awareness building for integration of PV technology application in energy management and resource planning

Content/scope:

The aim is to develop policies and legislations to foster and encourage the deployment of PV technology in the MENA region.

Expected impact:

Facilitate realization of renewable energy long term programs objectives.

Funding Scheme:

Coordination and support action

WG4: Energy Efficiency

Priority Topic 1

Energy Efficiency Road Map (Prospects and Challenges)

Funding Scheme:

Coordination Action (CSA/CA):

Activity Area:

Energy. 9: Knowledge for Energy Policy Making

9.1 Knowledge tools for energy-Related Policy Making (3/4)

9.2 Scientific support to policy (2/4)

"Doing more with less at MPCs."

Rationale

in line with the EU Green paper "doing more with Less" and also in line with recent MED-EMIP(Euro Mediterranean Energy Market Integration Project" activities with LAS/ Energy Department/Council of Arab Electricity Ministers to collectively adopt the EC EE end use EE directive

–Huge energy efficiency potential is not being tapped in most MPCs. This is mainly due to the lack of reliable information for the decision makers on such potential and the associated positive socio economic impact. Mostly they are used to supply side management practices in which demand forecasting based on historical trends is done and then power plants are tendered. This practice has lead to more than 10% increase in peak demand annually in recent years.

–On the other hand huge energy subsidies prevent private sector / end users from being very proactive in pursuing such opportunities. Such subsidies are being

paid by “a subsidizers” such as ministries of finance and it might be cost effective to subsidize some EE measures to kick start the market

Objectives

The objective of this coordination action is to provide the governments and policy makers and other relevant stakeholders such as financial institutions of decision support information and know-how to move the subject of EE forward and be able to allocate and justify the needed financial resources.

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Priority Topic 2

Develop optimized energy efficient buildings for the region.

Funding Scheme:

Collaborative project SICA

Be Ware : MED-ENEC I & MED-ENEC II “Energy Efficiency in the Construction in the Mediterranean”

Rationale:

Buildings are long lived assets and what we decide on today, we have to live with for a long time with possibilities of minor retrofits.

Such Designs needs to be localized to provide a reasonable practical solutions based on the regional, climate, social and economic situation and needs and available building material.

Objectives:

To identify solutions which effectively minimize energy consumption in buildings, improve comfort based on local conditions . This also can be for exiting and new buildings and can include Solar heating / cooling and application of innovative building materials, urban planning, related codes and legislation and experience exchange.

Priority Topic 3

Increasing efficiency and reliability of the solar collectors through developing new materials, specific coating materials & cleaning techniques

Funding Scheme:

(CP/SICA) Collaborative project-Specific international cooperation action

Rationale:

Efficiency of solar water heaters and other solar energy devices is dropping sharply due to local climatic conditions such as dust collection and adhesion. Also this will result in accelerated deterioration of such equipment.

Objectives:

To find solution to the problem by either developing new material, new coatings or new cleaning solutions.

Increase efficiency & lifetime of solar collectors in dusty climates

Priority Topic 4

Large energy intensive industries: Energy intensity improvements through Energy Efficiency

Funding Scheme:

CSA/SA Coordination and support action / Support Action

Rationale:

The industries in the MPC's consume about one third of the total energy consumption. Out of the 1000s of registered industries only few large and energy intensive industries consumes most of the energy in this sector.

This is about the Perito principle were few consumes most of the energy, therefore this project is to concentrate on such a few to improve efficiency, reduce waste and optimize processes.

Objectives:

Analyses of technical solutions identified by similar industries in the region and legislations and frame work conditions that are needed for their successful implementation

Know-how transfer of EE practices from North to south and South to South