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Country Report Syria

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Norsk-Data-Str. 1
61352 Bad Homburg, Germany
Tel: +49-6172-9460-103, Fax: +49-6172-9460-20
eMail: f.sauter@mvv-decon.com
http://www.mvv-decon.com

Döppersberg 19
42103 Wuppertal, Germany
Tel: +49-202-2492-0, Fax: +49-202-2492-108
eMail: nikolaus.supersberger@wupperinst.org
http://www.wupperinst.org
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<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AFD</td>
<td>Agence Francaise de Development</td>
</tr>
<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
</tr>
<tr>
<td>CCGT</td>
<td>Combined Cycle Gas Turbine</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CER</td>
<td>Certified Emission Reduction</td>
</tr>
<tr>
<td>CFL</td>
<td>Compact Fluorescent Lamp</td>
</tr>
<tr>
<td>CNG</td>
<td>Compressed Natural Gas</td>
</tr>
<tr>
<td>CSP</td>
<td>Concentrated Solar Power</td>
</tr>
<tr>
<td>CTF</td>
<td>Clean Technology Fund</td>
</tr>
<tr>
<td>DANIDA</td>
<td>Danish International Development Agency</td>
</tr>
<tr>
<td>DSM</td>
<td>Demand Side Management</td>
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<tr>
<td>EBPM</td>
<td>Evidence Based Policy Making</td>
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<tr>
<td>EE</td>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>EHV</td>
<td>Extra high voltage</td>
</tr>
<tr>
<td>EIA</td>
<td>Energy Information Agency</td>
</tr>
<tr>
<td>EPC</td>
<td>Energy Performance Contract</td>
</tr>
<tr>
<td>ESCO</td>
<td>Energy Service Company</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Fund</td>
</tr>
<tr>
<td>GHG</td>
<td>Green House Gas</td>
</tr>
<tr>
<td>GJ</td>
<td>Giga Joule</td>
</tr>
<tr>
<td>GWh</td>
<td>Giga Watt hours</td>
</tr>
<tr>
<td>HV</td>
<td>High Voltage</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development (Worldbank)</td>
</tr>
<tr>
<td>IDA</td>
<td>International Development Agency</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IISD</td>
<td>International Institute for Sustainable Development</td>
</tr>
<tr>
<td>IPP</td>
<td>Independent Power Producer</td>
</tr>
<tr>
<td>JICA</td>
<td>Japanese International Cooperation Agency</td>
</tr>
<tr>
<td>kWh</td>
<td>kilo Watt hours</td>
</tr>
<tr>
<td>LEED</td>
<td>Leadership in Environmental and Energy Design</td>
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<tr>
<td>LNG</td>
<td>Liquefied Natural Gas</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>LRT</td>
<td>Light Rail Transit</td>
</tr>
<tr>
<td>LV</td>
<td>Low Voltage</td>
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<tr>
<td>MED-EMIP</td>
<td>Euro-Mediterranean Energy Market Integration Project</td>
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<tr>
<td>MED-ENEC</td>
<td>Euro-Med Project on Energy Efficiency in the Construction Sector</td>
</tr>
<tr>
<td>MEMR</td>
<td>Ministry of Energy and Mineral Resources</td>
</tr>
<tr>
<td>MENA</td>
<td>Middle East and North Africa</td>
</tr>
<tr>
<td>MMBTU</td>
<td>Million British Thermal Units</td>
</tr>
<tr>
<td>MV</td>
<td>Medium Voltage</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>NERC</td>
<td>National Energy Research Center</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>----------</td>
<td>--------------------------------------------------</td>
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<tr>
<td>NET PV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
</tr>
<tr>
<td>PPA</td>
<td>Power Purchase Agreement</td>
</tr>
<tr>
<td>PSA</td>
<td>Production Sharing Agreement</td>
</tr>
<tr>
<td>RCREEE</td>
<td>Regional Centre for Renewable Energy and Energy Efficiency</td>
</tr>
<tr>
<td>RE</td>
<td>Renewable Energy</td>
</tr>
<tr>
<td>TBE</td>
<td>Theory Based Evaluation</td>
</tr>
<tr>
<td>toe</td>
<td>tons of oil equivalent</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nation Development Program</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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</table>
1. Project Synopsis

The "Regional Centre for Renewable Energies and Energy Efficiency (RCREEE)" was formally established June 25, 2008 through the signing of the "Cairo Declaration of Intentions on Establishment of a Regional Centre for Renewable Energies and Energy Efficiency (RCREEE)" by representatives of its member states: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia, and Yemen. The overall objective of RCREEE is, through its interventions, to achieve:

a) rapid implementation of cost-effective policies and instruments for the increased penetration of renewable energy (RE) and energy efficiency (EE) technologies and practices in member countries; and
b) increased market shares of companies and plants located in MENA-countries on the markets for technologies and services related to RE and EE in the MENA and EU regions.

For the first five years of operation, RCREEE receives financial support from the Governments of Egypt, Germany, and Denmark. The European Commission (EC) supports RCREEE through two regional programs: "MED-EMIP" and Phase II of "MED-ENECEC". Member countries will contribute financially by increasingly co-financing the costs of the participation of national officials in RCREEE seminars and workshops.

The present project is the first project support to RCREEE from the Danish Government. It is part of RCREEE's overall effort of providing member state administrations with better information and new planning tools and processes. It supports RCREEE in the development of a website which offers access to a complete subject-ordered list of member state RE&EE laws and regulations, reviewed policy documents, selected background and evaluation reports deemed to represent state-of-the-art high quality analytical work as well as discussion blogs on topics deemed to be of general interest for RCREEE governments.

In parallel and supporting the above activities, the project has gathered the pertinent information on EE and RE in each member country and made them available through the RCREEE website in an organised manner. Likewise the methodology on evidence based policy development and theory based policy evaluation was discussed and extended in each country and their relevance and applicability illustrated through case studies. On the basis of the country reports, a regional report was prepared to allow policy makers and decision makers in all RCREEE member countries to see the status of their EE and RE policies in a comprehensive regional context.

The activities were carried out by the project core team of four international experts assisted in each country by a national specialist. Workshops were held by the national specialists at the end of the project using the material and the methodological case studies developed throughout the project. The national and regional reports were revised to take into account the comments received.

Syria was visited by the project team during 1 to 5 August 2009.

The following sections in this report reflect the impressions gained by the project team through the discussions held during the course of the mission and all the information that has been available to the team. The main purpose of this country paper is to stimulate new thought on EE and RE policy development in Syria.
2. Summary of Energy Situation in Syria

In 2006, Syria’s total primary energy supply (TPES; 21.5 Mtoe) was dominated by fossil fuels, with crude oil/petroleum products (15.34 Mtoe, 71.3%), natural gas (4.68 Mtoe, 21.8%), hydro (0.88 Mtoe, 4.1%) and biomass (0.6 Mtoe, 2.8%).

The dominance of crude oil is due to the fact that unlike other countries of the Eastern Mediterranean region, such as Jordan or Lebanon, Syria accommodates significant domestic crude oil and natural gas reservoirs and was traditionally an oil-exporting nation. Syria’s 2006 crude oil production was 21 Mtoe (440,000 barrels per day). However, in recent years, national crude oil production has significantly declined. For example, in 2004, Syrian crude oil production was more than 29 Mtoe (604,800 barrels per day) and, therefore, superseded the 2006 production volume by nearly 40%. As a consequence of this decline, imports of crude oil and petroleum products are growing. In 2007, they represented about 32% of all imports to Syria compared to 4% in 2000. All energy imports including further energy products or resources constituted 34% of total Syrian imports in 2007 compared to 5% in 2000.

The power sector is managed by the “Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE)” and the “Public Establishment for Electricity Generation and Transmission” (PEEGT). They are controlled by the Ministry of Electricity. In 2006, total Syrian power production cumulated to 37,283 GWh. Oil satisfied more than 50% of the total supply while hydro and gas represented 11% or 38% respectively. The Syrian government aims to convert existing oil-fired power plants with dual oil-gas firing in order to free up oil for export and to avoid becoming a net oil importer in the future. However, progress towards implementing these highly ambitious plans has been slowed by a lack of investment capital.

In 2002, the Syrian government has launched a master plan for the development of renewable energy. According to the plan, renewables shall cover 4.3% of Syria’s total primary energy demand by 2011. However, it seems already clear that Syria will not meet this target. In collaboration with the GTZ, the government is currently developing an updated renewable energy plan, which will run until 2030 and comprise renewable expansion targets for each five years from 2010.

Syria’s declining domestic oil and natural gas reserves constitute a major driver for energy efficiency and renewable energy. The national government has made significant efforts to improve energy efficiency. In 2003, the National Energy Research Centre (NERC) was founded to foster energy efficiency and renewable energy. In February 2009, an “Energy Conservation Law” was issued to stimulate energy conservation in all sectors and raise public awareness and capacities for energy conservation. Other regulations, such as standards for energy consumption of household appliances or thermal insulation codes for buildings have been or adopted or drafted but are either not mandatory or not yet implemented. Therefore, existing energy efficiency policies had little impact so far.
3. Comparison of Syrian Practice with International Practice in Energy Efficiency

This section attempts to compare the present status of energy efficiency with international practice. Public policy intervenes to correct market failures, in the case of energy efficiency the most common failures are: distorted energy prices, external costs, poor access to technical information, agent-principal problems, budgetary constraints and excessive risk aversion, poor skills of investment appraisal. Policy instruments are intended to correct or compensate for these distortions. The most common among these instruments can be categorised as:

Corrective Measures
- Price Reform
- Institutional and legal reform
- Labelling
- Dissemination of information
- Research, development and demonstration
- Financial incentives
- Support for energy service companies (ESCOs)

Compensating Measures
- Standards
- Mandatory measures (e.g. compulsory audits and management obligations)
- Corporate agreements
- Efficiency obligations
- Transport and spatial planning

Normally these instruments should be combined within an overall strategy that sets out objectives and targets and defines the combinations of instruments that are expected to achieve the targets.

The following discussion reflects this taxonomy.

3.1 Strategy

Strategy sets out objectives and targets and defines the combinations of policy instruments that are expected to achieve the targets.

Syria has a system of central planning based on a Five Year Plan with annual commitments. A Special Commission for Energy prepares the Prospective Energy Plan; this Commission is headed by the Central Planning Commission with members from the Prime Minister’s Office, the Ministries of Electricity and Petroleum, the Atomic Energy Commission and independent experts.

The current Five Year Plan runs from 2006 to 2010; it proposes several general principles for improving energy efficiency, including:

- To improve the efficiency of electricity production and to reduce the grid losses
- To implement demand side management strategies
- Use of integrated resource planning strategies
- Energy price reform
- Regulations governing appliances and thermal insulation
No numerical targets for energy efficiency in the planning period were set. The general principles set out in the Plan were given more rigorous form in the “Energy Conservation Law”, which is described in detail in the next section.

The UNDP project (Supply-Side Efficiency and Energy Conservation and Planning) set an unofficial target to reduce national energy consumption by 1.83 percent and CO2 emissions by 765.5 ktons by 2008\(^1\). The estimate of emission reductions includes only the savings from the rehabilitation of units 3&4 at Banias power Plant at the first year of operation. Rehabilitation could add a further 290 ktonnes from rehabilitation of units 1&2 units at same power plant and some 2000 ktonnes from combined cycle gas turbines at Jander, Nasrieh and Zezon.

The next Five Year Plan will run from 2011 to 2015 and is now in preparation. Forecasts show a shortfall in available government funds for the electricity industry in the period and this is a main stimulus for the preparations underway to allow participation of private investors in the sector (see below). It appears that there will be some budget allocation for energy efficiency. Most of this money will go to NERC, but each Ministry will be allocated a fund for this purpose, presumably to provide resources for the energy conservation units to be established under the new Energy Conservation Law (see below).

There is an ongoing GTZ funded project to prepare a Master Plan for Energy Efficiency and Renewable Energy. In preliminary results, this project assesses the potential for saving in various sectors by 2030 as shown below.

<table>
<thead>
<tr>
<th>% saving</th>
<th>Electricity</th>
<th>Gas</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>10-15%</td>
<td>0</td>
<td>15-20%</td>
</tr>
<tr>
<td>Industry</td>
<td>5%</td>
<td>5-10%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Service sector</td>
<td>15-20%</td>
<td>5%</td>
<td>10-15%</td>
</tr>
</tbody>
</table>

The five-year plan of PEDEEE envisages that the energy efficiency of its operations will be improved through the reduction of technical losses by between 0.5% and 1.0% annually and through the improvement of the system power factor. It expects also to introduce three-tariff meters and to change the old mechanical meters with electronic meters that should reduce non-technical losses.

### 3.2 Legal Reform

*The proper implementation of energy efficiency requires an energy efficiency law that justifies the purpose of the activity, establishes a clear focus in government, assigns the responsibilities of actors, makes provision for an agency and specific instruments.*

The following list contains the most frequently occurring provisions in such laws:

- Recognising energy efficiency as an appropriate subject of legislation and regulation
- Identifying and communicating in a policy document or national plan the principles of energy efficiency policy
- Identifying through technical analysis the potential for saving and prioritizing the sectors with highest potential
- Defining policy interventions to promote energy efficiency e.g. fiscal and financial incentives, tradable certificates, and regulations
- Drafting of legislation to implement policy interventions
- Setting penalties for default

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• Creating institutional structures to promote energy efficiency
• Assigning staff in proper numbers and with proper qualifications to the institutions and ensuring adequate finance for the institutions
• Drafting national programmes for short and long-term management of energy efficiency
• Assigning responsibility to promote energy efficiency at national, regional and municipal levels
• Monitoring and evaluating progress

The Energy Conservation Law. The Energy Conservation Law was issued in February 2009. The Law also has some provisions to promote renewable energy. Under this law, the National Energy Research Centre (NERC, see below) is entrusted with coordinating the implementation of many of the measures. Consequently, the Law greatly strengthens the importance of the NERC and its authority.

Entities subject to the Law include:

• All energy producers, distributors and consumers of energy
• All importers and local manufacturers of equipment for energy generation and use
• Associations, institutions and engineering offices operating energy using activities
• Public and private educational institutions, scientific research centres, people’s associations, civil associations and religious bodies.

The law requires that every such entity, public or private, must establish an energy conservation unit headed by an Energy Liaison Officer. These energy conservation units will be of two sorts. Central units will be formed in Ministries and other important public organisations and sub-units will be formed in facilities and sites designated by the central units in collaboration with NERC, whether public or private, and in accordance with their energy consumption.

This hierarchical structure of energy conservation units is in varying degrees responsible to:

• Establish databases regarding all energy use
• Prepare monthly and annual reports on energy use according to models
• Identify opportunities for improved efficiency through the preparation of energy audit studies
• Implement all actions required by the organizational units and NERC

In the construction sector, building permits will be issued conditional on:

• Provision for the use of renewable energy in all private and public buildings; in particular, new building design must facilitate use of solar water heating.
• Thermal insulation of buildings to prescribed standards
• Adoption of energy-saving lighting systems and adoption of natural lighting
• Optimal design of buildings to improve thermal performance

NERC has the duty to prepare energy conservation-related regulations, codes and guidance in consultation with the concerned parties. Regulations and codes for energy conservation in residential, commercial, public and private service buildings will be promulgated subsequently by a Decision of the Council of Ministers on the proposal of NERC.

Similar obligations are laid upon energy conservation units in the transport sector as those imposed in industry.

Units in the transport sector are moreover obliged to adopt policies, strategies and techniques for energy conservation in the transport sector, including:
- Development of mass transport means within and outside cities
- Improving the energy use efficiency in vehicles
- Improving the efficiency of bus engines and stimulating the use of advanced technologies contributing to energy efficiency

NERC will have many services to deliver to support this programme; it is obliged under the Law to establish fees for the inspection and testing of energy using equipment, for assessment of renewable energy applications and for the preparation of energy audit studies.

The Energy Conservation Law is interventionist; it seeks solutions through regulation by the state with little or no participation through the private sector or the use of market based instruments. There is a massive administrative task to perform and ensuring regulatory compliance will be difficult. There will be a considerable challenge to train and keep the staff in the energy conservation units and it is not clear that there are clear policies and commitments to energy efficiency in the other Ministries. This is particularly a problem in Syria because there is rather little continuity and policy changes as Ministers change; without this commitment, if the work is not given priority by a new Minister then nothing will be done.

There is a certain ambiguity of function within NERC; it was conceived as a research centre, but now has been assigned an important coordinating and administrative role in implementing the new law. This may require some reorientation of NERC’s activities and a review of its internal priorities.

**New Electricity Law.** There exists at present no legal basis for the participation of private capital in the electricity sector. Given the deficiencies in power supply at present it is seen as urgent to remedy this absence. There is a strong intention in Government to finalise by 15th August 2009, a draft of a new law providing a legal basis for private participation in electricity supply and to issue the law by 2009/2010. The law is being developed by a special committee headed by the Deputy Minister of Electricity. The committee is comprised of legal and technical experts who can call any evidence they choose, but there is no generalised consultation process.

The law is expected to maintain the transmission company as a state entity, but to permit private activity in generation. It will allow capital and operating incentives for grid-connected renewables, but will not specify how they are to be delivered.

### 3.3 Price Reform

*It is well established that energy demand is price sensitive, especially demand for electricity. The most reliable results come from industrialised countries. Price reform will save large quantities of energy, especially in the long-run and can make a substantial reduction in GHG emissions from countries with distorted prices. Subsidies put a large strain on public accounts and weaken foreign trade balances. They also tend to devastate the state-owned enterprises that are normally a victim of the practice.*

Syria is an oil producer, but it is obliged to import a part of supply. Domestic production exceeds refining capacity so the country exports crude and imports petroleum products. The government has a monopoly of the sale of petroleum products. There are substantial subsidies to some products, both indirectly through implicit subsidies from domestic production and directly from the budget. Gasoline prices in Syria are relatively high by regional standards and probably not far from cost. By contrast diesel fuel is sold well below international prices. Subsidies to diesel cost around $9.6 billion in 2008 and are a major contribution to the budget deficit. HFO is also subsidised. The price of natural gas is fixed at about 90% of the price of HFO so is also somewhat lower than international prices.
Electricity is generated about two thirds from HFO and one third from natural gas so the production cost is subsidised indirectly through the subsidies to the fuels. The Public Establishment for Distribution (PEDEEE, see below) pays approximately the production cost as registered on the accounts of the generator. But then is heavily subsidised by transfers from the budget.

The electricity tariff effective since 1/9/2007 in Syrian Piastres per kWh (p/kWh) is given in the Table for selected groups of consumers. (In August 2009 1000 Syrian pounds equalled $21.72; so the lowest residential tariff of 25 Syrian Piastres is a little over 0.5 cents). Industry pays of the order of 5 cents / kWh. The opportunity cost of electricity estimated on the basis of HFO at international prices burnt in a steam turbine is of the order of 10 cents / kWh or more if transmission and distribution costs are included. It is clear that all electricity consumption is generously subsidised, but especially the domestic consumers up to 300 kWh / per accounting period, i.e. every two months.

**Table 1: Electricity tariff effective since September 1, 2007**

<table>
<thead>
<tr>
<th>Consumption Voltage Level</th>
<th>Peak</th>
<th>Day</th>
<th>Night</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>230kV</td>
<td>300</td>
<td>200</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>66kV</td>
<td>376</td>
<td>250</td>
<td>180</td>
<td>250</td>
</tr>
<tr>
<td>20kV</td>
<td>450</td>
<td>280</td>
<td>185</td>
<td>280</td>
</tr>
<tr>
<td>20/0.4kV</td>
<td>500</td>
<td>336</td>
<td>245</td>
<td>336</td>
</tr>
<tr>
<td>Industrial</td>
<td>500</td>
<td>336</td>
<td>245</td>
<td>336</td>
</tr>
<tr>
<td>Commercial</td>
<td>254</td>
<td>180</td>
<td>140</td>
<td>180</td>
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<tr>
<td>Agricultural</td>
<td>254</td>
<td>180</td>
<td>140</td>
<td>180</td>
</tr>
<tr>
<td>Residential (0.4 kV)</td>
<td></td>
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<td></td>
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<tr>
<td>1-100 kWh/ two months</td>
<td>22</td>
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<td></td>
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<tr>
<td>101-200 kWh/ two months</td>
<td>35</td>
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<tr>
<td>201-400 kWh/ two months</td>
<td>50</td>
<td></td>
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<tr>
<td>401-600 kWh/ two months</td>
<td>75</td>
<td></td>
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<tr>
<td>601-800 kWh/ two months</td>
<td>200</td>
<td></td>
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<tr>
<td>801-1000 kWh/ two months</td>
<td>300</td>
<td></td>
<td></td>
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<tr>
<td>1001-2000 kWh/ two months</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2001 kWh/ two months</td>
<td>700</td>
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</table>

Despite the heavy subsidies there has been some effort to bring prices closer to economic cost. Table 2 shows the development in prices for electricity to selected customers from 1988 onwards in Syrian Piastres per kWh. It is evident that prices in general have been considerable increased, with the emphasis being placed on prices to the productive sector. Prices to industry have increased by a factor 6 or more. Commerce and large residential consumers have seen similar rises, but the small residential consumers have been protected. Indeed, by virtue of larger ranges for the residential tariff, some consumers seem to pay less than before.

