Oman’s Energy Needs & Renewable Energy Investment Opportunities

Panel V

Oman Economic Forum – Muscat, 26 April 2010
Panel Members

- **Eng. Azhar Haroun Al-Kindi**, CEO, Oman Environmental Services Holding Company;
- **Mr. Amjad Rihan**, Director, Climate Change & Sustainability Services at Ernst & Young Middle East;
- **Mr. Ahmad Saleh Al-Jahdhami**, Director of privatization, & restructuring, Public Authority for Electricity and Water;
- **Mr. Gary Sigel**, Partner, Southern Energy Partners;
- **Mr. George Sarraf**, Partner, Booz &co.

**Moderator: Mr. John Cunneen**, Executive Director & Member, Authority for Electricity Regulation, Oman
Introduction to Sultanate of Oman

Summary profile

- **Location:** south east of Arabian peninsula
- **Land area:** approx 309,500 sq km
- **Coastline:** > 1,700km
- **Climate:** hot and humid
- **Population:** 2.7 million (0.7 million expat)
- **Population growth:** Omani 3.3% p.a. & expat 4.1% p.a.
- **Population demographic:** 52% of Omanis under 20 years of age
- **Religion & culture:** 60% Islamic, diverse cultural influences
- **Language:** Arabic, English widely spoken in business
- **Member of Gulf Cooperation Council (GCC)**

Source: The Report, Oman 2009 Oxford Business Group
Authority’s ‘Renewable Energy’ Study

Significant Solar potential

Matthias Loser, 2005

$\sum = 18 \text{TWe}$
Authority’s 2008 ‘Renewable Energy’ Study

- Authority commissioned COWI/SCO (the Consultant) to:
  - Identify renewable energy potential in Oman and provide initial technical and economic assessments of renewable electricity production;
  - prepare renewable energy technology profiles to include:
    i. technology descriptions, (including efficiencies, capacity factor), cost profiles (including equipment, installation, operating and maintenance and capital costs)
    ii. Technology advantages and disadvantages (inc non-energy benefits and potential reductions in greenhouse gas emissions), and technical, economic, and market potential (over 3 to 20 years)
  - Identify Barriers to renewable energy (regulatory, market, information, financial, economic) and recommend how to address
  - review support mechanisms used in other jurisdictions to promote Renewable Energy: suitable for Oman?
## Authority’s 2008 ‘Renewable Energy’ Study

**Results: Resource Potential in Oman**

<table>
<thead>
<tr>
<th>Renewable Resource</th>
<th>Conclusion of 2008 Study: Potential in Oman</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solar Energy</strong></td>
<td>Solar energy density in Oman among highest in the world. Significant scope for developing solar energy resources throughout Oman;</td>
</tr>
<tr>
<td><strong>Wind Energy</strong></td>
<td>Significant wind energy potential in coastal areas in the southern part of Oman and mountains north of Salalah. Wind speeds comparable inland sites in Europe that sustain large numbers of wind turbines;</td>
</tr>
</tbody>
</table>
| **Biogas**                  | Limited potential at present for electricity production.  
   *(pre Oman Environmental Services Holding Company SAOC)* |
| **Geothermal Energy**       | Limited potential at present for electricity production.                                                  |
| **Wave Energy**             | Limited potential at present for electricity production.                                                  |

*Source: Authority for Electricity Regulation, Oman: Renewable Energy Report June 2008*
## Authority’s ‘Renewable Energy’ Study