**Table 2: Development of electricity prices over time (p/kWh)**

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<tbody>
<tr>
<td>230 kV</td>
<td>34</td>
<td>75</td>
<td>170</td>
<td>200</td>
</tr>
</tbody>
</table>
One consequence of the subsidies is that demand is growing rapidly and is outpacing supply. Damascus at present suffers about two hours a day of electricity blackouts. The current shortage of 1,000 megawatts (MW) is expected to grow to 1,400 MW in 2011.

A proposal to change prices must be transmitted from the Ministry of Electricity or Petroleum to the Council of Ministers and then, if agreed, it is issued as a Ministerial Decree. We understand that the Ministry of Economic Affairs would like to eliminate subsidies, but that this is not as yet a published policy.

3.4 An Agency

Many countries have found it useful to establish a specialised institution to prepare initiatives, draft regulations, monitor progress, ensure compliance, administer funds and perform other administrative activities. It will not necessarily be the only institution with powers in the area. If fiscal incentives are adopted then these will be managed through the office responsible for taxation, but there will still be a need to confirm the technical acceptability of the investment. Compliance with standards for equipment and boilers will normally be performed by special corps of inspectors already engaged in standards work. The regulator would normally enforce any specific obligation on electricity networks.

Despite the need to involve existing institutions, it is often considered useful to create a specialised agency. This agency would typically have the following responsibilities.

- Developing and disseminating targeted information to specific categories of users
- Organising training; liaison with universities and professional bodies
- Developing energy efficiency standards
- Conduct of surveys; analysis of data and maintenance of database
- Conducting or managing programmes of certification and labelling
- Liaising with other state institutions (e.g. Taxation offices and inspectorates)
- Administering energy efficiency funds
- Specifying mandatory audits; certifying and/or licensing energy auditors
- Designing short-term and long-term energy efficiency programmes
- Monitoring, evaluating and reporting on the implementation state activities and private initiatives
- Designing and proposing new interventions as opportunities are identified

Legislation would probably be needed to establish such an agency and to specify its duties.

The National Energy Research Centre (NERC) was created in mid 2003 to strengthen and coordinate energy efficiency studies and to facilitate the use of renewable energy in Syria. It is a government-owned institution, totally financed by the state. It enjoys a certain independence from the Ministry of Electricity as it is financed through a separate budget line directly from the Ministry of Finance.
The Board of NERC is chaired by the Minister of Electricity and co-chaired by the Deputy Minister; The Deputy Ministers of Oil and Mineral Resources, Environment and Higher Education along with the General Director of the Atomic Energy Commission are members. The Board of Directors approves an annual plan and thereafter NERC acts largely autonomously. The control, albeit incomplete, by the Ministry of Electricity seems to limit the perspective of NERC and to exclude it from many important areas of energy conservation, e.g. petroleum products and transport; there could be a case for having the Centre depend from the Prime Minister.

NERC built upon, but was also temporarily parallel to, the work done under the Supply-Side and Energy Conservation and Planning Project (SSEECP), financed by UNDP / GEF and the OPEC Fund. This project began in 1999 and was completed in 2007. The main objectives were to improve energy efficiency through the creation of a multi-purpose Syrian Energy Services Centre (SECS) and a National Energy Efficiency Program (NEEP). The activities of the project included the strengthening of institutional capacity within the Ministry of Electricity to implement policies.

The main achievements of the project were:

- Walk-through energy audits completed for 200 industrial, commercial, and services facilities
- 50 detailed energy audit studies
- Conduct 20 feasibility studies to implement recommendations and improvements of energy audits
- An Integrated Resources Programme for energy/electricity use in Syria
- Standards and labels defined for residential electric appliances (refrigerators, washing machines, air conditions).
- Public awareness campaign and information dissemination for energy efficiency through brochures, TV and newspapers advertisements

The National Energy Efficiency Programme appears never to have been delivered.

Among the responsibilities of NERC are:

- Monitoring compliance with the provisions of the law
- Elaborating energy conservation policies and strategies
- Preparing draft laws and regulations for energy conservation and renewable energy with a view to submit them via the Minister of Electricity to the Council of Ministers
- Administering labels and standards for appliances
- Supervising energy conservation units in public entities and ensuring quality training for staff of these departments and units to properly carry out their tasks
- Cooperation with relevant ministries to develop proposals for government facilities, financial incentives, tax and customs exemptions; propose financing and banking mechanisms to further energy conservation
- Creation of laboratories for performance testing and evaluation, and development of energy conservation systems
- Preparation of awareness and education programs in the area of energy conservation, and
- Dissemination; cooperation with the Ministry of Education to introduce the energy consumption rationalization concepts in schools
- Implementation of projects in various energy conservation areas and restitution of the
- Guide the private sector and activate its role in energy conservation, encourage the creation of private companies or jointly with the stakeholders in the country in accordance with energy service-related provisions of laws and regulations in force.
- Work with the private sector to take stock of potential electricity generation using renewable energy sources
The staffing implications for NERC are challenging. The Law does allow private companies to do the compulsory audits and NERC estimates that some 65 companies are capable of doing so at present, with the likelihood that there will be more than one hundred by 2010. NERC has to issue guidelines and to approve the audits, which will be onerous.

3.5 Standards and /or Labels

The obligation on manufacturers and importers of equipment to label goods or to meet specified standards is a policy measure introduced to overcome the market failure caused by asymmetric information. Potential users of equipment, faced with a choice of designs, may not have the skills and information to understand the consequences of their choice. They may be tempted to choose low-cost equipment with high energy consumption in preference to higher price options that perform better. Manufacturers may not have an incentive to provide this information if they think that their comparative market advantages do not include greater efficiency than competitors. Labelling and standards are not exclusive; goods can be obliged to meet a certain minimum standards and then labelled according to their performance when it exceeds the standard. Labelling and standards both require testing facilities and protocols; both require rigorous and competent enforcement.

The power system experiences two peaks in demand one in winter from heating and one in summer from air-conditioning. These peaks exacerbate the load-shedding and drive investment. They provide the political impetus for labels on domestic goods and for the promotion of solar water heating (see below).

In October 2008 a law was passed requiring domestic appliances to be labelled according to their energy consumption. The law covers refrigerators, freezers, washing machines, air conditioners. The Law only specifies that standards will be introduced, but does not say what they will be. The intention was that the Law would be implemented in two stages; after the first six months the manufacturers and importers are required to seek labels for their goods; after twelve months monitoring of the market was to begin.

The Law cannot be implemented until the relevant instruments are signed by the Minister and this has not yet been done. NERC is now working with the Ministry of Industry to develop regulations to enforce the Law for specific appliances. The label is similar to the European label and has five categories of performance.

Responsibility to issue the standards rests with the Syrian Arab Standards and Methodology Organisation (SASMO). The only existing standard is that for refrigerators and that was added as an Annex to the existing standards for refrigerators.

NERC has developed testing protocols and has done some preliminary market campaigns; the Ministry of Industry has funded the construction of test laboratories to verify compliance of manufacturers and importers with the law. Implementation will begin with refrigerators, then air conditioners and washing machines. NERC was made responsible by the Energy Conservation Law to monitor compliance.

Interestingly there has been significant market transformation in fluorescent tubes without any government policy to support it. This tubes and electronic ballasts now dominate the Syrian market. Domestic manufacture of fluorescent tubes was unable to compete has simply closed.
Standards for buildings are an important special case because:

- The rate of new building in developing countries is far higher than anywhere else in the world
- Buildings are large consumers of energy
- Buildings last for decades and will determine energy use for a very long time
- Large improvements in the energy efficiency of buildings can be achieved at low cost
- Developers will not normally make those improvements because of various chronic market failures
- The principal-agent dilemma is especially acute

The thermal insulation code was prepared by NERC and issued in November 2007. It has been effective since 1st January 2009, but is not mandatory. The code specifies heat transfer standards for all external surfaces; it applies to new buildings. About 30,000 new legal buildings are constructed each year; many other buildings are erected, but are illegal.

NERC trained 1000 engineers in interpreting and implementing the code, but responsibility for application was never clear. Since the adoption of the Energy Conservation Law this code is now mandatory. Under the Law, NERC coordinates the implementation of the law, but depends upon other institutions to perform the required tasks. Licences for construction are issued by municipalities and inspections are made by the Order of Syrian Engineers and Architects (OSEA). The Order is a syndicate and was established in 1950; it incorporates all Syrian engineers and architects and considers itself as a non-governmental organization, but it is used by government and local government to perform certain regulatory tasks.

As noted earlier, the Energy Conservation Law also places significant obligations upon developers regarding solar water heating and thermal insulation.

UNDP / GEF is planning to co-finance a new programme in Syria for about $3.5 million that will support construction of demonstration building exhibiting high energy efficiency. Details are not yet available; the project document is expected to be issued at the beginning of 2010.

### 3.6 Financial Incentives

Financial incentives can be separated into economic and fiscal incentives. Economic incentives are aimed at encouraging investment in energy efficient equipment and processes by reducing the investment cost directly and fiscal incentives are those actions that reduce the cost indirectly through the taxation system. Economic incentives can be further divided into investment subsidies and concessional finance. Investment subsidies change the perceived cost of an investment and concessional finance changes the financing conditions. Fiscal incentives differ from other financial incentives in several ways. They do not need to be funded directly; they are funded indirectly in that they represent a loss of revenue to the state budget. Generally they are available to all who qualify according to the terms of the exemption; there is no application and award process. For this reason they are sometimes preferred as being less susceptible to corruption and to political manipulation. They can be managed through the normal tax compliance regime. In middle income countries this approach is generally only practical with companies.

A last instrument that might be included under this heading is feed-in tariffs for cogeneration. If the feed-in tariff is above the opportunity cost of electricity then the instrument does really constitute an incentive. The incentive is funded by other consumers of electricity unless a special compensation is paid from the state budget to the network. If the feed-in tariff is above the marginal cost of electricity at
subsidised fuel prices, but below the opportunity cost then it is simply a regulation to correct the monopoly purchasing power of the network and the distorted fuel prices.

NERC has some restricted power to make funds available to industry for energy efficiency and to recover their money through the energy savings – a kind of energy performance contract. The facility is limited to state industry. A large part of industry is state-owned (about 35%), but most new investment is private so the state share is shrinking.

3.7 Obligations

Another approach, which may be combined with incentives, is to oblige companies to undertake energy efficiency by mandatory measures. These can be multiple and include obligations to:

- To carry out audits at regular intervals
- To report to central government database and possibly to communicate audit results to the public
- To report energy consumption, saving measures and implemented measures
- To propose action plans to implement the energy savings measures identified in audits
- To carry out certain specified measures
- To appoint an energy manager
- Mandatory certification of auditors
- Mandatory comparison of operation and investment to reference values (norms, benchmarking)

Some, or all, of these requirements may be confined to large users and made conditional on crossing a defined threshold of energy use.

Obligations can be mandatory or voluntary. Two main sets of voluntary agreements have been introduced. The first set comprises agreements between government and representative bodies of appliance manufacturers to reach specified improvements in the performance of appliances; the approach has also been extended to vehicles. The second set comprises agreements with individual industries to improve their own on-site energy performance. Industry can have various motivations to participate in these agreements. Appliance manufacturers may expect to persuade government to supplement their efforts with instruments aimed at stimulating purchases by consumers. It may in some instances be a mechanism to forestall regulation. This latter reason may also encourage participation in agreements to reduce energy use in industrial processes. Such agreements, although voluntary, may also be a condition for financial incentives.

The Energy Conservation Law provides for a comprehensive and detailed set of mandatory measures, covering the provision of data, mandatory audits and obligatory investments for state-owned industry.

The Energy Conservation Law establishes energy conservation units in industry whose duties will include the preparation of monthly and annual reports on energy use and the identification of opportunities for improved efficiency through the preparation of energy audit studies. Subsequently state-owned industries are required to implement all actions required by the organizational units and NERC. There are seven principal sectoral associations in industry of which the largest users are metallurgy, chemistry and textiles. The NERC intends to establish within its staff a team for each sector that will establish an ongoing relationship with each association.

The central units and NERC will propose projects for implementation according to their economic feasibility. It is foreseen that the Council of Ministers shall in due course stipulate regulations and codes.
for norms in industrial energy processes.

Penalties are prescribed for failure to comply.

*In liberalised markets an alternative to promoting energy efficiency through state financial incentives and funds is to place an obligations placed on suppliers. In this scheme a supplier or distribution network manager scheme is placed under an obligation to demonstrate programs that save specified amounts of energy related to their total supply volume. The supplier or network operator then builds the costs into his cost-base; he then has the usual interest of a commercial company in keeping his cost-base as small as possible. The requirement is enforced by the regulator; failure to comply may be penalized in proportion to the deficit between the target savings for the supplier and the amount achieved. Savings do not have to be made within the supplier's own area; they can be in fuel oil, coal or transport fuels. Such schemes can be complemented by “white certificates”. In this arrangement, suppliers are obliged to demonstrate they either accomplished energy savings directly or have bought certificates from others who can show they have made savings.*

No such scheme has been introduced, although the PEDEEE has on its own initiative studied the possibility of buying 1 million CFLs and distributing them to consumers. The company would enter into a contract with the consumer that the cost be repaid through the electricity billing system. A major obstacle is that all income from the activities of PEDEEE (and PEGTE) go to the state and all costs are paid by the state. PEDEEE is therefore entirely indifferent to its financial balance and has no incentive to be more efficient in any sense.

There is no formal obligation of this nature on power companies. PEDEEE has its own programme to distribute them to users recovering the money through the bill. The faith of the public in CFLs has been partially damaged by the experience of cheap imported CFLs from China that fail quickly.

### 3.8 Audits and the Promotion of ESCOs

*The original of an Energy Service Companies or ESCO is that an entity other than the energy supplier should identify, design, finance, supervise and commission projects for a client, to be compensated by a share of the energy savings achieved over a defined period. The partition of savings is determined by a special contract known as an energy performance contract (EPC). Actual practice varies widely; some ESCOs will finance the project, others will organise finance. Implementation is not easy and there are relatively few successful examples. The name ESCO is sometimes also given to companies that just provide consulting services, but do not enter into an EPC. It is important to be clear what is meant, as the latter is a much easier exercise than the former.*

A significant audit programme was undertaken within the UNDP / GEF project in cooperation with the Electricity Distribution Company from Alexandria in Egypt. The programme ran over two years; it included capacity building in universities and industry; energy conservation centres were established. Walk-through energy audits were completed for 200 industrial, commercial, and services facilities and 50 detailed energy audits were performed on sites selected from the walk-through audits. From the detailed audits, 20 feasibility studies were made. The estimated savings were about SP4 billion with 2 – 3 year paybacks. There seems to have been little immediate follow up to this programme; some industry implemented the recommendations, but there was no systematic programme. The audit concept has since been revived in the Energy Conservation Law.
3.9 Transport and Spatial Planning

More than half of the global population now live in cities and according to UN Habitat, by 2030, it will be 60 percent. Cities consume enormous amounts of energy and they have great inertia; road systems and land-use decided now will influence energy use for a hundred years. In urban metropolitan areas, transport creates a third at least of total greenhouse gas emissions. Promotion of public transport options and careful design of cities is critical for reducing emissions in cities.

There seems to be no clear responsibility for energy efficiency in spatial planning. The main responsibility for energy efficiency lies with the Ministry of Electricity, who in turn have no influence over urban planning.

3.10 Dissemination of Information

Access to knowledge is costly and may impede an individual or company from undertaking activities in energy efficiency. It is a legitimate role of government to generate and disseminate knowledge as a public good. We interpret the term knowledge in this context very widely to include data, technical guidance, research and demonstration.

PEDEEE has had since 2004 an active programme to disseminate public information on energy conservation. Each of the distribution companies within PEDEEE has a budget for this work. Under an agreement with the Ministry of Education, the companies do not have to pay for TV time or for space in government newspapers. The main driver for this activity has been the inability fully to meet demand.
4. Comparison of Syrian Practice with International Practice in Renewable Energy

This section attempts to compare the present status of renewable energy policy in Syria with international practice.

Public policy intervenes to correct market failures. In the case of renewable energy, the most common failures are somewhat similar to those identified previously for energy efficiency, but with a different emphasis. Distorted energy prices, unrecognised external costs, poor access to technical information all play a part. There is however a significant difference. Many measures of energy efficiency are cost effective, but prevented by distortions of the conventional market. This is also true of some renewable options, such as solar water heating. Many renewable energy technologies are not cost-effective even if the distortions of the conventional market are removed. They are justified by the external costs that they avoid, especially the external costs of GHG emissions. This means that they must be financially subsidised to financial incentives of one sort or another are critical to renewable policy.

In addition to these general market failures there can be specific market failures for electricity generated from renewable energy that is fed into a national grid as electricity. Excessive and unjustified costs of connection to the grid, inability to connect, disputes over responsibility for payment – these can impede renewable deployment.

Policy instruments are intended to correct or compensate for these various distortions.

4.1 Targets and strategy

Strategy sets out objectives and targets and defines the combinations of policy instruments that are expected to achieve the targets.

Hydropower contributes significantly to electricity generation in Syria. There are three large hydroelectric power stations on the Euphrates River under the control of the Ministry of Irrigation. The installations are designed primarily for irrigation, but produce important volumes of power. The installed capacity these plants is 1.5 GW.

The wind potential is strong in places; annual mean daily wind speed in some regions of the country reaches 8 m/sec. There is only one small and ancient demonstration plant connected to the grid.

The solar regime is good and extensive; the annual average long-term solar radiation on a horizontal plane is around 5 kWh/m2/day or 18 MWh/m2/Year. The average daily radiant flux varies from 4.4 kWh/m2/day in the mountainous areas in the west to 5.2 kWh/m2/day in the desert regions in the Badia. The annual sunshine hours also vary between 2,820 hours to 3,270.

Syria has developed two successive and related Renewable Energy Master Plans. The first arose from a project under UNDP funding that was implemented by UN-DESA and co-ordinated by the Ministry of Electricity. The Master Plan was envisaged to include specific plans to:

- Maximize the use of renewable energy sources in Syria such as hydropower, wind, solar thermal, and any other available renewable energy sources
- Increase the contribution of photovoltaic and wind energy in grid-connected electricity generation in order to reduce oil and gas consumption
• Disseminate suitable renewable energy resources in different geographic regions according to resources availability and energy demand patterns
• Provide government incentives to promote renewable energy applications and local manufacturing of components of renewable energy technologies such as wind turbines, photovoltaic cell
• Initiate pilot projects to demonstrate viable technology

It covered a period of 10 years, from 2002 to 2011 by which year the contribution of renewable energy technologies was to be 1012 ktoe / yr, equivalent to 4.3% of the primary energy demand. Of the renewable total, 50% was to be wind.

These targets will not be met. There are several reasons for the failure to achieve these targets. The money was apparently foreseen within the Five Year Plan, so financing was not a critical obstacle. One view is that the recommendations were never followed up politically; NERC did not exist at the time and there was no institution to adopt and continue the work. The UNDESA project unfortunately neglected to look into the policy and legislation needed to support the targets and it did not fully address the human and financial resources that would be needed. Another concern is that the tenders which were made did not attract bidders. The budget of NERC did include finance for a wind plant, but only one tender was received and the technical specification was not met (see below).

NERC is now renewing and extending this plan with support from GTZ and addressing some of the issues previously overlooked. The new Master Plan will run to 2030 and the tentative targets for the end of this period are:

• 1000 – 1500 MW of wind power
• 250MW of Biomass based plant
• 250 MW of photovoltaic plant
• 1 MTOE per annum of solar heat

The Plan will contain targets for each five years from 2010; it is at present tentative and needs to be approved by the Ministry of Electricity and then by the Council of Ministers.

### 4.2 Legal Reform

The main legal elements in a policy to promote renewable technologies are a clear targeted strategy or road map, a specialised agency to implement public activities and a support system specifically aimed at allocating the extra costs of the technology.

No such legislation exists. The revision of the Electricity Law now in preparation will clear some obstacles to the participation of private capital and may indicate in general terms some scheme of support for renewables.

### 4.3 An Agency

A specialised institution to make research, prepare initiatives, draft regulations, monitor progress, ensure compliance, administer funds and perform other administrative activities can be useful in promoting renewable technologies.

NERC has a mandate to promote renewable energy, but the main concerns of policy are determined by the heavily subsidized conventional energy sector, which has no reason to promote renewable energy that is more costly than alternatives. The institutional mandate of NERC needs to be reinforced
by a clear legal basis for significant incentives and commitments.

4.4 Standards and/or Labels

Standards would be inappropriate for large developments in renewable energy. Commercial developers are well equipped to decide for themselves on efficient and effective specifications. There is a good case for standards for small appliances such as solar heaters.

There are no standards for solar appliances in Syria. The need is recognised; the political responsibility rests with the Syrian Arabian Organisation for Methodology and Standards (SASMO).

The Higher Institute of Applied Science and Technology in its Centre at Damascus has test-beds for solar collectors, but they seem to be research facilities and do not appear to be used for any purpose with commercial implications. At this Centre there is also a climatic station and rigs to measure reflectivity, emissivity and other optical properties of materials. There seems to be no clear linkage to industrial or commercial objectives and no common vision among NERC, SASMO and the Higher Institute of Applied Science and Technology as to how to proceed to develop and implement standards.

4.5 Financial Incentives (Capital support)

Many financial incentives have been used in different countries to promote renewable energy. Support can either be offered to investment or to operation. Investment support for renewables is general delivered through the same type of instruments that are used to support investment in energy efficiency, e.g. capital grants, tax exemptions, soft loans and loan guarantees. In the case of grid connected renewables it is possible also to offer support to operation either by allowing the electricity to be sold at inflated tariffs or by obliging certain parties to purchase specified volumes. These instruments are to some extent exclusive and are discussed together in the next section.

There are no concessions on import duties for renewable energy products and components. However, renewable energy projects benefit from the Investment Promotion Law of 2007. This law governs capital investments in development projects, and applies to economic and social development projects approved by the Supreme Investment Council; it offers incentives to attract investments such as land ownership, and free foreign currency transfer out of Syria.

Some consideration is being given within NERC for financial incentives for domestic solar water heating. The intention is apparently to make concessionary finance available as a 50% grant and a 50% soft loan, but it is a tentative proposition and no decision has been taken.

4.6 Feed-In Tariffs and Obligations

Grid connected renewable energy is rarely cost-effective in its own right. It must be subsidised if it is to be developed by private industry. There are two main ways of delivering the subsidy. One is by offering higher prices than those available commercially; the other is by creating a second valuable good that represents the value of the fact that the energy is generated from renewables. The second scheme is operated by issuing certificates that certify the renewable origin and then obliging an identified group (normally suppliers) to buy them. This creates a market and therefore a price.

The offer of higher tariffs may be created by tendering a concession, it being understood that the con-
cession will be granted however the price achieved compares to market prices for electricity. This stands in continuity with traditional processes of tendering large plants to IPPs; it allows secondary criteria, such as percentage domestic content, to be added to the evaluation criteria. It has recently been adopted by Denmark for large developments. Higher tariffs made also be operated by a feed-in tariff that is made available to any generator.

Certificate based schemes define a quantity of renewable electricity to be produced and market forces identify a price that is unknown at the outset; feed-in tariffs fix a price to be paid for renewable electricity, but it is unknown what volume will be offered.

The main entities responsible for electricity supply are the PEEGT (Public Enterprise for Electricity Generation and Transmission) and PEDEEE (Public Enterprise for Distribution and Exploitation of Electrical Energy). The two entities are technically separated from, but in practice controlled by, the Ministry of Electricity; there is no separate regulatory agency. PEDEEE receives power at 66 kV and distributes at 20 kV and 0.4 kV. The Bulk Supply Tariff for power received from PEEGT is flat and is calculated to cover the costs of generation and transmission. PEDEEE sells to industrial consumers on a three-part Time of Use tariff and covers its costs of supply from PEEGT for this group (but not the opportunity costs – see above). Households are in the main subsidised even in relation to the costs of supply from PEEGT. Overall losses are about 25% of which transmission is 2-3%, technical losses are about 15% and the remaining 8% are non-technical losses. There is a small and old Danish wind plant of 150 kW connected to the PEDEEE network.

There is no legislative provision for any market within the electricity supply industry other than some indication of the contractual arrangements for any future IPPs.

Syria has a long history of state ownership in the sector and tendering is unfamiliar. The National Energy Research Centre (NERC) made a Call for Tenders in 2007 for constructing a wind farm of about 6 MW in Homs (Central Syria). The project was executed within the framework of an MOU on financial and economic cooperation between the Kingdom of Spain and the Syrian Arab Republic and was to be financed through a mixed credit (50% as financial assistance in the nature of a grant and 50% export credit). The tender was restricted to Spanish firms individually or within joint ventures. Only one bid was received and that failed to meet the technical specification.

Recently a tender was issued for a 200 MW diesel engine installation near Damascus and five companies replied proposing BOO and BOOT schemes.

A tender is planned a 1 MW photovoltaic station.

Syria is still getting to grips with the methodology of tendering and technical assistance with the process is needed.

4.7 CDM Finance

The Clean Development Mechanism offers operating support to projects through the provision of a market for the certificates of Carbon Emission Reduction. This is a complex project cycle, but can be useful for large projects.

Syria certified the protocol in the middle of 2005 and has designated General Commission for Environmental Affairs (GCEA) as the national authority for the CDM-Designated National Authority (DNA); it has not yet established an operational and financial mechanism to prepare projects. There are no
CDM projects in Syria as yet and the Ministry of Environment does not expect any in the near future; technical assistance is needed to cope with the complexities of the project cycle. The Ministry of Environment does not have the authority to oblige operating entities to implement CDM projects and generally they seem not to detect an interest for them to do so.

It seems that there have been discussions with Sweden, Finland and Italy over various options for developing CDM projects but that none of these have lead to fruition.

4.8 Information

It is a legitimate role of government to generate and disseminate knowledge as a public good. The main need in this respect is for data on the renewable resource. It makes no sense for every developer to make their own measurements of solar and wind data. The need is especially acute for wind as the extent of the resource varies locally.

A UNDP project in the late 80s supported the development of atlases for wind and solar resources. These need to be elaborated in more detail.

In 1994 the Meteorological Department and Scientific Studies and Research Centre (SSRC) issued a Solar Atlas for Syria.

A Wind Atlas for Syria was published in 1999 through cooperation between Syrian authorities and the Danish RISO Institute. The Wind Atlas is mainly based on data collected by 49 wind-monitoring stations established around the country over the period 1965-1993. At each site, the Atlas presents the measured wind speed data and calculated mean wind speeds (m/s) and power density (W/m²) at heights of 10 m, 25 m, 50 m, 100 m, and 200 m at 4 roughness classes. Most sites also include a wind rose and wind speed duration curve.

4.9 Industrial Policy

It is important that countries develop their own capacity to manufacture and / or assemble renewable technologies in parallel with the investment process. This can be done by targeted research, by grants to appropriate industries and by local manufacturing obligations in tendering.

There are no financial mechanisms or incentives to encourage the manufacture of renewable energy technologies either by Government banks or financial institutions.

The partial disengagement of Syria and the West in the recent past has impeded the exchange of learning and technology and restricted the participation of Syrian R&D institutions in international programmes. Similarly there has been little incentive in universities to develop the human resources to support the integration, of renewable technologies.

There are 25 domestic manufacturers of Solar Water Heaters, of which one is a state company. Chinese imports are very competitive and Turkish products also contest strongly the market. In the absence of some targeted industrial policy the prospects for domestic manufacture are difficult.

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There is some local capacity to assemble photovoltaic panels. The research centre of the Higher Institute of Applied Science and Technology in Aleppo has the capacity to produce 250 kW of photovoltaic panels per year from imported components. But it appears that only 150 kW of its products have been installed over the past 10 years, so clearly demand is well below the capacity to supply. The objective of the research centre is to sell to other state organisations (Ministry of Agriculture for pumping; Ministry of Transport for lighting) – it does not appear to have commercial ambitions. There is an intention to develop a state capacity in assembly of photovoltaic panels as a joint venture between the Ministry of Electricity and private interests from the Ukraine. The expected capacity is around 11 MW per year and the Ministry of Electricity has apparently underwritten the purchase of the entire output. There seems to have been no public, analytical process undertaken in support of this venture.

There are no domestic manufacturers of wind plant.
5. Case Studies

The purpose of the case studies is to demonstrate the processes of evidence-based policy making (EBPM) and theory-based evaluation (TBE). These techniques are well-known in the literature and have been widely applied, but not generally to technical areas of policy such as energy efficiency and renewable energy. There is potential for application in these areas because the methodologies provide a systematic basis for analysis and debate among stakeholders around a common and clear statement of the policy intervention that can be maintained and improved throughout the project cycle from formulation, through implementation, monitoring and evaluation.

The basic expression of this methodology is the behavioural model that underlies our understanding of the reaction of stakeholders to the policy instrument.

5.1 Evaluation of Standards and Labels

5.1.1 Background and Context

The first example that we choose in this case for illustration is the analysis of a programme to introduce standards and labels for domestic refrigerators.

5.1.1.1 The Labelling Programme in Syria

Standards for energy use in appliances have been an important constituent of energy efficiency policy in many countries. The basic idea is that consumers are lead to make poor choices of equipment because they lack the information to permit them to judge the benefits of paying more for efficient appliances. Mandatory labeling of the performance of equipment can overcome this market failure.

The most persuasive evidence of the potential impact of standards and labels is the refrigerator market in the US. The average new refrigerator sold in the U.S. today uses only a quarter of the electricity that would have been used by a refrigerator sold 30 years ago despite the new product’s increased size and added features. This correlation between labels and technical change does not of course mean causality, but generally throughout the world countries have introduced labelling programmes and they are generally thought to be effective.

Background to Standards and Labels in Syria

In October 2008 a law was passed requiring domestic appliances to be labelled according to their energy consumption. The law covers refrigerators, freezers, washing machines, air conditioners. The Law only specifies that standards will be introduced, but does not say what they will be. The intention was that the Law would be implemented in two stages; after the first six months the manufacturers and importers are required to seek labels for their goods; after twelve months monitoring of the market was to begin. The label is similar to the European label and has five categories of performance.

Responsibility to issue the standards rests with the Syrian Arab Standards and Methodology Organisation (SASMO). The only existing standard is that for refrigerators and that was added as an Annex to the existing standards for refrigerators.
NERC has developed testing protocols and has done some preliminary market campaigns; the Ministry of Industry has funded the construction of test laboratories to verify compliance of manufacturers and importers with the law. Implementation will begin with refrigerators, then air conditioners and washing machines. NERC was made responsible by the Energy Conservation Law to monitor compliance.

Technical Options

There are various technical possibilities for improving the performance of refrigerators by using thicker insulation, more efficient components and better seals. Table 3 presents some data on technical options and cost implications for a small refrigerator. The original data came from a study by the Government of India, but has been retrieved from the methodology paper of the model developed by CLASP for calculating the impact of labels and standards\(^3\). This reference contains several other examples from a range of countries and appliances.

The refrigerator studied is a 165-liter, manual-defrost, single-door domestic refrigerator-freezer. The price of the commonly available basic model was US$189 USD. Table 3 shows how successive improvements in design can reduce energy consumption and at what capital cost.

Table 3: Engineering Parameters for Indian Baseline Refrigerators and Efficiency Improvements

<table>
<thead>
<tr>
<th>Design Number</th>
<th>Design Option</th>
<th>Price Increase</th>
<th>Price Factor</th>
<th>Purchase Price</th>
<th>Elec. Cons. kWh/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Baseline design</td>
<td>0</td>
<td>1.00</td>
<td>189</td>
<td>438</td>
</tr>
<tr>
<td>1</td>
<td>0+ Gasket heat leak reduction by 25%</td>
<td>3</td>
<td>1.01</td>
<td>192</td>
<td>416</td>
</tr>
<tr>
<td>2</td>
<td>1+ Use higher EER(4.13) compressor</td>
<td>8</td>
<td>1.04</td>
<td>197</td>
<td>336</td>
</tr>
<tr>
<td>3</td>
<td>2+ Increase insulation thickness in door and wall by 50%</td>
<td>20</td>
<td>1.11</td>
<td>210</td>
<td>237</td>
</tr>
<tr>
<td>4</td>
<td>3+ Increase evaporator area by 33%</td>
<td>25</td>
<td>1.13</td>
<td>215</td>
<td>230</td>
</tr>
<tr>
<td>5</td>
<td>4+ Increase condenser area by 50%</td>
<td>35</td>
<td>1.19</td>
<td>225</td>
<td>215</td>
</tr>
</tbody>
</table>

Refrigerator Ownership

The UNDP / GEF project on Energy Efficiency made some market research on refrigerator usage. The project assembles a committee of local manufacturers and representatives from the Ministry of Industry. The estimates of the project were that refrigeration accounted for about 23% of domestic electricity

consumption in Syria as a whole and about 31% in Damascus. The committee made tests of characteristic refrigerators and found the average consumption of all types of tested refrigerators to be 785 KWh/year. This is the average of the sample, not the average usage of all appliances in Syria. The market will be skewed to smaller models and therefore average consumption should be less.

The number of families in Syria is about 3.8 million and the penetration of refrigerators is 0.97.

5.1.1.2 Scope of the Case Study

This case study seeks to analyse the benefits of improved designs to the national economy and also the likely effect of labelling programmes on consumer choice. It considers various ways in which the impact of the programme might be enhanced.

5.1.2 Evidence-based policy making

The procedure that we have proposed to implement evidence-based policy making comprises the following steps.

1. **Alternative** forms of intervention need to be reviewed and short-listed. Evidence of the success or failure of similar instruments in developed and developing countries needs to be studied with special emphasis on the conditions that created success and failure.
2. There must always be a **base-case** against which alternatives are screened. Alternatives should include all available instruments.
3. All the relevant potential **impacts** need to be identified and where possible, quantified.
4. Impacts should be assessed in **consultation** with the subjects of policy.
5. The cost of **compliance** needs to be assessed. Consideration should be given to how these costs can be minimized. It is necessary to consider who pays the compliance costs; there are generally alternatives with different implications for equity. The **procedures for compliance** need to be worked out as does the procedure for **monitoring** impacts.
6. **Indicators** need to be established of what is expected from the policy measures. These indicators should cover outputs, outcomes and impacts. Intermediate indicators are important in helping understand how policies work, how measures interact and how they can be improved.
7. Quantitative analysis of impacts is essential. The analytical method most commonly used is economic **cost-benefit analysis**.
8. Cost-benefit analysis should take into account **opportunity costs** of energy and **external environmental costs**.
9. **Multi-criteria analysis** maybe a useful support to decision making; sensitivity analysis is one expression of this idea.

The first five steps are discussed in this section; the formulation of indicators is discussed in the section on theory-based evaluation and the last three steps are demonstrated in the section on economic cost-benefit assessment.

5.1.2.1 Alternative forms of intervention

One alternative is to do nothing and to let technical progress take its course; this is also the base case and is discussed below.
Alternative standards

An important choice is whether to adopt endorsement labels or comparative labels. Endorsement labels simply attest to the fact that the appliance meets certain specified performance criteria. Comparative labels allow consumers to compare performance among similar products using either discrete categories of performance or a continuous scale.

In either case there is a range of standards that might be chosen as the basis for a labelling programme. The exact choice is probably not critical, certainly it would be difficult to make ex ante or ex post analysis of the costs and benefits of different choices. There are some clear practical aspects. Clearly the standards chosen should differentiate among the products on offer; it is no good if ranges are so wide that all products fit into a single category. There is some justification for having the highest standard at a level that is not yet available of the market as it provides an incentive for manufacturers and importers to achieve this performance. Standards should not exclude a large part of local production; it is possible that some local manufacturers will be obliged to close, but standards should be set at levels that are attainable. Standards should be reviewed from time to time and raised as the technology improves.

Minimum Energy Performance Standards (MEPS) can be an alternative or a complement to labelling. The idea behind MEPS is that no product is allowed on the market that does not meet a minimum standard.

It is also possible to combined labels with schemes of inducements to consumers to purchase more efficient appliances. This can be useful when the advantages to the electricity supply industry of efficiency are not fully reflected in tariffs.

We study here the basic case of comparative labels with variants that include complementary incentives and MEPS.

Mandatory or voluntary

The adoption of labels and standards may be voluntary or mandatory. In some respects voluntary programmes are more difficult to enforce than mandatory programmes because there is no regulation to enforce; the only issue is whether appliances are fraudulently labelled.

With voluntary programmes it is found, unsurprisingly, that manufacturers choose not to label poorly performing appliances so part of the impact is lost.

Some countries have reached voluntary agreements with manufacturers, allowing them discretion to achieve specified targets of energy efficiency averaged over their sales. This permits more flexibility in achieving improvements. It is much more difficult to assess compliance with this arrangement as it involves supervision of the entire product range, not just random sampling of individual appliances.

5.1.2.2 Base Case

It is more difficult than one might expect to construct a base case for this policy, because there is inevitably technical progress that will occur anyway without the policy. This will happen because of nor-
mal competitive pressures that drive manufacturers to make better products. This process is extremely hard to assess.

In the analysis described here we ignore natural technical progress and assume that without intervention the same range of appliances will be offered to the market. This is unrealistic, but it is hard to know how to improve on this assumption; we therefore make it, but note its consequences.

5.1.2.3 Impacts

We assume, for want of better information, that the technical information given in Table 3 is broadly appropriate for Syria. We therefore consider a policy of five standards with 0 being the basic design and 4 being the topmost. Appliances with design option described as 5 in the Table would therefore fit into category 4.

We assume also:

- 3.8 million households in Syria with 100% penetration of refrigerators (approximately true) and the average size and performance of refrigerator as described by the basecase in Table 3
- 1% growth per year in the refrigerator stock per year
- 1% growth in the size and consumption of the average appliance (in the absence of labels)
- Lifetime of 15 years for appliances and that the age profile is flat so that 1/15 of the stock is replaced every year

The impacts upon the domestic consumer we assess from the tariffs at which they pay for electricity and the costs of various designs as set out in Table 3.

The impact on the national economy we assess by calculating the fuel and capital displaced on the power system calculated at border prices for fuel, in other words at the opportunity cost of electricity. Assuming that the incremental investment in electricity generation is a steam turbine burning heavy fuel oil we assess this at about 12 USc/kWh. The value is very sensitive to international prices for petroleum, but this figure is roughly correct for present circumstances.

For the environmental impacts we assume that the average GHG avoided per kWh of electricity is 800 g / kWh, based on a steam turbine burning HFO.

5.1.2.4 Consultation

A labelling programme mobilises many stakeholders, including consumers, retailers, manufacturers and the mass media. A market transformation programme will work best when all these stakeholders work together in a coordinated fashion and the relationships between them are understood and function properly. Good consultation with manufacturers, retailers, consumer organisations and media is essential.

The participation of media experts is necessary because information and promotion campaigns must be run in parallel with the introduction of labels and media experts can advise on the targeting and content of such campaigns.

5.1.2.5 Compliance
Ensuring compliance with labelling and standards is the responsibility of government that will normally be delegated to a specialist agency. It is important to ensure good compliance not only because it affects the impact of the programme, but because if some manufacturers comply and others do not then the compliant manufacturers may lose sales and revenues.

Even in industrialised countries compliance rates can be quite low. Studies in Australia showed that one manufacturer had a 2% compliance rate, i.e. only 2% of appliances were labelled.

Compliance is an area where middle income countries do have difficulties; even in very visible circumstances non-compliance with regulations is common, e.g. the construction of illegal buildings. Ensuring compliance with labelling requirements will require a trained staff, testing laboratories and well-adapted protocols for regulatory risk assessment.

Compliance with the rebate scheme that we outline above would also be quite onerous. It would be necessary to verify transactions randomly to ensure that they met the requirements of the scheme.

Fines and potentially prosecution are essential if compliance is to be taken seriously.

It is an area where technical assistance could be helpful.

5.1.3 Theory-based Evaluation

5.1.3.1 Methodology

Evaluation of a project depends upon an underlying belief in how actors will be affected by the policy and how they will respond. We call this belief a “behavioural model”. We specify the behavioural model as a causal sequence in which the successive steps of policy implementation are shown in the first column and then in subsequent columns are listed various indicators, risks and assumptions. The successive steps of the policy may or may not specify recognisable behavioural assumptions; it depends very much on the type of policy investigated.

The behavioural model is a formal description of the process of implementation, the concerns to be raised at each stage and the measures that are to be adopted to make everything is working as expected. It provides a structure for the analytical steps and indicates the evidence that should be sought at each stage to support assertions or on which to found analysis. It allows the issues that might affect implementation to be identified and it allows different stakeholders to debate around a clear and concrete representation of the policy. In later stages it serves as the basis for monitoring and evaluation.