### Results: Policy Instruments to Support Renewable Energy Projects

<table>
<thead>
<tr>
<th>Instrument</th>
<th>PROs</th>
<th>CONs</th>
<th>Suitable for Oman?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Taxes</td>
<td>Creates even playing field for renewable energy</td>
<td>Difficult to estimate objectively the optimum level of tax.</td>
<td>Tax would increase supply costs and subsidy but not induce change in consumer consumption.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited Applicability</td>
</tr>
<tr>
<td>Tax Credits</td>
<td>Creates incentives for investors</td>
<td>May distort market prices</td>
<td>Applicable</td>
</tr>
<tr>
<td>Green Marketing</td>
<td>Based on willingness to pay (WTP) and optional schemes</td>
<td>Difficult to control and limited information on consumer WTP</td>
<td>Would have very little impact in Oman.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited Applicability</td>
</tr>
<tr>
<td>Investment subsidies</td>
<td>Increase incentives to establish and invest in renewable energy generation</td>
<td>May result in overinvestment</td>
<td>May create new subsidy flow in the system to investors.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Applicable</td>
</tr>
<tr>
<td>Feed in Tariffs</td>
<td>Efficient in promoting RE if monitored carefully and changed in accordance with technological developments</td>
<td>Investor risk if removed for political reasons</td>
<td>Applicable</td>
</tr>
<tr>
<td>Renewable Energy Quotas</td>
<td>Effective way to promote renewable energy projects</td>
<td>New tendering procedures required but simple to administer. Tends to promote established technologies</td>
<td>Easily accommodated in OPWP and RAEC tendering systems.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Applicable</td>
</tr>
</tbody>
</table>

Source: Authority for Electricity Regulation, Oman: Renewable Energy Report June 2008
Authority’s ‘Renewable Energy’ Study

Recommendations

Study recommendations:

**Recommendation 1: Small Projects & Further Feasibility Studies**
- Immediate implementation of small scale renewable energy projects, particularly in rural areas. Pilot projects would help demonstrate technical and economic performance of technologies under local conditions, and facilitate the transfer of knowledge and know how to relevant institutions in Oman;
- Further feasibility studies with focus on CSP.

**Recommendation 2: Oman to develop policies to support Large Scale Projects**
- If solar and wind energy resources are to be utilized on a large scale in Oman, as the Study finds they could, new policies and funding mechanisms will be needed to support and encourage renewable investment. We recommend focus on:
  a. Renewable energy quotas: e.g. renewable projects to account for X% of total system capacity by 2015;
  b. Feed in tariffs: for large scale projects feed in tariffs over stages of development (tariffs in the latter stages of a project would be lower than initial stage due to the technology being proven, economies of scale etc).

**Recommendation 3: Further Research**

*Source: Authority for Electricity Regulation, Oman: Renewable Energy Report June 2008*
## Authority’s ‘Renewable Energy’ Study

### Results: Electricity Production Costs – Fossil Fuel Vs Renewable

<table>
<thead>
<tr>
<th>Fossil Fuel Generation</th>
<th>Renewable Energy Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT (gas cost $1.5 mmBTu) 140MW</td>
<td>Small PV Grid connected 20KW</td>
</tr>
<tr>
<td>GT (gas cost $6 mmBTu) 140MW</td>
<td>Large PV Grid connected 20MW</td>
</tr>
<tr>
<td>CCGT (gas cost $6 mmBTu) 400MW</td>
<td>Solar Thermal 20 MW</td>
</tr>
<tr>
<td>Heavy Fuel Oil 300MW</td>
<td>Small hybrid PV-Diesel system 10kW</td>
</tr>
<tr>
<td>Coal Steam 1000MW</td>
<td>Wind Farm Joba area 20MW</td>
</tr>
<tr>
<td>New Diesel Unit 1MW</td>
<td>Wind Farm Thumrait area 20MW</td>
</tr>
</tbody>
</table>

| 9.1 | 163.5 |
| 26.5 | 96.2 |
| 19.3 | 79.6 |
| 28.5 | 94.2 |
| 15.8 | 34.1 |
| 61.9 | 28.3 |

*Source: Authority for Electricity Regulation, Oman: Renewable Energy Report June 2008*
Renewable Energy Strategy Timeline

Timeline Overview

Stage 1: Immediate implementation of Small Scale Pilot Projects (RAEC) & further feasibility studies

Stage 2: Design & Implementation of Policies to support implementation of Large Scale Renewable Projects

Stage 3: Large Scale Renewable Energy Projects

Recommendations:

Pilot project initiative: AER/ RAEC
Large solar feasibility: PAEW
Large solar competition: PWP

Recommendations:

- Designated National Authority (DNA) to administer Clean Development Mechanisms (CDM) MECA
- Policy instruments: Tax Credits, Investment subsidies, Feed in Tariffs, MNE/MOF
- Renewable Energy Quotas MNE/ ERC
- Changes to market regulations PAEW/ AER
Renewable Energy in Oman

Status:

- Significant potential for renewable energy use in Oman;
- Renewable energy projects to be implemented within the existing statutory framework and market structure to provide:
  i. Competitive tendering for large renewable projects;
  ii. Compliance with Economic Purchase obligations;
  iii. Customer protection safeguards (e.g. security and quality of supply);
  iv. Private sector investment and secure transfer ‘know how’ to Oman;
  v. Assurance that only Appropriate Persons implement projects; and
  vi. Careful assessments of cost and “Subsidy’ implications.

- The Authority is promoting Pilot Projects in the RAEC Authorized Area (within the existing statutory framework) – shortlist announced in April 2010;
- Feasibility study for large solar project initiated in 2009, competition for project expected in 2010 / 2011
National ‘Renewable Energy’ Strategy?

- Pilot Projects (100%)
- PAEW (Phase 1) / PWP (Phase 2)
- Large Solar feasibility/project
- PAEW / AER
- PAEW / AER
- PAEW / AER
- PAEW / AER
- R.E. Quota
- Tax Credits & Investment Subsidies
- Energy Efficiency
- Feed In Tariffs
- PAEW/Ministry of Finance
- Ministry of Finance / Ministry of National Economy
- Local Manufacturing
- Financial & Energy Resources Council
- Ministry of National Economy / Ministry of Commerce and Industry
- Designated National Authority
- Technical Regulations
- AER
- AER / RAEC

Ministry of Environment & Climate Affairs
Potential for ‘Renewable Energy’ Capacity

**MIS Expected Case**

<table>
<thead>
<tr>
<th>Year</th>
<th>MIS Peak Demand MW</th>
<th>Annual TWh</th>
<th>System load factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>3,424</td>
<td>15.7</td>
<td>52.3%</td>
</tr>
<tr>
<td>2010</td>
<td>3,800</td>
<td>17.5</td>
<td>52.6%</td>
</tr>
<tr>
<td>2011</td>
<td>4,304</td>
<td>19.9</td>
<td>52.8%</td>
</tr>
<tr>
<td>2012</td>
<td>4,746</td>
<td>22.1</td>
<td>53.0%</td>
</tr>
<tr>
<td>2013</td>
<td>5,065</td>
<td>23.6</td>
<td>53.3%</td>
</tr>
<tr>
<td>2014</td>
<td>5,411</td>
<td>25.4</td>
<td>53.5%</td>
</tr>
<tr>
<td>2015</td>
<td>5,757</td>
<td>27.1</td>
<td>53.7%</td>
</tr>
<tr>
<td>2016</td>
<td>6,045</td>
<td>28.6</td>
<td>54.0%</td>
</tr>
<tr>
<td>2017</td>
<td>6,347</td>
<td>30.1</td>
<td>54.2%</td>
</tr>
<tr>
<td>2018</td>
<td>6,664</td>
<td>31.8</td>
<td>54.4%</td>
</tr>
<tr>
<td>2019</td>
<td>6,998</td>
<td>33.5</td>
<td>54.7%</td>
</tr>
<tr>
<td>2020</td>
<td>7,348</td>
<td>35.3</td>
<td>54.9%</td>
</tr>
<tr>
<td>2021</td>
<td>7,715</td>
<td>37.3</td>
<td>55.1%</td>
</tr>
</tbody>
</table>

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**MIS Expected Case Demand Forecast**

MW


3,424 3,800 4,304 4,746 5,065 5,411 5,757 6,045 6,347 6,664 6,998 7,348 7,715

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MIS Expected Case Demand Forecast
> 5,400 MW of new MIS capacity required by 2021

Renewable quota of 10% of new capacity by 2021:  = 540MW  (7% of total MW)

Renewable quota of 20% of new capacity by 2021:  = 1,080MW (14% of total MW)
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