5.1.3.2 Indicators

Indicators need to be established of what is expected from the policy measures. These indicators should cover outputs, outcomes and impacts. Intermediate indicators are important in helping understand how policies work, how measures interact and how they can be improved.
• Inputs are the financial, human, technical or organizational resources used in the endeavour.
• Outputs are objectively verifiable indicators that demonstrate the progress made in implementing the measures.
• Outcomes are the immediate effects on the regulated subject.
• Impacts are direct measurements of the improvements that the programme is designed to bring about.

5.1.3.3 The Behavioural Matrix

The behavioural matrix for the basic scheme of mandatory comparative labelling is shown in Figure 3.1. The example illustrates how the behavioural matrix can be useful in helping identify the indicators that are necessary to ensure that policy is proceeding as planned.

The matrix can also be helpful in identifying flanking policies to cope with some of the risks and assumptions identified through the detailed breakdown of the expected behaviour and causal sequence. For example the requirement for sustained and detailed monitoring and remedy of non-compliance is very clear. The need for communication strategies is also very evident to explain to professional groups and to consumer what labels are, how they help and how to use them.

The behavioural matrix is also helpful in understanding how the policy may fail and in this instance there are several risks that appear from the analysis that could reduce impact. They are:

• If tariffs are so low that consumers have no reason to invest in more efficient devices then it may be necessary to supplement the policy with rebates to consumers for the incremental cost

Domestic manufactures may not have the necessary skills and capital to compete; it may be useful to provide grants for training and retooling production lines.

It is apparent that there is a danger that the policy has little environmental impact, but requires a big effort in ensuring regulatory compliance.
### Table 4: Behavioural matrix for standards and labels

<table>
<thead>
<tr>
<th>Behavioural model</th>
<th>Input</th>
<th>Output</th>
<th>Outcome</th>
<th>Impact</th>
<th>Risks</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>All appliances are required to indicate performance in conformity with prescribed categories</td>
<td>Administrative time ($)</td>
<td>Regulations defining standards and labelling obligations (Y/N)</td>
<td>Manufacturers review product range and manufacturing facilities</td>
<td></td>
<td></td>
<td>Manufactures believe compliance will be rigorously imposed</td>
</tr>
<tr>
<td>Manufacturers change product range and make new investments</td>
<td>New operations, new capital ($)</td>
<td>• Better adapted products and facilities (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td>Local manufacturers cannot meet new specifications or have no money to invest</td>
</tr>
<tr>
<td>A better range of products is offered to the market</td>
<td></td>
<td>• Numbers of improved appliances (#)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government undertakes promotional campaigns with representative organisations and media</td>
<td>Administrative time ($)</td>
<td>Information disseminated to professional and consumer groups (#)</td>
<td>Awareness of scheme and potential benefits is enhanced (?)</td>
<td></td>
<td></td>
<td>• Consumers give priority to energy use in choosing equipment</td>
</tr>
<tr>
<td>Behavioural model</td>
<td>Indicators</td>
<td>Impact</td>
<td>Risks</td>
<td>Assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------</td>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Consumers purchase more efficient appliances          | Incremental expenditure ($)                     | Sales of efficient appliances increase (#) | Consumers are indifferent to benefits | • Consumers understand the labels and standards  
• More efficient appliances are justified by tariffs |
| Compliance rates of manufacturers and importers are monitored | Administrative time ($)  
Testing laboratories ($) | Compliance rates assessed (#) |                       | • Adequate resources are directed to compliance ($)               |
| Penalties imposed on non-compliant actors             | Administrative time ($)                         | • Better compliance across the market (#) |                      | Government is prepared to prosecute if needed                    |
| More efficient devices save energy and GHG emissions  |                                                 | • Estimated from sales data (#,$)           |                      | • Baseline model is correct                                       |

Note on symbols:  
• $ indicates indicator is measured in financial terms  
• # indicates indicator is measured in numbers  
• Y/N indicates indicators is a yes or no observation  
• ? indicates indicator that cannot be quantified, but can be assessed qualitatively
5.1.4 Economic cost-benefit assessment

- Quantitative analysis of impacts is essential. The analytical method most commonly used is economic cost-benefit analysis.
- Cost-benefit analysis should take into account opportunity costs of energy and external environmental costs, particularly of the avoided emissions of carbon.
- Multi-criteria analysis is a useful support to decision making.

5.1.4.1 Estimation of behavioural change

Consumer behaviour in the choice of appliances will depend on the price that they pay for electricity. Prices in the residential sector at present are shown in the Table 5 in piastres per kWh and in US c/kWh assuming an exchange rate of 100 SP = $2.17. The Table also shows our estimation of the likely discount rate to be applied by these consumer groups and the percentage of consumers that fall into each category. This last data we have estimated from other countries with similar income.

Table 5: Residential electricity tariff

<table>
<thead>
<tr>
<th>Consumption volume</th>
<th>Piastres /kWh</th>
<th>USc/kWh</th>
<th>Discount rate (%)</th>
<th>% of consumers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100 kWh/ month</td>
<td>25</td>
<td>0.54</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>101-200 kWh/ month</td>
<td>35</td>
<td>0.76</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>201-400 kWh/ month</td>
<td>50</td>
<td>1.09</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>401-600 kWh/ month</td>
<td>75</td>
<td>1.63</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>601-800 kWh/ month</td>
<td>200</td>
<td>4.34</td>
<td>15%</td>
<td>2%</td>
</tr>
<tr>
<td>801-1000 kWh/ month</td>
<td>300</td>
<td>6.51</td>
<td>15%</td>
<td>1.5%</td>
</tr>
<tr>
<td>1001-2000 kWh/ month</td>
<td>350</td>
<td>7.60</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>&gt;2001 kWh/ month</td>
<td>400</td>
<td>8.68</td>
<td>15%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Combining this with the design information from Table 3 we can calculate the annual cost of owning and operating a refrigerator of the specified efficiency level at the discount rate and tariff level for each class of consumer. The results are in Table 6. The cheapest option for each tariff class is shown in bold. For the consumers in the lowest categories the basic option is the cheapest; no improvements are justified. These consumers form by far the largest number of consumers. This finding holds also for the lowest three groups even if the discount rate is dropped to 15%. For the consumers in the higher categories a refrigerator of level 3 is optimal. The last column shows the savings of the optimal design over the base design.

Table 6: Optimal Design by Tariff Level

<table>
<thead>
<tr>
<th>Consumption volume</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100 kWh/ month</td>
<td>97</td>
<td>98</td>
<td>101</td>
<td>107</td>
<td>109</td>
<td>114</td>
<td>0%</td>
</tr>
<tr>
<td>101-200 kWh/ month</td>
<td>79</td>
<td>80</td>
<td>82</td>
<td>86</td>
<td>88</td>
<td>92</td>
<td>0%</td>
</tr>
<tr>
<td>201-400 kWh/ month</td>
<td>63</td>
<td>63</td>
<td>64</td>
<td>67</td>
<td>68</td>
<td>71</td>
<td>0%</td>
</tr>
<tr>
<td>401-600 kWh/ month</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>49</td>
<td>50</td>
<td>52</td>
<td>0.7%</td>
</tr>
<tr>
<td>601-800 kWh/ month</td>
<td>51</td>
<td>51</td>
<td>48</td>
<td>46</td>
<td>47</td>
<td>48</td>
<td>10.0%</td>
</tr>
</tbody>
</table>
The opportunity cost of electricity for the state taking into account the international price of heavy fuel oil and the capital costs of generation, transmission and distribution is probably about 12 c/kWh (fuel cost at international prices in 2008 was 7.86 c/kWh). At 12 c/kWh the optimal design at a discount rate of 15% is level 5, which gives a saving of about 24% with respect to the base case.

Whilst recognising the weaknesses in the data we draw some robust conclusions:

- There are large cost-effective savings to be made
- In the presence of the highly distorted market for electricity, a policy of standards and labels will have little or no effect on the small residential users that make up the bulk of demand
- There is a big discrepancy between the welfare optimum for the state and the individual choices both with and without the policy option

### 5.1.4.2 Estimation of impacts

Table 7 shows our estimation of impacts if all purchasers of new refrigerators chose the optimal design according to their tariff. The first column shows the tariff group and the second column shows their optimal choice of design; the third and fourth columns show the consumption and the savings with respect to the base case. The fifth and sixth columns show the GHG emissions and the savings from the base case. The last two columns show electricity savings and GHG savings weighted according to the number of consumers in each category. From this we can see that the average weighted annual saving in electricity per purchase is only 10 kWh/year and the savings in GHG emissions per purchase are only 8 kg/year. Multiplying up by the number of new purchases, assumed to be 1/15 of the total refrigerator stock we find that the impacts over the country are just 2.5 GWh per year and 2000 tonnes of CO2. Of course this accumulates with time, every year there are new purchases and after the entire stock is renewed the savings would be proportionately greater, but the impact is still very low.

The impacts are very limited because the great majority of consumers in the low tariff category have no incentive to choose more efficient appliances even if they have the information to guide their choice. The rational choice is the cheapest device. It is only a few large consumers that rationally should buy efficient models. They may do so anyway, without labelling so to that extent the savings in the Table may be too high.
Table 7: Impacts on Electricity Use and GHG Emissions

<table>
<thead>
<tr>
<th>Tariff group</th>
<th>Optimal design</th>
<th>Consumption kWh/yr</th>
<th>Savings kWh/yr</th>
<th>GHG CO2 (kg)</th>
<th>Saving (kg)</th>
<th>Weighted savings kWh</th>
<th>Weighted CO2 savings (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100 kWh/ month</td>
<td>0</td>
<td>438</td>
<td>0</td>
<td>350</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>101-200 kWh/ month</td>
<td>0</td>
<td>438</td>
<td>0</td>
<td>350</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>201-400 kWh/ month</td>
<td>0</td>
<td>438</td>
<td>0</td>
<td>350</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>401-600 kWh/ month</td>
<td>0</td>
<td>438</td>
<td>0</td>
<td>350</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>601-800 kWh/ month</td>
<td>3</td>
<td>237</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>4.0</td>
<td>3.2</td>
</tr>
<tr>
<td>801-1000 kWh/ month</td>
<td>3</td>
<td>237</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>3.0</td>
<td>2.4</td>
</tr>
<tr>
<td>1001-2000 kWh/ month</td>
<td>3</td>
<td>237</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>2.0</td>
<td>1.6</td>
</tr>
<tr>
<td>&gt;2001 kWh/ month</td>
<td>3</td>
<td>237</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Average weighted annual saving in electricity per purchase (kWh/yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>Average weighted annual saving in GHG emissions per purchase (kg/yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.0</td>
<td></td>
</tr>
</tbody>
</table>
This deficiency might be remedied by “bribing” consumers to move their purchase to efficient designs. Table 8 shows the benefits to the state of consumers shifting their purchases. We again assume that the opportunity cost of electricity is 12 USc/kWh including the capacity element. We further assume a 10% discount rate for the state. The present value of benefits from a shift from the personal optimum to the national optimum (i.e. design level 5) is nearly $200 for the low tariff groups, but very much less for the high tariff groups who are already incentivised to choose level 3 designs.

The incremental cost of moving from the base case to level 3 is only $21. So the state can afford to pay the difference for the consumer will have very large benefits from the avoided subsidies. Indeed it will recoup the expenditure within the year.

Table 8: Benefits to state from shifts to nationally optimal designs

<table>
<thead>
<tr>
<th>Tariff category</th>
<th>Personal optimum</th>
<th>kWh/yr</th>
<th>Savings (kWh/yr)</th>
<th>Saving ($/yr)</th>
<th>PV saving ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100 kWh/ month</td>
<td>0</td>
<td>438.00</td>
<td>223</td>
<td>26</td>
<td>194</td>
</tr>
<tr>
<td>101-200 kWh/ month</td>
<td>0</td>
<td>438.00</td>
<td>223</td>
<td>25</td>
<td>191</td>
</tr>
<tr>
<td>201-400 kWh/ month</td>
<td>0</td>
<td>438.00</td>
<td>223</td>
<td>24</td>
<td>185</td>
</tr>
<tr>
<td>401-600 kWh/ month</td>
<td>0</td>
<td>438.00</td>
<td>223</td>
<td>23</td>
<td>176</td>
</tr>
<tr>
<td>601-800 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>22</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>801-1000 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>22</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>1001-2000 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>22</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>&gt;2001 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>22</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

The “bribery” of consumers to purchase more efficient appliances can be achieved by cooperation with retailers. It would be possible for example for consumers to receive a discount of $20 from the retailers on the price of an efficient refrigerator in return for disposal of the old appliance. The retailer is then reimbursed by the electricity industry.

The impacts of the labelling together with the rebate scheme are estimated in Table 9. It follows the same form as Table 7. The impacts are now very much greater because the small consumers are brought into the scheme.

Multiplying up by the number of new purchases, as described earlier, we find that the impacts over the country are a reduction by 51 GWh per year of electricity use and 40,000 tonnes of CO2. After 15 years the annual impact would be some 750 GWh, roughly corresponding to a 100 MW power plant.

The data of course is only indicative, but the main conclusion is robust; adding the complementary rebate scheme increases the impact of the labels by a factor of 20.

A Minimum Energy Performance Standard (MEPS) aligned on the performance of level 3 designs would have exactly the same impact. The choice between the two is essential practical and political. The rebate scheme has the advantage of being voluntary and having no direct cost to the consumer. It may be difficult to implement in some respects, but it does not create big incentives to smuggle and fraudulently label appliances.

The MEPS has the advantage that it costs little to the state other than the costs of compliance. It will be less popular as it increases the price of goods. It creates strong incentives to fraudulently label or
sell under the counter non-compliant stock.
### Table 9: Impacts on electricity use and GHG emissions (labels plus rebates)

<table>
<thead>
<tr>
<th>Tariff group</th>
<th>Adopted design</th>
<th>Consumption kWh/yr</th>
<th>Savings kWh/yr</th>
<th>GHG CO2 (kg)</th>
<th>Saving (kg)</th>
<th>Weighted savings kWh</th>
<th>Weighted CO2 savings (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>121</td>
<td>96</td>
</tr>
<tr>
<td>101-200 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>40</td>
<td>32</td>
</tr>
<tr>
<td>201-400 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>401-600 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>601-800 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>801-1000 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>1001-2000 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>&gt;2001 kWh/ month</td>
<td>3</td>
<td>237.00</td>
<td>201</td>
<td>190</td>
<td>161</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Average weighted annual saving in electricity per purchase (kWh/yr): 201

Average weighted annual saving in GHG emissions per purchase (kg/yr): 161
5.1.5 Conclusion

5.1.5.1 The Methodology

The example shows how EBPM and TBE can help to improve the sharpness of policy options by identifying risks and assumptions through the elaboration of the behavioural model and then by suggesting policy variants that can overcome perceived difficulties. In this instance it is the supplementary rebates to small consumers than compensate for the disincentive of the low electricity tariffs. They multiply the impact of the policy many fold.

The analysis could be much improved by a better description of the distribution of users by size and of the capital stock of refrigerators by size, efficiency and age. The data for such an analysis does not exist in Syria as far as we know and if it did it would be beyond the scope of this project to analyse it.

5.1.5.2 Standards and Labelling as a Policy Instrument

The impact of standards and labelling in Syria will be low as the policy is presently formulated. The main obstacle is the very low tariffs for domestic consumers. These could be overcome either by a supplementary rebate scheme for the incremental cost of more efficient appliances or by the introduction of MEPS. The two variants have much the same impact; the choice between them depends on the relative acceptability and practicality.
5.2 Evaluation of Policy Instruments for Private Wind Energy Development

Competitive Bidding and Feed-in Tariff

The second example that we choose in this case for illustration is the analysis of competing instruments for the promotion of wind energy in Syria.

5.2.1 Promotion of Private Investment in Wind Energy in Syria

The wind potential in Syria is strong in places; annual mean daily wind speed in some regions of the country reaches 13 m/sec. There is only one small and ancient demonstration plant connected to the grid.

Syria has developed two successive and related Renewable Energy Master Plans. The first arose from a project under UNDP funding that was implemented by UN-DESA and co-ordinated by the Ministry of Electricity. It covered 10 years, from 2002 to 2011, by which year the contribution of renewable energy technologies was to be 1012 ktoe / yr, equivalent to 4.3% of the primary energy demand. Of the renewable total, 50% was to be wind.

These targets will not be met. The UNDESA project unfortunately neglected to look into the policy and legislation needed to support the targets and it did not fully address the human and financial resources that would be needed. Another concern is that the tenders which were made did not attract bidders. The budget of NERC did include finance for a wind plant, but only one tender was received and the technical specification was not met.

NERC is now renewing and extending this plan with support from GTZ and addressing some of the issues previously overlooked. The new Master Plan will run to 2030 and will contain targets for each five years from 2010; the tentative target for wind for the end of this period is 1000 – 1500 MW. The Plan is at present tentative and needs to be approved by the Ministry of Electricity and then by the Council of Ministers.

5.2.2 Scope of the Case Study

This Case Study considers two policy instruments to promote wind power. One is a system of competitive bidding of specific favourable sites. The other is the adoption of a feed-in tariff at a predetermined rate.

The case study applies the concepts of evidence based policy formulation and theory based evaluation with the intention to demonstrate how these techniques can clarify analysis. The study covers the following three aspects:

- Evidence based policy preparation: For both policy instruments behavioural models are developed and the respective expected impacts are analysed.
- Economic assessment of the wind energy option: An economic assessment of the wind energy option for Syria is presented indicating the major factors determining the economic viability of this option.
- Conclusions regarding the utility and application of the methodology and to some extent the substance of the policy instruments analysed.
5.2.3 Comparison of Policy Instruments for the Promotion of Wind Power

5.2.3.1 General Context

Specification of the Alternative Policy Instruments

For the following analysis the following simplifying assumptions are made:

- The objective of the Government of Syria is to develop the wind power use of certain well specified geographical areas.
- For these areas preliminary wind data are available and are made available to interested wind developers, but the Government of Syria does not assume responsibilities.
- The two options are:
  - Competitive bidding for large areas. The Government of Syria would select the most attractive bid with the lowest tariff requirement.
  - A feed-in tariff perhaps differentiated by area.

For these two policy option the policy instrument and the concession awarding procedure are elaborated below.

Wind Policy Objectives

We assume that the objectives of the Syrian Government in developing the wind power potential of the country are:

- Optimal development of the resource,
- Lowest cost and most manageable grid extension,
- Minimal administrative costs,
- Surprise-free procedures,
- Strong competitive pressures for cost reduction on manufacturers,
- Maximisation of local content and development of local manufacturing capability,
- Lowest project price,
- Predictability of generation.

In achieving these objectives the government would need to consider how stakeholders will adapt to specific instruments. These concerns can be expressed through subsidiary objectives:

- Transparent and non-discriminatory allocation of sites,
- Clear criteria for choice among offers,
- How developers will manage risks in the electricity market,
- How developers will manage risks in the certificate market.
Assumptions

We assume in both cases that the certificates of emission reductions (CERs) issued under any CDM certification process are assigned to the developer. It does not significantly affect the analysis if they are assigned to other parties. The overall economic advantage of wind power is unaffected by the allocation of costs and benefits to different parties. The allocation will determine whether the different parties will see a benefit for them as individual entities. The developer will be rewarded by a combination of the PPA and carbon credits. If he receives the carbon credits then the PPA will be lower.

The assignment of the carbon credits should be to the party that perceives the highest value and/or lowest risk. The optimal allocation of CERs will depend on circumstances. It might be best to attribute them to the developer if it is a large scale plant done by major players on the world scale who would be better able to market the certificates than the state. For smaller projects, the state may be able to consolidate the CERs and manage things better.

5.2.3.2 Competitive Bidding

Specification of the Option

For the forthcoming discussion of the two options, it is necessary to specify the competitive bidding option (even to simplify the option certain extent for the transparency of the discussion):

- Syria will make available government owned land as the basis for a concession
- The concession will be auctioned in a two-stage procedure (pre-qualification and competitive bidding),
  - Pre-qualification: The admission criteria will be proven experience and financial capacity,
  - Competitive bidding: Selection of the most attractive bid.
- For the bid-evaluation there will be:
  - Bid acceptance criteria: The qualification of the bidder is acceptable
  - Ranking criteria: A set of ranking criteria based on the electricity sector policy options will be applied.
- Concession negotiation with the first ranked bidders: With the winner the conditions of the concession contract, the tariff and other technical conditions will be negotiated (concession contract and long-term PPA).
- Project implementation and monitoring: The Government of Syria will carefully monitor the project implementation.
- In parallel the next competitive bidding round can be launched.

Advantages

This option has the following advantages:

- **Low bid preparation effort**: The basis for the tender is are the delimitations of the concession area and the available data regarding the wind potential
- **Site development**: The burden and responsibility of the site development remains with the investor.
- **Market response**: The Government receives and immediate response from potential investors.
- **Integration into the national electricity system**: The feed-in point is defined.

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5.2.3.3 Feed-in Tariff

Specification of the Option

- The Government determines the feed-in tariff, which offer attractive development potentials and should provide incentives for the development of pilot projects.
- The Government develops a comprehensive legal and contractual framework of feed-in tariffs and the technical and contractual conditions to be applied.
- The feed-in tariff will be guaranteed in form of long-term power purchase agreements (PPA).
- Investors will evaluate the available information and will develop their sites.
- The investment proposals will be evaluated according to well specified criteria, which are known to all interested parties.
- Preparation of the following generation of wind projects: Based on the gained experience the Government will revise the feed-in tariff and conditions for the next-generation wind projects.

Advantages of this Option

The stated advantages of these options are:

- **Programme administration:** Once the general conditions and the feed-in tariff are defined the programme management and transaction costs are low.
- **Entrepreneurial freedom:** The investors know the conditions and have the maximum freedom to invite partners and to develop projects.
- **Market response:** The attractive feed-in tariff and the legal and contractual framework facilitate the development of the project.
- **Participation of national investors:** The feed-in tariff offers also for national investors good business opportunities because all sizes of wind parks can be developed.

5.2.3.4 Evidence Based Policy

We specify the behavioural models for these two policy instruments as a form of logical framework in which the successive steps of policy implementation are shown in the first column and then in subsequent columns are listed various indicators, risks and assumptions. The successive steps of the policy may or may not specify recognisable behavioural assumptions; it depends very much on the type of policy investigated.

The indicators that we adopt are measures of input, output, outcome and impact. By these terms we mean the following:

- Inputs are the financial, human, technical or organizational resources used in the endeavour,
- outputs are objectively verifiable indicators that demonstrate the progress made in implementing the measures,
- outcomes are the immediate effects on the regulated subject,
- impacts are direct measurements of the improvements that the programme is designed to bring about.

The behavioural model is a formal description of the process of implementation, the concerns to be raised at each stage and the measures that are to be adopted to make everything is working as ex-
pected. It provides a structure for the analytical steps and indicates the evidence that should be
sought at each stage to support assertions or on which to found analysis. It allows the issues that
might affect implementation to be identified and it allows different stakeholders to debate around a
clear and concrete representation of the policy. In later stages it serves as the basis for monitoring and
evaluation.

Behavioural models for the two policy instruments considered here are shown in Tables 10 and 11.
### Table 10: Behavioural Model of Competitive Bidding for Wind IPP and Associated Indicators, Risks and Assumptions

<table>
<thead>
<tr>
<th>Behavioural model</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Transmission company prepares network expansion plan; agrees priorities with regulator</td>
<td>• Time of officials and electricity supply industry staff ($)</td>
</tr>
<tr>
<td></td>
<td>• Transmission expansion plan and agreed requirements and restraints in development of wind site</td>
</tr>
<tr>
<td>• Prepare and publish request for proposals including requirements for domestic content.</td>
<td>• Time of officials to prepare RFP ($)</td>
</tr>
<tr>
<td></td>
<td>• Consulting contract to assist ($)</td>
</tr>
<tr>
<td></td>
<td>• Documents prepared (Y/N).</td>
</tr>
<tr>
<td>• Foreign and domestic investors and manufacturers perceive profitable opportunities.</td>
<td>• Number of prospective investors that request bid documents and seek to prequalify (#)</td>
</tr>
<tr>
<td></td>
<td>• Sufficient local capacity to allow multiple competitive bids.</td>
</tr>
<tr>
<td>• Bidders arrange consortium with local partners.</td>
<td>• Consortia formed (#)</td>
</tr>
<tr>
<td>Behavioural model</td>
<td>Indicators</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>• Prepare and submit prequalification</td>
<td>• Time of officials to assess submissions ($).</td>
</tr>
<tr>
<td></td>
<td>• Possibly consulting advice ($).</td>
</tr>
<tr>
<td></td>
<td>• Number of bids submitted: value of domestic content ($).</td>
</tr>
<tr>
<td></td>
<td>• Some exposure of a range of domestic investors (?).</td>
</tr>
<tr>
<td></td>
<td>• Sensitisation of some foreign investors to prospects (?).</td>
</tr>
<tr>
<td>• Qualified bidders appoint agent for measurement</td>
<td>• Agent appointed. Measurements completed on schedule (Y/N).</td>
</tr>
<tr>
<td></td>
<td>• Bidders will cooperate on measurement</td>
</tr>
<tr>
<td>• Bids prepared submitted and evaluated.</td>
<td>• Time of officials to assess submissions and prepare contract ($).</td>
</tr>
<tr>
<td></td>
<td>• Possibly consulting advice ($).</td>
</tr>
<tr>
<td></td>
<td>• Winning bid selected (Y/N).</td>
</tr>
<tr>
<td></td>
<td>• Number of bids submitted.</td>
</tr>
<tr>
<td></td>
<td>• Terms of proposed PPA (#).</td>
</tr>
<tr>
<td></td>
<td>• Value of domestic content ($).</td>
</tr>
<tr>
<td></td>
<td>• Some exposure of a range of domestic investors (?)</td>
</tr>
<tr>
<td></td>
<td>• Sensitisation of some foreign investors to prospects ($)</td>
</tr>
<tr>
<td>• Winner deposits commitment fee / performance bond.</td>
<td>• Bids are higher than expected.</td>
</tr>
<tr>
<td></td>
<td>• Bidders discount value of CERs.</td>
</tr>
<tr>
<td></td>
<td>• Risk assessed as moderate.</td>
</tr>
<tr>
<td></td>
<td>• Winner withdraws. Risk assessed as low.</td>
</tr>
<tr>
<td>Behavioural model</td>
<td>Indicators</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>• Selected bid is constructed and commissioned.</td>
<td>• Power plant commissioned (Y/N).</td>
</tr>
<tr>
<td>• Construction schedule is observed because of contract penalties.</td>
<td>• Winner withdraws. Risk assessed as low.</td>
</tr>
<tr>
<td></td>
<td>• Time overruns. Risk assessed as moderate.</td>
</tr>
<tr>
<td>• Plant operates with high availability because of contract penalties.</td>
<td>• Nominal cost of balancing power ($).</td>
</tr>
<tr>
<td></td>
<td>• Time to monitor and evaluate plant performance ($).</td>
</tr>
<tr>
<td></td>
<td>• Volume of electricity generated (GWh).</td>
</tr>
<tr>
<td></td>
<td>• Volume of fuel purchased for power plant (GJ).</td>
</tr>
<tr>
<td></td>
<td>• Financial cost of power acquired by PEGTE under PPA ($).</td>
</tr>
<tr>
<td></td>
<td>• Value of fuel saved at opportunity cost ($).</td>
</tr>
<tr>
<td>• CO2 emissions are reduced from baseline; fuel burn is reduced; domestic manufacture is strengthened; net cost to country is acceptable.</td>
<td>• Time to monitor and evaluate plant performance ($).</td>
</tr>
<tr>
<td></td>
<td>• Value of domestic content ($).</td>
</tr>
<tr>
<td></td>
<td>• Volume of CO2 emission reduction (mt).</td>
</tr>
<tr>
<td></td>
<td>• Value of carbon emission reductions ($).</td>
</tr>
<tr>
<td></td>
<td>• Net cost of project ($).</td>
</tr>
</tbody>
</table>

Note on symbols:
- $ indicates indicator is measured in financial terms
- # indicates indicator is measured in numbers
- Y/N indicates indicators is a yes or no observation

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## Table 11: Behavioural Model of Feed-In Tariff for Wind IPP and Associated Indicators, Risks and Assumptions

<table>
<thead>
<tr>
<th>Behavioural model</th>
<th>Indicators</th>
<th>Input</th>
<th>Output</th>
<th>Outcome</th>
<th>Impact</th>
<th>Risks</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prepare legislation and regulations necessary to implement FIT</td>
<td>• Time of officials and legislation ($)</td>
<td>• Published law and regulations (Y/N)</td>
<td>• Supplementary conditions defined (Y/N)</td>
<td>• Supplementary conditions added to applications for FIT</td>
<td>• Possible delays in finding legislative time</td>
<td>• Control of development will be difficult</td>
<td>• Insufficient local capacity; may be a restraint on competition</td>
</tr>
<tr>
<td>• PEGTE and Ministry collaborate to define terms and conditions to ensure optimal development of sites</td>
<td>• Time of officials and PEGTE staff ($)</td>
<td>• Conditions defined (Y/N)</td>
<td>• Supplementary conditions added to applications for FIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ministry specifies requirements for local content</td>
<td>• Time of officials in Ministry ($)</td>
<td>• Requirements defined (Y/N)</td>
<td>• Status of local manufacturers in negotiations enhanced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Insufficient local capacity; may be a restraint on competition
- Monitoring local content may be problematic
<table>
<thead>
<tr>
<th>Behavioural model</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input</td>
</tr>
<tr>
<td>• Explain and promote concept; foster stakeholder groupings - experts, landowners, municipalities, etc</td>
<td>Time of officials ($)</td>
</tr>
<tr>
<td>• Local and foreign investors develop projects and make preliminary enquiries</td>
<td>Time to prepare feasibility studies ($)</td>
</tr>
<tr>
<td>• Detailed measurements of wind resource performed</td>
<td>Time of specialised consultants ($)</td>
</tr>
<tr>
<td>• Final project form defined; finance arranged; land rights acquired. Submitted to Ministry/PEGTE</td>
<td>Time of consortia and consultants ($)</td>
</tr>
</tbody>
</table>

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Syria.doc
<table>
<thead>
<tr>
<th>Behavioural model</th>
<th>Input</th>
<th>Output</th>
<th>Outcome</th>
<th>Impact</th>
<th>Risks</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auction of concession where there are competitive bids</td>
<td>Time of officials in Ministry and PEGTE ($)</td>
<td>Winning bid selected (Y/N)</td>
<td>Projects authorised (#)</td>
<td></td>
<td></td>
<td>Developers may delay or withdraw for financial or technical reasons – little means of control</td>
</tr>
<tr>
<td>PEGTE adapts network expansion plan to cope with timing and nature of developments</td>
<td>Time of officials in Ministry and PEGTE ($)</td>
<td>Expansion plan revised (Y/N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authorised projects constructed and commissioned</td>
<td>Equipment, construction costs, supervisory costs ($)</td>
<td>Completed plant (Y/N)</td>
<td>Power plant commissioned (Y/N).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant operates with high availability because of commercial interest of owner</td>
<td>Nominal cost of balancing power ($)</td>
<td>Electricity generation (GWh)</td>
<td>Volume of electricity generated (GWh).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fuel displaced (GJ)</td>
<td>Volume of fuel purchased for power plant (GJ).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Financial cost of power acquired by PEGTE on terms of FIT ($)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Value of fuel saved at opportunity cost ($)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioural model</td>
<td>Indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Input</td>
<td>Output</td>
<td>Outcome</td>
<td>Impact</td>
<td>Risks</td>
<td>Assumptions</td>
</tr>
<tr>
<td>• CO2 emissions</td>
<td>Time to monitor and evaluate plant performance ($)</td>
<td>Value of domestic content ($)</td>
<td>Volume of CO2 emission reduction (mt)</td>
<td>Net cost of project ($)</td>
<td>• CO2 emissions are reduced from baseline; fuel burn is reduced from baseline; domestic manufacture is strengthened; net cost to country is acceptable.</td>
<td></td>
</tr>
<tr>
<td>are reduced from baseline; fuel burn is reduced from baseline; domestic manufacture is strengthened; net cost to country is acceptable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note on symbols:
- $ indicates indicator is measured in financial terms
- # indicates indicator is measured in numbers
- Y/N indicates indicators is a yes or no observation
5.2.3.5 Result of the Comparison

Through consideration of this deconstructed specification of the policy instrument we can begin to assess the merits of each instrument according to the objectives of the policy. The results of this comparison are shown in Table 12.

This case study is intended purely as an indication of the policy process and its relationship to evidence and analysis. It is not intended to provide a definitive answer to the question of what policy instrument is desirable.

The study shows that either instrument can be elaborated to provide a convincing option for implementation; it identifies some of the issues that need further exploration in each case and some of the risks that need to be managed before implementation is initiated.
### Table 12: Criteria for Choice among Options

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Competitive Bidding</th>
<th>Feed-in Tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key objectives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal development of the resource</td>
<td>Letting a large concession as a whole should reduce the dangers of interference from sub-optimal location of turbines.</td>
<td>Uncoordinated development of sites could limit production from the combined area. Might be avoided by detailed monitoring by PEGTE/Ministry, but at considerable effort.</td>
</tr>
<tr>
<td>Lowest cost and most manageable grid extension</td>
<td>A large concession in common ownership should ease the problems over locating, sizing and timing grid interconnections.</td>
<td>Feed-in tariffs create a high degree of unpredictability in demand for network reinforcement. Where projects are small, as is the case with most existing feed-in systems, this may not be a problem, but in the development of a large resource in piecemeal fashion it might be difficult to manage.</td>
</tr>
<tr>
<td>Minimal administrative costs</td>
<td>These are significant in terms of preparing tender documents and evaluating bids. Small in comparison to the project size.</td>
<td>There is a substantial effort required to provide the legislation and regulation required to implement the policy. Subsequently costs are low as tariff is for a standardised product.</td>
</tr>
<tr>
<td>Surprise-free procedures</td>
<td>There is the danger of withdrawal of the preferred bidder at a late stage. The likelihood can be reduced by clear specification of objectives and conditions and by consistency in negotiation. In the event of such a withdrawal the bidder should forfeit commitment fees and negotiations begun with the bidder next in line.</td>
<td>Surprises can originate from unexpected responses to tariff levels especially at early stages (see above).</td>
</tr>
<tr>
<td>Strong competitive pressures for cost reduction on manufacturers</td>
<td>A concession implies a quota of output fixed within a narrow range. There is some evidence that in quota systems because the volume of turbine sales is fixed manufacturers are not motivated to cut prices to extend sales. The value of this argument in Syria is debatable, because manufacturing technology is determined by international costs and markets.</td>
<td>A feed-in tariff is alleged to encourage price cutting to encourage higher volumes of sales at lower costs in turn leading to lower costs through higher volumes. There is some evidence that this has happened on European markets, but the relevance of this to the Syrian case is low.</td>
</tr>
<tr>
<td>Criterion</td>
<td>Competitive Bidding</td>
<td>Feed-in Tariff</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Maximisation of local content and development of local manufacturing capability</td>
<td>This is easily incorporated into the concession bidding. A lower limit can be set and a clear weighting applied to content above that limit. Monitoring of compliance is relatively straightforward because there is just the single project to monitor. Penalties for non-compliance can be exacted.</td>
<td>A lower limit of local content can be set as part of the regulation. It would be more difficult to provide incentives to exceed the limit. Compliance would be more cumbersome because of the larger number of projects, but not impossible.</td>
</tr>
<tr>
<td>Lowest project price</td>
<td>Tender of a concession should ensure that the lowest cost and most efficient operator wins the project and offers the lowest price electricity.</td>
<td>There is a significant problem in determining the level of feed-in tariffs. Feed-in tariffs if set too low will mean that no projects are offered and if set too high will mean that many are offered and the output is costly. Over time, by trial and error this can be corrected.</td>
</tr>
<tr>
<td>Predictability of generation</td>
<td>Saving major failings of the bidding system the predictability of the timing of generation additions should be good. The worst scenario is that no bids are received, which is unlikely. If the preferred bidder withdraws, there will be the next best candidate. Large commitment fees should be paid on contract settlement and penalties for delays.</td>
<td>The development is less predictable; it depends upon how attractive the feed-in tariff is.</td>
</tr>
</tbody>
</table>

### Subsidiary Objectives

<p>| Transparent and non-discriminatory allocation of sites | This is not an issue for the competitive tender, because the site is allocated to the preferred bidder. | It is not obvious how to offer sites under a feed-in tariff. First-come first served would be very hard to administer objectively and transparently in conjunction with necessary technical qualifications. Offering a site to the best technical proposal would equally be difficult; it would require penalties linked to deficient performance to avoid spurious technical claims. Auctioning the sites would seem to be the best option. That would entrain considerable administrative costs, but would bring with it some of the advantages of the competitive bidding process. |</p>
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Competitive Bidding</th>
<th>Feed-in Tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimise data acquisition costs</td>
<td>Competitive tender allows bidders to appoint a joint agent for measurement.</td>
<td>Under FIT a joint agent is less feasible. Data costs may be higher.</td>
</tr>
<tr>
<td>Criteria for choice</td>
<td>It may be difficult to choose among competing offers unless the technical criteria and weighting of criteria are carefully considered and designed. This can be done. One option would be a base requirement in terms of peak capacity, load factor, domestic content with the decision based on the PPA (evaluated according to a specified formula) adjusted by marginal improvements in terms of the base criteria.</td>
<td>There is no problem of this kind. Proposals need to be screened for environmental, planning and technical acceptability, but nothing else.</td>
</tr>
<tr>
<td>Risk for developer in electricity market</td>
<td>The developer faces no market risk for electricity; in the tender he proposes a PPA and that will be in force throughout the duration of the project.</td>
<td>There is no electricity market risk for a developer in a feed-in tariff. Income is assured over the lifetime of the project.</td>
</tr>
<tr>
<td>Risk for developer in certificate market</td>
<td>The project will only be financially viable with large financial subsidies from the carbon emission reductions. The future value of these is unknown and is a significant risk to the developer. A large developer with a large portfolio of plant and experience in the carbon market and strategies for that market, may perceive this risk less highly than a smaller developer under the feed-in tariff scheme.</td>
<td>Unless the Government of Syria proposes to take on the market risk of the CERs by offering a high feed-in tariff and keeping the CERs, the developer under the feed-in tariff is exposed to the same risks as for the concession. The smaller projects under the feed-in tariff may imply smaller companies to develop them and consequently less experience of the carbon market and less willingness to be exposed to that uncertainty.</td>
</tr>
</tbody>
</table>
5.2.4 Economic Cost-benefit Assessment

5.2.4.1 Methodology Applied

Assumptions and Data Base - Wind

The data used for the assessment of the wind energy option are shown in Table 13. In this table a difference is made between the cost of the wind energy supply to be under the responsibility of the wind energy IPP and the cost for stand-by capacity to be covered by the Syrian electricity sector (or Steam Turbine HFO).

Table 13: Data for Wind Energy

<table>
<thead>
<tr>
<th>Wind energy</th>
<th>Currency US Dollar</th>
<th>Currency Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td>Value</td>
</tr>
<tr>
<td>Required rate of return - IPP Wind</td>
<td>%</td>
<td>20%</td>
</tr>
<tr>
<td>Economic lifetime</td>
<td>years</td>
<td>20</td>
</tr>
<tr>
<td>Capital recovery factor (CRF)</td>
<td></td>
<td>0.2054</td>
</tr>
<tr>
<td>Investment cost wind turbine</td>
<td>USD/kW</td>
<td>1500</td>
</tr>
<tr>
<td>Levelised capital costs</td>
<td>USD/kW/year</td>
<td>308.03</td>
</tr>
<tr>
<td>Stand-by capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required rate of return - Electricity sector</td>
<td>%</td>
<td>10%</td>
</tr>
<tr>
<td>Economic lifetime</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Capital recovery factor (CRF)</td>
<td></td>
<td>0.1037</td>
</tr>
<tr>
<td>Investment stand-by capacity</td>
<td>USD/kW</td>
<td>1400</td>
</tr>
<tr>
<td>Required stand-by capacity</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Levelised capital costs</td>
<td>USD/kW/year</td>
<td>72.58</td>
</tr>
<tr>
<td>Levelised capital costs (energy)</td>
<td>US cent/kWh</td>
<td>16.94</td>
</tr>
<tr>
<td>Operation and maintenance</td>
<td>US cent/kWh</td>
<td>1.00</td>
</tr>
<tr>
<td>Total costs (energy)</td>
<td>US cent/kWh</td>
<td>17.94</td>
</tr>
</tbody>
</table>

Exchange rate: 1.4 USD/Euro

These assumptions are:

- Investment costs: 1500 USD/kW
- Cost for back-up: 1400 USD/kWh - the back-up capacity is required for 50% of the installed wind capacity
- Capacity factor: 27%, which corresponds to the expected operation condition of new wind energy parks in Syria
5.2.4.2 Assumptions and Data Base - Steam Turbine HFO Fired

Price Forecast Based on Crude Oil Prices

The US Department of Energy/Energy Information Agency has produced long-term forecasts of crude and petroleum product prices to 2030 (EIA, 2009). This is an authoritative source; it may not be right, but a great deal of effort and analysis has gone into its creation and it is a reasonable source to adopt.

Figure 2 shows the forecasts of crude prices in real and nominal terms to 2030.

It is statistically clear that fuel prices are strongly correlated over the medium term. We use a formula to describe a plausible relationship between HFO prices and crude oil prices. This formula is derived from regression studies of the price of HFO and crude at Rotterdam.

The formula we use is: \[ y = 0.97x - 79 \]

where \[ y = \text{HFO nominal price in $/tonne} \] and \[ x = \text{nominal price of crude in $/tonne} \]

This procedure gives a central case for HFO prices as shown in Figure 1.
We propose to use real 2007 prices for the cost benefit analysis to avoid having to link the power purchase agreement to inflation.

**HFO Steam Turbine**

The key-data for the HFO Steam Turbine alternative are given in Table 14. For the HFO price between 2010 and 2030 a linear interpolation is used.

**Table 14: Data for HFO Steam Turbine**

| Heavy fuel oil alternative | Currency US Dollar | | Currency Euro | |
|-----------------------------|--------------------|----------------|----------------|
|                            | Unit   | Value |    | Unit   | Value |
| Investment costs            | USD/kW  | 1,400.00 | Euro/kW | 1,000.00 |
| Levelized capital costs     | USD/kW/year | 145.17 | Euro/kW/year | 103.99 |
| Capacity factor             | %      | 90%   |    | %      | 90%   |
| Levelized capital costs     | USD/kW   | 1.34 | Euro/kW   | 1.02 |
| Non-fuel O&M costs          | USD/kW   | 0.50 | Euro/kW   | 0.36 |
| Total fixed costs           | USD/kW   | 2.34 | Euro/kW   | 1.67 |
| Total costs                 | USD/kW   | 12.49 | Euro/kW   | 9.92 |
| Value of CO2 CERs           |         |       |    |         |       |
| CO2 emissions HFO generation | g/kWh  | 676.9  | g/kWh | 676.9  |
| Value of CO2 CERs (0 USD / t CO2) | USD/kWh | 1.36 | Euro/kWh | 0.96 |
| Value of CO2 CERs (50 USD / t CO2) | USD/kWh | 3.38 | Euro/kWh | 2.41 |
5.2.4.3 Result of the Assessment

Figure 3 shows the projection of units cost for the two energy supply alternative. The increase steam-turbine generation unit cost is due to the assumed price increase (in real terms) for HFO.

In addition to the base case, two price variations over the whole planning period are considered:

- 30% higher HFO prices,
- 30% lower HFO prices.

With these projections of the unit costs it is possible to determine economic assessment criteria (the cost of the Steam-turbine HFO alternative is the benefit of the wind power alternative). The results are given in Table 15.

Table 15: Wind Energy - Economic Assessment Criteria

<table>
<thead>
<tr>
<th>Economic assessment</th>
<th>Unit</th>
<th>Base case</th>
<th>Higher price</th>
<th>Lower price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic IRR</td>
<td>%</td>
<td>n/a</td>
<td>16%</td>
<td>n/a</td>
</tr>
<tr>
<td>Economic NPV (DR 10%)</td>
<td>US-cent/kWh</td>
<td>-26.38</td>
<td>6.16</td>
<td>-56.95</td>
</tr>
</tbody>
</table>

In the base case the wind power alternative is not economically viable. Under the assumptions of 30% higher HFO prices, the wind option would be economically feasible with an IRR of 16%. In Figure 3 it can be seen that under the high HFO price scenario the wind energy option would have very soon lower unit costs.

Fig. 3: Forecast of Unit Costs for Wind Energy and Steam-turbine HFO
5.2.4.4 Variation HFO Prices and Required Rate of Return on Equity

The required rate of return on investment of IPP Wind developers is a key-factor in evaluating the costs of wind energy in Syria. The analysis is based on a rate of 20%, which reflects the perceived risk regarding the innovative character of wind energy IPPs in Syria and the still not well developed regulatory framework. Figure 4 illustrates the impacts of the required rate or return upon the unit costs of wind turbines.

Fig. 4: Impact of required rate of return on investment upon unit costs

To illustrate the impacts of the stated assumptions a sensitivity test was prepared:

- Wind energy - Required rate of return between 10% and 20%,
- Price for HFO in 2010: The price was varied between 450 and 650 USD/tonne (while the long-term HFO price for 2030 is kept constant at 800 USD/tonne).

In Table 16 the NPV per kW installed wind capacity for a range of 2010 HFO prices and IPP wind return requirements are given.

Table 16: Wind Energy - Impact of HFO and Return on investment requirements
(NPV in USD per installed kW wind capacity)

<table>
<thead>
<tr>
<th>HFO 2010 USD/tonne</th>
<th>IPP Wind - Required rate of return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>650</td>
<td>46.69</td>
</tr>
<tr>
<td>600</td>
<td>40.48</td>
</tr>
<tr>
<td>550</td>
<td>34.28</td>
</tr>
<tr>
<td>500</td>
<td>28.08</td>
</tr>
</tbody>
</table>
The conclusion of this assessment is:

- Under the assumed long-term projection of the HFO price (see Figure 1) of 800 USD/tonne in 2030, the wind energy option might be very attractive for Syria. The open issue is the level of HFO prices in 2010 - for this the sensitivity test is prepared for different HFO prices in 2010.
- The key-issue is the return in investment expectation for wind energy. By developing an appropriate and reliable legal and institutional framework for Wind Energy (reducing the return requirements from 20% down to 14% or lower) the economic feasibility of the wind energy option is secured over a wide range of possible 2010 HFO prices.

5.2.5 Carbon Credits

The economic rate of return on the investment is increased when we account for the economic benefits of generating less greenhouse gases and in particular less carbon dioxide. This can be put in economic terms by assuming a value for the reductions in carbon monetised by selling the certificates that certify the reduction (CERs) on the appropriate exchange.

The certificates may be assigned to the developer or to the state. If they are assigned to the developer then the PPA would be adjusted accordingly to bring the expected rate of return on capital back to the required level. The CERs carry a risk, as their future value is not known. The optimal assignment of CERs will depend on which partner can best manage that risk. This will vary from development to development. If the developer is large and has a big portfolio of credits it may be best to add them to that portfolio. In other circumstances the developer may be unwilling to accept the risk and would therefore demand a disproportionately higher PPA and a better result might be obtained if the state took the CERs.

The assignment does not affect the economic assessment of the project as a whole. The Table 17 shows the situation for two price levels for the carbon credits (20 and 50 USD/t CO$_2$) and Figure 5 shows the economic net cash-flow for the wind option (based on one kW installed wind capacity). The CO$_2$ emissions are based on the HFO alternative electricity generation. The price of 20 USD/t CO$_2$ would not be sufficient to achieve an economic feasibility of the wind energy option for Syria, with a price of 50 USD / t CO$_2$ the economic IRR would be higher than the economic acceptance threshold of 10%.

Table 17: Wind Energy - Economic Assessment Criteria with Carbon Credits (Base case)

<table>
<thead>
<tr>
<th>Economic assessment</th>
<th>Unit</th>
<th>Base case</th>
<th>Carbon credit USD/t CO$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>20.0</td>
</tr>
<tr>
<td>Economic IRR</td>
<td>%</td>
<td>n/a</td>
<td>1.35</td>
</tr>
</tbody>
</table>
It is of interest to illustrate the importance of carbon credits for one of these different cases. This is done in Table 18 for IPP Wind Return Requirement - 16 % / HFO prices in 2010 of 470 USD/tonne. Considering this specific case, it can be seen that with a carbon credit of 20 USD / t CO₂ the wind energy option would be highly attractive for Syria and while offering a sufficiently high return for the IPP wind developer.

Table 18: Wind Energy - Economic Assessment Criteria with Carbon Credits (IPP Wind Return Requirement - 16 % / HFO price 2010 470 USD / tonne)

<table>
<thead>
<tr>
<th>Economic assessment</th>
<th>Unit</th>
<th>Base case</th>
<th>Carbon credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>20.0 USD/t CO₂</td>
</tr>
<tr>
<td>Economic IRR</td>
<td>%</td>
<td>4.50%</td>
<td>19%</td>
</tr>
<tr>
<td>Economic NPV</td>
<td>US-cent/kWh</td>
<td>-5.21</td>
<td>5.47</td>
</tr>
</tbody>
</table>
5.2.6 Conclusion

5.2.6.1 The Methodology

The case study demonstrates the advantages of developing deconstructed versions of policy prescriptions as an aid to analysis and to stimulate focused debate among stakeholders. It demonstrates the approach for the case of two policy options for wind and shows how the options can then be analysed in the light of the policy objectives to form the basis for decision.

The study then demonstrates the linkage between this deconstructed specification and detailed economic analysis.

5.2.6.2 Policy instruments for Wind

It is beyond the purpose of this illustrative case study to draw definitive conclusions regarding the wind energy option for Syria and the involvement of private wind IPPs.

Some interesting aspects of the study are:

- **Competitive bidding**: The start of the tendering and bidding process might not require an elaborated legal and contractual framework and business negotiations might be initiated very fast. This policy option is appropriate for big wind parks on land that can be legally tendered as a single concession.

  Without a reliable sector strategy (development of the transmission network and required back-up capacities) and stated sector policy objectives and legal / contractual framework, the negotiations can be at risk.

- **Feed-in tariff**: The up-front efforts of this policy option are high because the appropriate feed-in tariff has to be determined and the legal and contractual framework has to be developed. There is some risk in the early stages that tariffs may be set too high or too low as there is little basis on which to proceed. The standardised nature of the transaction makes it appropriate for small sites spontaneously offered by developers.

- **Economic and commercial viability**:  
  - The wind energy option can be economically justified, but the assessment shows that the main issues are the opportunity cost of fuel and the return on equity requirements of the wind IPPs. The wind energy option is only an economic viable option (considering the national perspective) under quite restrictive conditions, namely:
    - A power purchase agreement that is based on the opportunity costs of alternative supplies of electricity.
    - Sufficiently low perception of risk by the developer to bring discount rates down to say 16%.
    - Quite large credits for the carbon emissions that are avoided (higher than $20 / tonne)
    - The commercial viability depends very much upon the offered / permitted return on investment for the wind IPP. By establishing a reliable regulatory framework the perceived risk can be significantly reduced so that a return requirement of 16% will be acceptable for wind IPPs.
    - If the Government decides to hand over the certificates of CO2 emission reductions to the wind IPP they will be part of the equity remuneration.
6. Institutional Reform - Strategic Options

The policy cycle is illustrated in the following figure.

**Fig. 6: Illustration of the Policy Process**

There are institutional needs at all stages of this cycle. Decision-making proceeds through the general processes available in the executive and legislative branches of government. Normally policy briefs will originate from the executive and be elaborated by Ministerial departments often with analytical support from agencies of government and paid consultants and in consultation with other stakeholders. Primary legislation is debated and finally sanctioned by the legislature. In many countries Ministerial Decrees are used to elaborate on primary legislation.

This structure needs to be properly serviced with evidence and analysis if it is to work well. There is a need for an institution, or perhaps several, to gather and maintain evidence and to carry out analytical work that feeds into the formulation of policy and later guides the monitoring and evaluation and reformulation of policy. Foresight studies are a part of the evidence that should be considered in policy formulation and these should take into account the evolution of global trends and policies in energy and the environment, but also of trends beyond these disciplinary frontiers.

Implementation of policy may be conducted by Ministerial departments or nominated agencies. In developed countries, implementation is often assigned to specialist agencies. In developing countries it is more common that policy is implemented by the Ministry. Implementation will often be demanding of resources, this may be the case for some market based instruments as well as the majority of regulations.

### 6.1 Improvement of Policy Coordination and Implementation
As discussed in the previous sections, the Syrian government already has adopted plans and strategies for promoting energy efficiency and renewable energy. However, the impact of these policies is rather limited due to inadequate policy implementation. In this regard, fragmented responsibilities among several governmental entities and a lack of policy coordination are considered a major barrier for advances in renewable energy promotion and energy efficiency. Several entities and ministries are involved in Syrian energy policy-making. Resource and energy planning are under auspices of the Higher Planning Council (HPC) and the Supreme Energy Committee (SEC). The power sector is managed by the Ministry of Electricity, whereas national oil reserves and the oil industry are controlled by the Ministry of Petroleum and Mining Resources. Energy efficiency in the different economic sectors is handled by the Ministries responsible for each corresponding sector. The new energy conservation law furthermore requires establishment of central energy conservation units in all Ministries. In 2003, the National Energy Research Centre (NERC) was created to strengthen and coordinate energy efficiency studies and to facilitate the use of renewable energy in Syria.

Issues related to renewable energy are covered by several entities. HPC and SEC examine renewable energy resources and some activities on renewable energy are attached to the Atomic Energy Commission (AEC). Syrian hydro power plants are managed by the Public Establishment of the Euphrates Dam, which is part of the Ministry of Irrigation. The Ministry of Environment is planning renewable energy projects as part of the national greenhouse gas mitigation strategy. The Ministry of Agriculture and Agrarian Reforms has conducted programmes for renewable-based water pumping systems and the Ministry of Industry supports the manufacturers of renewable energy technology equipment.

The activities of the aforementioned authorities are implemented without a coordinating entity. In the late 1990s, a study funded by the European Union proposed to establish a Renewable Energy Authority as part of the Ministry of Electricity. Such an authority, however, has not been set up yet. As a first step, Syrian policy-makers could consider to establish an inter-ministerial steering group on energy efficiency and renewable energy under auspices of the Prime Minister to coordinate related activities among the involved ministries. Shifting the responsibility for both fields to the Prime Minister’s office would emphasise their high political priority and possibly ease policy implementation. In a second step, the government might form a department for renewable energy and energy efficiency under the Prime Minister’s office in order to concentrate responsibilities. Studies on the deployment of renewable energy conclude that clearly defined institutional responsibilities are needed in order to successfully disseminate renewable energy technologies and avoid planning delays or a lack of coordination between different authorities. The government of India has even set up a Ministry of New and Renewable Energy which fosters the development, production and deployment of renewable energy technologies. Among other achievements, it has contributed to the rapid development of India’s wind industry in recent years. However, Syrian economic and social structures are different from India’s (population size etc.), and it has to be analysed how experiences from India could be transferred.

An independent and strong agency is needed to prepare, follow up and monitor the implementation of renewable and energy efficiency policies and regulations in Syria. Monitoring of implementation and compliance seems to be particularly important as Syria’s previous energy policy plans and strategies have shown little impact. These tasks are currently handled by the National Energy Research Centre (NERC), which was founded in 2003 to supervise advances on the fields of energy efficiency and renewable energy as well as to carry out research and development activities. The NERC was funded by the state and its board is chaired by the Minister of Electricity and co-chaired by the Deputy Minister. Other Deputy Ministers dealing with energy issues are board members, e.g. the Deputy Minister of Oil and Mineral Resources. Besides monitoring of compliance, existing regulations for renewable energy and energy efficiency delegate important tasks to NERC, e.g. preparation of draft laws, regulations and policy strategies, cooperation with relevant ministries and capacity building measures.

In order to strengthen the competencies of NERC, the following steps are proposed: Being mainly
controlled by the Ministry of Electricity seems to limit the perspective of NERC and to exclude it from many important areas of energy conservation. Thus, the government could consider - as in the case of a possible inter-ministerial steering group - to locate the centre under the auspices of the Prime Minister. This would also strengthen NERC’s position towards the conventional energy sector, which has a high influence on Syria’s energy policy agenda. In addition, NERC’s institutional mandate should be reinforced by a clear legal basis for significant incentives and commitments for renewable energy and energy efficiency.

6.2 Adopting Incentive Mechanisms and Capacity Building

Regarding the deployment of renewable energy, there is a lack of incentives to meet the government’s policy targets – despite ambitious policy targets and strategies. This situation is partly due to a strong focus of Syrian energy policy on the expansion of capacities for the production and conversion of domestic crude oil and natural gas. It seems that the promotion of renewable energy is not among the top priorities of Syrian energy policy and characterised by a fragmented, project-oriented approach. Most renewable energy projects revolve around the 2007 “Investment Promotion Law No. 8”, which governs capital investments in development projects and applies to approved economic and social development projects in all economic sectors, including the energy sector.

In order to shift the focus of Syrian energy policy and to build an effective and efficient renewable energy policy framework, capacity building measures and a comprehensive market-oriented incentive scheme for the deployment of renewable energy are recommended. Capacity building initiatives should involve domestic and international experts as well as technology demonstration projects in order to create examples of best practice and increase the knowledge on the benefits of renewable energy and energy efficiency. Programmes for capacity building could encompass educational measures as well as international field trips to visit showcase plants. Similar projects are being realised and funded in several countries by international organisations in collaboration with national or local stakeholders. For example, the United Nations Development Programme (UNDP) and the Chinese Development and Reform Commission (NDRC) plus other organisations commonly realise capacity building measures for a commercialisation of renewable energy technologies in China. The initiative encompasses activities such as workshops and offers support for the design and implementation of regulations as well as the realisation of demonstration projects and feasibility studies (UNDP et al. 2009). In Syria, the “Supply-Side and Energy Conservation and Planning Project (SSEECP)” by UNDP and the GEF which was completed in 2007 was a step in the right direction. The Syrian government is suggested to strengthen its collaboration with international donating organisations in order to foster international knowledge transfer.

The design and adoption of a major incentive mechanism for renewable energy should encompass different types of renewable energy technologies and guarantee financial support while at the same time inducing technology cost reductions and innovation. So far, NERC has merely published one tender for a wind turbine in 2007, which attracted only one bidder that did not meet the technical requirements. A tender for two wind parks with a capacity of 130 MW will be announced this year. In general, competitive bidding processes as an instrument for the promotion of renewable energy imply some risks, especially for projects in developing countries or emerging economies, as they do not offer investment security over a clearly defined period of time. Further risks, in case tenders have attracted sufficiently qualified bidders, are withdrawal of the preferred bidder at a late stage or “cost dumping” among the bidders. The United Kingdom tried competitive bidding for renewable energy resource obligations during the 1990s under its “Non-Fossil-Fuel Obligation” (NFFO) policy. Power producers bid on providing a fixed quantity of renewable power with the lowest-price bidder winning the contract. The process encouraged competing projects to bid below costs in order to be awarded contracts, with the result that successful bidders were unable to meet the terms of the bid or ended up insolvent. There-
fore, contracts awarded to low-bidders did not always translate into projects. On the other hand, bidding processes implicate important advantages. They may reduce the danger of interference from sub-optimal location of turbines, ease problems over sizing and grid interconnections and lead to small administrative costs in comparison to the project size.

Feed-in tariffs are an alternative approach for renewable energy promotion; they have been adopted in numerous countries. Feed-in tariff schemes include guaranteed purchase prices over a clearly defined period (usually 20 years). Therefore, they provide a high degree of investment security, which is essential for encouraging investments of independent power producers in a monopolised power sector like the Syrian one and for stimulating transfer of technology and know-how. These effects would be consistent with Syria’s current policy to open the electricity sector to IPPs in order to attract foreign capital. This step is needed to modernise and expand the country’s power sector and to satisfy growing electricity demand. Furthermore, such a development could help to reduce domestic demand for Syria’s shrinking crude oil and natural gas reserves.

However, preparing a feed-in legislation requires a substantial administrative effort and a high degree of accuracy. In order to design the instrument in a most effective and efficient way, details of the regulation should be discussed in a consultation process with concerned stakeholders. Furthermore, a feed-in tariff scheme should be complemented by measures to strengthen the national power grid in order to enable grid access of new power producers.

Despite the complexity of feed-in tariff schemes, many developing countries and emerging economies have implemented or plan to implement them, including Argentina, Brazil, China, Ecuador, India, Kenya, Nicaragua, Pakistan, Mauritius, South Africa, Taiwan and recently Iran. One of the oldest feed-in schemes exists in Mauritius. In the early 1990s, the Mauritanian government has established a feed-in tariff for bagasse and co-generation. Sugar cane production is one of the major drivers of the Mauritanian economy with about 80% of the arable land being used for this purpose. Bagasse is used for co-firing in thermal power plants.

In order to make feed-in tariffs a viable policy option for Syria, the instrument’s design should be modified in a way, which limits its impact on national electricity tariffs. In most industrialised countries, grid operators forward the costs of feed-in tariffs to the electricity consumers. However, developing or emerging countries are particularly vulnerable to high electricity prices, which is why the Syrian government should consider alternative mechanisms for financing a feed-in tariff system. One major option is a national fund for renewable energies. The primary source of such a fund would be the national budget but in general, international donors could also make a contribution. However, financing trough funds bears certain risks. For example, a change in government or macro-economic data might lead to stop-and-go policies, which would constrain investment security. Furthermore, the fund would have to set aside large reserves as tariff payments are generally provided over a long time. Due to Syria’s limited financial capacities, the government could consider to limit the costs of the feed-in tariff scheme by setting an overall cap for the supported power generating capacity. Alternatively or in complementation to the overall cap, the scheme could include specific capacity caps per technology or plant. In any case, the regulation should encompass a provision for revising the cap before it is reached in order to provide continuous investment security.

Regarding energy efficiency, the Syrian government has adopted or drafted some specific policy mechanisms and regulations, such as the “Energy Conservation Law”, labels and standards for home appliances and thermal insulation codes for buildings. The regulations, however, have not yet indicated a significant impact since they are either non-mandatory or not yet implemented. This situation suggests a combination of different problems and solutions. Firstly, further awareness campaigns and

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5 The fibrous residue remaining after sugarcane stalks are crushed to extract their juice.
capacity building measures are needed to create legitimation and political will for binding energy efficiency standards. Secondly, concentrating the administrative responsibilities for energy efficiency under the office of the Prime Minister and therefore increasing the political priority of energy efficiency as suggested above might ease the enforcement of stronger instruments for energy efficiency. Thirdly, capacities of the NERC need to be boosted as it is responsible for preparing and implementing energy efficiency regulations.

In addition to domestic policy schemes, we suggest to foster technology transfer from industrialised countries to Syria. No CDM projects have been or are being implemented in Syria yet. Technical assistance is needed to cope with administrative barriers of the CMD and there is a lack of interest in CDM projects among operating entities. As discussions with Sweden, Finland and Italy over potential technology transfer projects have failed, the government should identify and analysis barriers for CDM projects in Syria. In order to overcome these barriers, Syria is recommended to request advice from international organisations, such as UNEP, which offer capacity building measures on the CDM project cycle for government officials.

6.3 Removal of Energy Subsidies

In order to enable an adequate impact of policies for promoting renewable energy and energy efficiency, the reform of Syria’s energy pricing system needs to be continued. The first step of an energy efficient policy should be to adjust energy prices in order to give correct signals to consumers, whilst maintaining incentives for behavioural changes or to acquire energy efficient equipment and technologies. Although subsidies for electricity and transportation fuels such as diesel were significantly reduced in recent years, Syrian energy prices do not reflect the true costs of energy production and acquisition. Some petroleum products are subsidised substantially, both indirectly through implicit subsidies from domestic production and directly from the budget. While gasoline prices are relatively high by regional standards, diesel fuel is sold well below international prices. Heavy fuel oil is also subsidised. Electricity generation is subsidised indirectly through subsidies to the fuels and by transfers from the budget.

A reduction of energy subsidies would increase the impact of incentives for energy efficiency and renewable energy and, at the same time, induce a more efficient utilisation of domestic resources such as crude oil. Recent regulations, such as the national “Energy Conservation Law”, imply that the Syrian government has recognised the need to alleviate distorted energy prices. Since 2006, the national government has studied strategies to increase end use prices of energy products in a socially viable way. In this context, it is recommended to take measures, which strengthen the population’s capability to deal with an increase in energy prices and to choose a targeted approach in removing energy subsidies, which differentiates between different groups of incomes. The United Nations Environment Programme and the International Energy Agency state that removing energy subsidies does not mean the abandonment of social policy goals. Instead, the latter could be achieved more effectively through alternative mechanisms involving direct welfare payments or investment in social services.
List of References

Annex 1

Mission Report
Mission Report

The country mission was successfully completed in the time span of 1 to 4 August 2009. The mission programme had been prepared by the local specialist in coordination with the Syrian representative in RECREEE's Board of Trustees. The mission received high attention at the Ministry of Electricity and the Minister himself received the experts for an extensive exchange of thoughts.

The mission programme was as follows:

<table>
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<tr>
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<th>Programme Item</th>
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<tr>
<td>1 Sept</td>
<td>Travel to Damascus</td>
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<td>1 Sept</td>
<td>Meeting at NERC</td>
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<tr>
<td>2 Sept</td>
<td>Meetings at Ministry of Electricity (Minister and Deputy Ministers)</td>
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<td>2 Sept</td>
<td>Meeting at PEDEEE</td>
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<td>3 Sept</td>
<td>Meeting at Higher Institute of Applied Science</td>
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<td>Meeting at Ministry of Local Administration and Environment</td>
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<td>Meeting at UNDP</td>
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<td>Meeting at Planning Commission</td>
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<td>Meeting with Atomic Energy Commission</td>
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<td>4 Sept</td>
<td>Half day Seminar</td>
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<td>4 Sept</td>
<td>Internal team meeting</td>
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<tr>
<td>5 Sept</td>
<td>Transfer to Beirut</td>
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Some stakeholder could not be visited, but participated in the half day seminar. A list of stakeholders is attached in the following Annex 2. Most of them (some 20 persons) attended the seminar and engaged in lively discussions.

The seminar was hosted by the Ministry of Electricity and held in the executive meeting room of the Ministry. The Deputy Minister, Eng. Hisham Mashfej gave a welcoming speech and pointed out the Syrian Governments resolve to engage in renewable energy and energy efficiency.

The seminar had three main objectives (1) to promote RECREEE in Syria, (2) to discuss with stakeholders the findings of the mission and (3) to introduce the participants to the ideas of Evidence Based Policy Making and Theory Based Policy Evaluation by giving a detailed presentation on that topic (Annex 5) and by presenting case studies illuminating the methodology (Chapter 5 above). Finally the seminar was used to give a preview on the three day workshop on EE and RE policy development. The presentation is attached in Annex 6.
List of Stakeholders
## List of Stakeholders

<table>
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<tr>
<th>Organisation</th>
<th>Contact Person</th>
<th>Position</th>
<th>email</th>
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<tbody>
<tr>
<td>Ministry of Electricity</td>
<td>Prof. Ahmad Kussay Kayalli</td>
<td>Minister</td>
<td></td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Abdulhalem Kassem</td>
<td>Deputy Minister</td>
<td>a.h.kassem@com</td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Hisham Mashfeij</td>
<td>Deputy Minister</td>
<td></td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Nedal Karmoushe</td>
<td>Director of Planning</td>
<td><a href="mailto:karmouchehned@mail2world.com">karmouchehned@mail2world.com</a></td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Adel Maalouf</td>
<td>Director of Training</td>
<td></td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Mohamed Sheki</td>
<td>Director General</td>
<td><a href="mailto:nerc@mail.sy">nerc@mail.sy</a></td>
</tr>
<tr>
<td>Ministry of Electricity</td>
<td>Eng. Adel Maalouf</td>
<td>Director of Training</td>
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</tr>
<tr>
<td>National Energy Research Centre</td>
<td>Eng. Mohamed Sheki</td>
<td>Director General</td>
<td><a href="mailto:nerc@mail.sy">nerc@mail.sy</a></td>
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<tr>
<td>PEDEEE</td>
<td>Mustafa Shekhi</td>
<td>Vice General Manager</td>
<td></td>
</tr>
<tr>
<td>PEDEEE</td>
<td>Marwan Obeid</td>
<td>Project Manager</td>
<td><a href="mailto:marwanob@ureach.com">marwanob@ureach.com</a></td>
</tr>
<tr>
<td>PEDEEE</td>
<td>Imad Al Ghawi</td>
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<td></td>
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<tr>
<td>PEDEEE</td>
<td>Dr. Eng. Issam Bahssas</td>
<td>Director of Planning and</td>
<td></td>
</tr>
<tr>
<td>PEEGT</td>
<td>Eng. Nassouh Semesmieh</td>
<td>Deputy General Manager</td>
<td><a href="mailto:nsimsmiah@yahoo.com">nsimsmiah@yahoo.com</a></td>
</tr>
<tr>
<td>PEEGT</td>
<td>Alsharaa Nabil</td>
<td>Planning Manager</td>
<td><a href="mailto:nalsharaa@gmail.com">nalsharaa@gmail.com</a></td>
</tr>
<tr>
<td>State Planning Commission</td>
<td>Menhal Alaridi</td>
<td>Head of Section of Renewable Energy</td>
<td><a href="mailto:aridi20@hotmail.com">aridi20@hotmail.com</a></td>
</tr>
<tr>
<td>State Planning Commission</td>
<td>Boskra Al Fakiani</td>
<td>Vice Manager of Energy</td>
<td><a href="mailto:aridi20@yahoo.fr">aridi20@yahoo.fr</a></td>
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<tr>
<td>Atomic Energy Commission</td>
<td>Dr. Ali Hainoun</td>
<td>Head, Energy Planning</td>
<td><a href="mailto:ahainoun@aec.org.sy">ahainoun@aec.org.sy</a></td>
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<td>Atomic Energy Commission</td>
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<td>UNDP</td>
<td>Abir Zeno</td>
<td>Energy &amp; Environment</td>
<td><a href="mailto:abir.zeno@undp.org">abir.zeno@undp.org</a></td>
</tr>
<tr>
<td></td>
<td></td>
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Annex 3

Seminar Programme
Methodology and Policy for Energy Efficiency and Renewable Energies
Half-day Seminar - Syria, 4 August 2009, 10:00 - 13:00
Ministry of Electricity

Objective of the Seminar: The seminar serves the objective of the project to support RCREEE’s overall effort of providing member state administrations with better information and new planning tools and processes. The seminar will give an introduction to evidence based policy development and theory based policy evaluation for Energy Efficiency and Renewable Energy and the seminar will be used to discuss some preliminary findings in Syria.

The seminar will have the following structure:

1. Welcome, by Eng. Hisham Mashfij, Deputy Minister of Electricity
2. Presentation of RCREEE, by Ashraff Kraidy
3. Introduction to the Project and to the Seminar, by the project team leader, Florian Sauter-Servaes
5. Status of EE and RE Policies and their Development in Syria, by Abdul Raouf Yahia and Danyel Reiche
6. Case studies, by Martin Ehrlich and Nigel Lucas
7. Preview on Information Workshop, December 2009, by Martin Ehrlich
8. General Discussion
Data Matrix
### Regulations / incentive schemes

**Primary Legislation**  
Laws, Directives.

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<th>Regulation Type</th>
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<td>Secondary Legislation</td>
<td>Decrees or implementing regulations which regulate the implementation of primary legislation. (Non)</td>
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<td>Policy Statements</td>
<td>Official statements of relevant political decision-makers (e.g. minister for energy).</td>
</tr>
<tr>
<td>Under Discussion</td>
<td>Law is being discussed by legislative institutions and/or is in draft phase already. Low of Electricity (Under preparation)</td>
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<tr>
<td>Adopted</td>
<td>Law has been adopted by legislative institutions. (Non)</td>
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<tr>
<td>Targets/Aims</td>
<td>Both specific targets (e.g. 10% of electricity from renewable sources by 2010) and general aims (e.g. promotion of renewable energy) formulated in regulations.</td>
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<tr>
<td>Instruments</td>
<td>“Tools” or mechanisms selected to achieve targets/aims of a regulation (e.g. feed-in tariffs, standards).</td>
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<tr>
<td>Duration</td>
<td>Timeframe of regulations (e.g. a law is effective until 2011 or shall be amended by 2011). No time frame.</td>
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<td>Governmental Entities</td>
<td>E.g. ministries (Ministry for Environment) or agencies (e.g. national energy agency). Ministry of Energy (NERC) - Prime Minister Office (Atomic Energy Commission) - Prime Minister Office (Scientific Research and Studies Centre)</td>
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<tr>
<td>Industry</td>
<td>E.g. utilities, state companies</td>
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<tr>
<td>Non-governmental</td>
<td>E.g. renewable energy associations, industry associations, environmental organisations Syrian Environment Protection Societies (NGO’s)</td>
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## Renewable Energy: Regulations / Incentive schemes

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<td>3- thermal Insulation Code for buildings</td>
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<td>NERC</td>
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<td>To regulate Energy generated by R.E.</td>
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UD: Under Discussion and/or in draft phase; A: Adopted; I: Implemented, EE: Energy Efficiency, RE: Renewable Energy
NERC: National Energy Research Centre, SPC: State Planning Commission
Renewable Energy: Commissioned reports DURING THE PASE OF PREPARATION of regulation / incentive scheme

<table>
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<th>Source</th>
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<td>1) National Renewable Energy Master Plane</td>
<td>2003</td>
<td>UN-DESA</td>
<td>Ministry of Electricity (MoE)– Damascus-Syria</td>
<td>To ensure an increasing contribution from renewable sources of energy to meet Syria’s Primary Energy Demand</td>
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<td>4) 9th 5 year plan (2006-2010) chapter 11: Energy Sector</td>
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<td>SPC</td>
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<td>To assist on the use of RE&amp; EE and to increase the share of RE in the Energy Balance</td>
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<td>5) Study of Electricity Tariffs</td>
<td>2006</td>
<td>EU Framework Contract, Support for Policies</td>
<td>MoE</td>
<td>Restructuring the Electricity Tariff</td>
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<td>6) Power Sector Action Programme (PSAP)</td>
<td>2005</td>
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<td>MoE</td>
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Renewable Energy: Evaluation reports on IMPACT of regulation / incentive scheme

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2
3
4

Current Status of Renewables

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<th>Annual Production (GWh)</th>
<th>Installed Capacity (GW)</th>
<th>Annual Production (GWh)</th>
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<th>Budget (Mill. $ per year)</th>
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<td>Research –Studies- Planning and implementing pilot projects for R.E.&amp;E.E.</td>
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<tr>
<td>Atomic Energy Commission</td>
<td>Research of renewable Energy</td>
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<tr>
<td>Scientific Research and Studies Centre</td>
<td>Research and applications of Solar Energy</td>
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<td><strong>Industry (e.g. utilities, state companies)</strong></td>
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<td><strong>Non-Governmental Organisations (including industry associations etc.)</strong></td>
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</tbody>
</table>
# Energy Efficiency: Regulations / incentive schemes

<table>
<thead>
<tr>
<th>Type of Law</th>
<th>Title of Law</th>
<th>Year</th>
<th>Responsible Institution</th>
<th>Status*</th>
<th>Source</th>
<th>Targets/ Aims</th>
<th>Instruments</th>
<th>Duration</th>
<th>Impact Analysis</th>
<th>Title of Analysis</th>
<th>Year</th>
<th>Author</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Legislation</td>
<td>1- Insulation building code</td>
<td>2007</td>
<td>NERC &amp; order of engineering</td>
<td>I</td>
<td></td>
<td></td>
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<td></td>
<td>2- Label and standards for home appliances</td>
<td>2008</td>
<td>NERC &amp; Ministry of industry &amp; Ministry of trade...</td>
<td>A</td>
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<td></td>
<td>3- Energy conservation law</td>
<td>2009</td>
<td>NERC</td>
<td>A</td>
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</table>
## Economical, Technological and Environmental Impact Assessment of National Regulations and Incentives for RE and EE: Country Report Syria

<table>
<thead>
<tr>
<th>Secondary Legislation</th>
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<tbody>
<tr>
<td>Policy statements</td>
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</table>

UD: Under Discussion; A: Adopted; I: Implemented
### Energy Efficiency: Commissioned reports DURING THE PASE OF PREPARATION of regulation / incentive scheme

<table>
<thead>
<tr>
<th>Title of Study</th>
<th>Year</th>
<th>Author</th>
<th>Source</th>
<th>Main conclusion of report: # to be understood as first impression for project members</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Possible benefits of a national efficiency measures</td>
<td>2004</td>
<td>e.g. NEEA 2004</td>
<td>National Energy Evaluation Agency, City</td>
<td>Efficiency measures could create the following benefits: …</td>
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<tr>
<td>2 DSM assessments report</td>
<td>2005</td>
<td>MOE</td>
<td>MOE</td>
<td>Potential of DSM measures</td>
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</tbody>
</table>

### Energy Efficiency: Evaluation reports on IMPACT of regulation / incentive scheme

<table>
<thead>
<tr>
<th>Title of Study</th>
<th>Year</th>
<th>Author</th>
<th>Source</th>
<th>Main conclusion of report: # to be understood as first impression for project members</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Impact of industry energy efficiency initiative on energy consumption</td>
<td>2008</td>
<td>e.g. NEEA 2008</td>
<td>National Energy Evaluation Agency, City</td>
<td>Energy consumption war reduced by x mb per year compared to …</td>
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</table>

## Energy Efficiency: Institutions

<table>
<thead>
<tr>
<th>Institution</th>
<th>General Responsibilities of Institution</th>
<th>Number of Staff</th>
<th>Budget (Mill. $ per year)</th>
<th>Link/Contact</th>
<th>Involvement in legislation process? Y/N</th>
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</thead>
<tbody>
<tr>
<td>Governmental entities</td>
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<tr>
<td>Ministry of Electricity (NERC)</td>
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</tbody>
</table>
Presentation on Methodology
Evidence based policy making and theory based evaluation

Nigel Lucas
Contents

- Evidence based policy making
- Theory based evaluation
- The linkages
  - Theory
  - Indicators
Evidence Based Policy Making?

• What is Evidence Based Policy Making?
• Why do we need it? What have we been doing before - making it up?
• What is evidence?
• I do not have the time or resources.
• Is it all I need?
What is Evidence Based Policy Making?

Many different definitions, but what it really means is just:

“An approach to policy development and implementation which uses rigorous techniques to develop and maintain a robust evidence base from which to develop policy options”.

All policies are based on evidence - the questions are:

• Is the evidence reliable?
• Are the processes by which evidence is turned into policy fit for their purpose?
Why do we need it?

• Policy often driven by prejudice or short-term political pressure
• Made by small groups – exhibits preferences and perceptions of this group – can be changed when group changes – may not be accepted by stakeholders - partial and unstable
• Foreign consultants and agencies often prescribe remedies from home with little thought whether they are appropriate. Mimicry is not policy.
• Agencies have their own agendas and visions that may conflict among themselves and with those of government
• Countries need well-resourced, in-house capabilities to analyse and evaluate policy and more transparent processes

• The perceived need is more stable and robust policy with greater acceptance
What is evidence?

- The evidence base must be both broad enough to develop a wide range of policy options, and detailed enough for those options to stand up to intense scrutiny.
- An evidence-based approach should show continuity between foresight, strategy, policy, and implementation.
- Evidence does not necessarily mean hard facts like scientific data, although the objectively verifiable evidence is important.
- Evidence is any information that can be used to turn policy objectives into feasible and effective policy instruments.
- Can distinguish three main components:
  - **hard data** (facts, trends, survey information)
  - **analytical reasoning** that processes data to illuminate problems
  - **stakeholder opinion** on an issue or set of issues.
- Research, analysis of stakeholder opinion, public perceptions and beliefs, cost/benefit analyses, economic and statistical modelling are important sources of evidence.
- Judgement of the quality of the methods that are used to gather and synthesise the information is vital.
Evidence and time horizons

• Often we work under pressure. Can only do what is reasonable
• Four options for research
  – Review existing research
  – Consult experts
  – Commission new research
  – Consider a wide range of fully costed and appraised options
• Operate on different time scales
Reconciling evidence and time

Evidence needed rapidly to answer pressing policy questions
Nine features of better policy making

- LOOK FORWARD
- LOOK OUTWARD
- INNOVATE
- SEEK EVIDENCE
- BE INCLUSIVE
- BE JOINED UP
- MONITOR
- EVALUATE
- LEARN

directly addressed by EBP&TBE

Is it all I need?
Good evidence is necessary, but not sufficient

There are policy processes that:

<table>
<thead>
<tr>
<th></th>
<th>Use it well</th>
<th>Use it poorly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use good information</td>
<td>![Green Square]</td>
<td>![Yellow Square]</td>
</tr>
<tr>
<td>Use poor information</td>
<td>![Yellow Square]</td>
<td>![Red Square]</td>
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</tbody>
</table>

Need evidence and process
The process of evidence-based policy making (I)

• **Alternative** forms of intervention need to be reviewed and short-listed. Evidence of the success or failure of similar instruments in developed and developing countries needs to be studied with special emphasis on the conditions that created success and failure.

• There must always be a **base-case** against which alternatives are screened. Alternatives should include all available instruments.

• All the relevant potential **impacts** need to be identified and where possible, quantified.

• **Indicators** need to be established of what is expected from the policy measures. These indicators should cover outputs, outcomes and impacts.

• **Intermediate indicators** are important in helping understand how policies work, how measures interact and how they can be improved.
The process of evidence-based policy making (II)

• Impacts should be assessed in **consultation** with the subjects of policy.
• The cost of **compliance** needs to be assessed. Consideration should be given to how these costs can be minimized.
• It is necessary to consider **who pays the compliance costs**; there are generally alternatives with different implications for equity.
• The **procedures for compliance** need to be worked out and for **monitoring** impacts.
• Quantitative analysis of impacts is essential. The analytical method most commonly used is economic **cost-benefit analysis**.
• Cost-benefit analysis should take into account **opportunity costs** of energy and **external environmental** costs.
• **Multi-criteria analysis** is a useful support to decision making.
What is Theory-Based Evaluation?

- Theory-Based evaluation focuses on analysis of the **theoretical** or **logical sequence** by which a policy intervention is expected to bring about its desired effects.
- For instance, a theory-based evaluation might ask about the steps that are implicit between a policy **initiative** (e.g. introduction of minimum energy performance standards for electrical appliances) and the policy **outcome** (reducing energy and GHGs). The Figure represents the implicit theory of policy makers:

<table>
<thead>
<tr>
<th>Introduction of MEPS</th>
<th>Consumer is empowered to make a better judgement and change behaviour</th>
<th>Manufacturers are incentivised to make more efficient models</th>
<th>Market is transformed and inefficient devices become obsolete</th>
<th>Energy use and CO2 emissions fall; Domestic manufacture strengthened</th>
</tr>
</thead>
</table>

- The concept is similar to the logical framework for project evaluation, but because it depends on an explicit behavioural model it can handle not linear logical structures.
Theory and the policy cycle

Foresight → formulate → Evidence

Foresight → reformulate

formulate

Theory

Model

Indicators

Implement

Evidence

evaluate

monitor
Introduction of MEPS

- Consumers are indifferent to energy use – buy only on price
- Manufacturers are obliged to make more efficient models
- Market is swamped by poor quality smuggled goods
- Energy use and CO2 emissions rise; domestic manufacture falls

- Failure to be clear about the causal sequence by which a policy is expected to work can result in poor and even contrary outcomes
- Theory Based evaluation does not prevent us constructing a bad model but tells us what indicators we should examine to make sure things are going well
Indicators need to be established of what is expected from the policy measures. This is vital for evaluation.

Indicators should cover:
• inputs, i.e. the financial, human, technical or organizational resources used in the endeavour
• outputs, (objectively verifiable indicators that demonstrate the progress made in implementing the measures, e.g. the creation of a minimum energy performance standard),
• outcomes (immediate effects on the regulated subject, e.g. the offer of new products and retooling of production lines) and
• impacts (direct measurements of the improvements that the programme is designed to bring about, e.g. more efficient products and lower energy use).
Intermediate indicators

• Impact indicators tell you if you are getting the results that you wanted
• Generally thought they are not sufficient in themselves
• Intermediate indicators are useful and indeed necessary to verify the underlying theory
## Indicators and the theoretical models (Labels and standards)

<table>
<thead>
<tr>
<th>Causal sequence</th>
<th>Indicators</th>
<th>Risks</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of standards and supporting measures</td>
<td>• Administrative time and effort</td>
<td>• Consumer surveys show consumers and manufacturers change expectations</td>
<td>Inadequate accompanying measures; consumers unaware or unaffected</td>
</tr>
<tr>
<td></td>
<td>• Standards published and supporting measures in place</td>
<td></td>
<td>Manufacturers have confidence in regulatory system</td>
</tr>
<tr>
<td>Manufacturers incentivised to make more efficient models</td>
<td>• New investment and production measures ($)</td>
<td>• Range of new products determined by survey</td>
<td></td>
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<tr>
<td></td>
<td>• Strengthened manufacturing capacity - inspection</td>
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</tr>
<tr>
<td>Consumers choose better devices; do not seek non-compliant cheaper goods</td>
<td>• Administrative time and effort in ensuring compliance ($)</td>
<td>• Consumers purchase better quality products – consumer and market surveys</td>
<td>Low cost non-compliant goods excluded from market</td>
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<tr>
<td></td>
<td>• More discriminating purchases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity consumption lowered</td>
<td>• Consumer normally pays more ($)</td>
<td>• Better capital stock in households – household surveys; market studies</td>
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<tr>
<td></td>
<td></td>
<td>• Lifetime cost decreases</td>
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<tr>
<td></td>
<td></td>
<td>• Electricity consumption decreases</td>
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<td></td>
<td></td>
<td>• CO2 emissions decrease</td>
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<tr>
<td></td>
<td></td>
<td>• Manufacturing base strengthened</td>
<td></td>
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</tbody>
</table>
The price of carbon

- 0$/tonne
- 2$/tonne
- 10$/tonne
- 50$/tonne
- 0$/tonne $0 / kW
- 2$/tonne $34 / kW
- 10$/tonne $170 / kW
- 50$/tonne $850 / kW
Who pays and how?

- Energy efficiency is win-win. No real issue – it is a sensible target of public policy intervention. Lower costs; benefits to state and company.

- Renewable energy; it is not so clear. In many instances; definitely more costly than alternatives.

- Why should Syria pay the difference?

- If not Syria then who and how? CDM? Policies and Measures (PAMs)

- Without clarity on who should be and is willing to accept the additional cost, it is hard to have entirely coherent renewable policy
## A toolbox for policy formulation

1. Introduction
2. Objectives and requirements for RE&EE support schemes
3. Overview of the toolbox
   a. Evidence-based policy making
   b. Theory-based evaluation
   c. Cost-benefit analysis
4. Case studies
   a. Introduction
   b. Regulatory framework for renewables
   c. Incentive schemes for solar water heaters?
   d. Finance through the CDM (landfill)
   e. Market transformation strategy for renewables (pv)
   f. Energy efficiency obligations
   g. Energy efficiency fund
   h. Energy audits?
   i. ESCOs
   j. Labels and standards
   k. Public awareness campaigns?
5. Combining instruments
   a. Legislation
   b. Agency
   c. National strategy
6. Technical assistance
Bibliography for evidence-based policy making and theory-based evaluation

- See also extensive bibliography from the Overseas Development Institute on Evidence Based Policy Making http://www.odi.org.uk/rapid/Bibliographies/EBP/bibliography.html
Many thanks for your attention
Preview on Training
Preview of the Three-day Workshop on RE & EE Policies
- December 2009 -

Martin Ehrlich
Contents of the Presentation

- Objective of the Project
- Objective of the Training & Information Component
- Audience for the RE & EE Policy Event
- Modules of the RE & EE Policy Event
- Programme for Senior Policy Decision Makers
- Programme for Policy Analysts and Consultants
Objective of the Impact Assessment Project

- **To achieve:**
  - Rapid implementation of cost-effective policies and instruments
  - Accelerated deployment of cost effective RE & EE technologies
  - **Through:**
    - Increased penetration of „evidence based“ policy formulation and „theory based“ policy evaluation

- **Specific objectives of the project:**
  - Comparative analysis of RE & EE policies
  - Provision of impact assessments of RE & EE policy and promotion instruments in RCREEE countries
  - Strengthening of the methodological basis for policy formulation
  - Provision of recommendations for adjustments of the policy making process
Objective of the Training & Information Component

- Presentation of the methodological basis:
  - Evidence based policy making and planning procedures
  - Theory based evaluation and procedures for application in practice
- Country specific and regional conclusions
- Recommendations regarding the policy making process
- Presentation of Case Studies
  - Case Study on EE promotion
  - Case Study on RE promotion
Information Regarding the Available Project Results

- Key-documents for RCREEE countries
- Country Reports with the assessment of EE & RE policies and instruments
- Synthesis Report
- Contacts within the RCREEE countries for networking and professional contacts
- Case Studies on evidence based policy preparation and theory based policy evaluation
Programme for Senior Policy Decision Makers

- Presentation of the Impact Assessment Project
  - Scope of the project and organisation
  - Value of international comparative analysis
- Key elements of the methodological basis for policy preparation and assessment
  - Need for a methodological basis
  - Benefits of a sound methodological basis
  - Short and long term requirements
- Presentation of international practice
  - Policy making process
  - Policy implementation and impact assessment
- Result of the country review
  - RE and EE policy making process
  - Policy implementation
  - Observations and recommendations
Programme for Policy Analysts and Consultants

- Presentation on methodological basis (international practice and practice in RCREEE countries)
  - Evidence based policy formulation
  - Theory policy evaluation
    Including: Economic evaluation of policy instruments / Integration of climate policy benefits in RE & EE policy analysis
- Presentation of case studies (including the discussion of case studies prepared by participants)
  - Presentation of selected policy instrument
  - Required theoretical framework and selected approach
  - Result of the case study
  - Comment on country-specific conditions and challenges
Economical, Technological and Environmental Impact Assessment of National Regulations and Incentives for Renewable Energy and Energy Efficiency

A project financed by the Ministry of Foreign Affairs of Denmark

Audience for the RE & EE Policy Event

• 1st day: Senior decision makers
  • Presentation of the Impact Assessment Project
  • Key elements of the methodology
  • Recommendation of the country & regional assessment

• 2nd & 3rd day: Policy analysts and RE & EE experts
  • Detailed presentation of the synthesis report and country assessments
  • Discussion of case studies with presentation of the methodological basis
Economical, Technological and Environmental Impact Assessment of National Regulations and Incentives for Renewable Energy and Energy Efficiency

A project financed by the Ministry of Foreign Affairs of Denmark

**Modules of the RE & EE Policy Event**

<table>
<thead>
<tr>
<th>Morning Session</th>
<th>Afternoon Session</th>
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<tbody>
<tr>
<td>1st day</td>
<td>2nd day</td>
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<tr>
<td>● Presentation of the National Regulations and Incentives Project</td>
<td>● Presentation of International Practice</td>
</tr>
<tr>
<td>● Key principles of evidenced based policy making and theory based evaluation</td>
<td>● Result of the Country Review</td>
</tr>
<tr>
<td></td>
<td>● Presentation of International Practice in the Synthesis Report</td>
</tr>
<tr>
<td></td>
<td>- International practice</td>
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<tr>
<td></td>
<td>- Assessment of RCREEE practices</td>
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<td></td>
<td>- Energy planning and political consultation process</td>
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<td></td>
<td>● Presentation of the Country Report</td>
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<tr>
<td></td>
<td>- Methodological basis for policy preparation</td>
</tr>
<tr>
<td></td>
<td>- Assessment of the policy making process</td>
</tr>
<tr>
<td></td>
<td>Country specific conclusions and recommendations</td>
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<tr>
<td>3rd day</td>
<td>Case study on Renewable Energy</td>
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<tr>
<td>Case study on Energy Efficiency</td>
<td>● Selected RE policy instrument</td>
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<tr>
<td>● Selected EE policy instrument</td>
<td>● Theoretical framework</td>
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<tr>
<td>● Theoretical framework</td>
<td>● Results of the case study</td>
</tr>
<tr>
<td>● Results of the case study</td>
<td>● Country specific conditions</td>
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<tr>
<td>● Country specific conditions</td>
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Energy Situation in Syria
Energy Situation in Syria

Syrian Energy Mix and Demand Projections

In 2006, Syria’s total primary energy supply (TPES; 18.9 Mtoe) was dominated by fossil fuels, with crude oil/petroleum products (71%) and natural gas (27%) representing 98% of the total (TPES). Hydropower covered around 2% of the national TPES and the percentage of combustible renewables was less than 0.1%. The dominance of crude oil is due to the fact that unlike other countries of the Eastern Mediterranean region, such as Jordan or Lebanon, Syria accommodates significant domestic crude oil reservoirs and was traditionally an oil-exporting nation. Syria’s 2006 crude oil production was 21 Mtoe (440,000 barrels per day). However, in recent years, national crude oil production has significantly declined. For example, in 2004, Syrian crude oil production added up to more than 29 Mtoe (604,800 barrels per day) and, therefore, superseded the 2006 production volume by nearly 40%. As a consequence of this decline, imports of crude oil and petroleum products are growing. In 2007, they represented about 32% of all imports to Syria compared to 4% in 2000. All energy imports constituted 34% of total Syrian imports in 2007 compared to 5% in 2000.

Syria’s primary energy demand is expected to double in the coming decade, reaching 45.2 Mtoe in 2020 up from 22.5 Mtoe in 2007. While the consumption of oil products is forecasted to increase by about 73% and demand for natural gas is expected to triple, the amount of hydropower consumed in Syria is envisaged to remain constant.

Fig. 7 Scenario of Syria’s Primary Energy Demand until 2020

Electricity

In 2006, total Syrian power production cumulated to 37,283 GWh, indicating an increase from 25,227 GWh and 32,077 GWh in 2000 or 2004 respectively. With an annual electricity demand of 14,720 GWh, the residential sector represents the largest portion of total Syrian final power consumption. Due to domestic oil and natural gas reserves, the national power sector is dominated by oil and natural gas, with oil satisfying more than 50% of the total supply (see Fig. 8). Until 2015 and 2020, power demand is projected to grow to 72,000 GWh or 96,360 GWh respectively, implying an annual growth of
In 2005, Syria’s installed power generating capacity (total installed capacity: 7,057 MW) was dominated by fossil-fired steam turbine units (3,547 MW), followed by hydropower plants (1,528 MW) and gas-fired plants (1,341 MW). Many of the existing thermal power generation units are both fired with natural gas and heavy fuel oil, being high of age. Most steam turbine and gas turbine plants are operative for nearly or more than two decades. With Syria’s power demand growing, adding and renewing electricity supply capacity has become an important national priority. The Syrian government aims to replace existing oil-fired power plants with natural gas-fired plants in order to free up oil for export and to avoid becoming a net oil importer in the future. According to the statements made by the Minister of Electricity, Syria’s electricity sector requires an estimated investment of $6 to $8 billion to modernise and extend the national electricity infrastructure to meet increasing demand. The country plans to add 3,500 MW of capacity by 2010, which would be equivalent to nearly 50% of the total installed capacity in 2005. By 2014, Syria aims to convert all thermal power plants to natural gas-fired plants.

Progress towards implementing these highly ambitious plans has been slowed by a lack of investment capital. The power sector is managed by the “Public Enterprise for Distribution and Exploitation of Electrical Energy (PEDEEE)” and the “Public Enterprise for Electricity Generation and Transmission” (PEEGT). They are controlled by the Ministry of Electricity. In order to attract capital needed for plant investments, Syria has opened the power sector to Independent Power Producers (IPPs). Funding for power projects has reportedly been provided by the European Union and Gulf-based development agencies. So far, three projects with a total capacity of 1,950 MW have been announced by the Ministry of Electricity, two of which shall start operation in 2009. All plants are natural gas-fired and are realised by international companies.

The country’s newest operating power plant is a gas- and oil-fired facility located in Al-Zara near Hama. It has a generating capacity of 660 MW and was completed by Mitsubishi in the year 2000. There are three large hydroelectric power stations in operation on the Euphrates River with a total capacity of 1.5 GW. The commissioning dates of these plants range from 1956 to 2002. The latest plant is situated at the Tishreen dam. It includes six water turbines with a total capacity of approximately 600 MW.
**Crude Oil and Natural Gas**

Syria’s proved recoverable reserves of crude oil and natural gas liquids accumulate to 2,459 million barrels or 335 million tonnes. As mentioned before, national crude oil production added up to 21 Mtoe (440,000 barrels per day) in 2006. The national upstream oil industry is controlled by the state-owned Syrian Petroleum Company (SPC). The largest foreign oil producer is Al-Furat Petroleum Co., a joint venture established in 1985, which currently consists of the SPC, Shell, India’s Oil and Natural Gas Corporation and the China National Petroleum Company (CNPC).

In 2006, Syria exported about 37% of its oil production volume. Sytrol, Syria’s state oil marketing firm, markets all oil exports. The majority of Syrian crude oil exports are transferred to OECD European countries. Regional integration of the Syrian oil industry is increasing through the opening of the Syrian link of the Arab Gas Pipeline. Plans for expanding the pipeline network are ongoing. Syria has three oil export/import terminals managed by the Syrian Company for Oil Transportation (SCOT), including two larger ports (Baniyas, Tartous) and a terminal handling smaller cargoes (Latakia).

Concerning the production of petroleum products, there are two operating state-owned refineries, which are situated at Baniyas and Homs. They produce a surplus of heavy products but fall short of lighter products, such as distillates. As a consequence, Syria needs to import significant amounts of light petroleum products.

Syrian proved recoverable natural gas reserves add up to about 300 billion m$^3$. However, compared to major gas-producing countries, such as Iran (26,740 billion m$^3$), Saudi Arabia or Qatar (25,633 billion m$^3$), Syrian gas reserves are rather small.

**Renewable Energy**

In 2002, the Syrian Ministry of Electricity in cooperation with the UN Department of Economic and Social Affairs (UN DESA) has launched a master plan for the development of the usage of renewable energy sources. The plan includes specific actions to be taken up for mainstreaming renewable energy in the national energy balance as well as research, development and demonstration projects. By increasing the share of renewables in Syria’s energy supply, the national government intends to alleviate the dependence on hydrocarbon fuels. Until 2011, renewable energy shall represent 4.3% of Syria’s total primary energy demand. Fig. 9 illustrates the envisaged share of different renewable energy technologies by that time.

Currently, the government is developing an updated renewable energy master plan in collaboration with the GTZ. The plan will run until 2030 and comprise renewable expansion targets for each five years from 2010. The plan has been drafted and needs to be approved by the responsible governmental entities.
The existing renewable energy master plan calls for a total investment of $ 1.48 billion in the renewable energy sector with a focus on wind power, bio-energy, solar hot water systems and photovoltaic. Syria’s current five-year plan (2006-2010) further outlines the national strategy for promoting renewable energy, containing the following milestones:

- Generate the maximum advantages out of renewable energy sources, such as hydropower, wind energy, solar thermal power and any other renewable resources available;
- Photovoltaic technologies and wind energy shall make increasing contributions to the Syrian power supply in order to alleviate the dominance of oil and gas;
- Renewable energy promotion policies need to take into account regional needs and potentials. For example, wind energy shall be promoted in regions with high wind speed; biomass shall be used in rural areas.
- The government intends to provide incentives for renewable energy technologies, such as solar thermal applications in the residential sector and manufacturing of wind turbines, photovoltaic panels and solar thermal sets.

The 2002 renewable energy master plan and the outlined renewable energy strategy have stimulated some renewable energy projects. However, it seems already clear that Syria will not meet its renewable energy target as these renewable energy projects are by far insufficient to meet the envisaged investment volume. In 2007, the National Energy Research Centre (NERC) published a call for tenders for constructing a 6 MW wind farm in Homs. However, only one bid was submitted which failed to meet the technical requirements. A tender for two wind parks with a capacity of 130 MW will be announced this year. Syria also accommodates 25 manufacturers of solar water heaters; pilot projects to install solar water heaters in public buildings are underway. The country has a high potential for photovoltaic technologies, especially in vast semi-desert regions in its central and eastern parts. In 2007, photovoltaic panels in rural areas of Syria produced about 80 KWh of electricity. The research centre of the Higher Institute of Applied Science and Technology in Aleppo possesses capacity for the production of 250 kW of photovoltaic panels per year from imported components. Furthermore, the Ministry of Electricity is considering to form a joint venture for the production of photovoltaic panels with investors from the Ukraine, aiming at an annual production capacity of 11 MW.
Energy Efficiency

Syria’s primary and final energy intensity are rather high compared to the EU-27. However, they are significantly below the regional average of the Middle East. In 1998 the UN Development Programme (UNDP), the Global Environment Facility (GEF) and the OPEC Fund started a “Supply Side and Energy Efficiency Conservation and Planning Project (SSEECP)”. The project continued until 2007, aiming to improve demand-side management through the creation of a multi-purpose Syrian Energy Services Centre (SECS) and a National Energy Efficiency Programme (NEEP).

**Fig. 10 Syrian Primary and Final Energy Intensity in Comparison to the Regional Average of EU-27 and the Middle East (World Energy Council 2008b)**

The objectives of the project focus on improving electrical energy efficiency, reducing the growth rate of power demand and mitigating greenhouse gas emissions from industrial and other sources. In order to meet these objectives, several measures have been conducted. Those encompassed more than 250 walk-through audits of public buildings (e.g. industrial buildings, hotels, mosques, and government buildings), more than 100 detailed building audits of industrial and large commercial facilities, more than 20 feasibility studies and more than 10 pilot projects. Another goal of the project was to strengthen institutional capacities in the realm of energy efficiency, in particular the capacity of the Ministry of Electricity, to implement sustainable long-term energy policies. For the purpose of setting up development and demonstration projects of efficient and renewable energy technologies, the National Energy Research Centre (NERC) was created in 2003, which is now the country’s most important energy think tank.

The SSEECP project set an unofficial target to reduce energy consumption by 1.8% until 2011. It is not clear if Syria will meet this target. For the period until 2020, the project team concluded that improved demand-side management could generate energy savings in the range of 4,500 GWh, which is...
equivalent to approximately 12% of Syria’s present power production. Fig. 11 illustrates the contributions of each sector to the envisaged energy savings. It becomes clear that the residential sector implicates the highest single-sector potential for energy rationalisation. This corresponds to the pattern of Syrian primary energy consumption, which is dominated by the residential sector.

**Fig. 11 Sectoral Contributions to Possible Energy Savings until 2025**

The Syrian strategy for energy efficiency is unveiled in the government’s five-year plan (2006-2010), concentrating on the dissemination of energy efficiency applications. The plan comprises no targets for energy efficiency but a package of different objectives:

- Improve the efficiency of power production and reduce grid losses;
- Increase the reliability of energy production and distribution systems;
- Implementation of demand-side management strategies;
- Implementation of integrated resource planning strategies targeted to increase power production capacities;
- Creation of new policies for energy pricing to encourage energy conservation in residential, commercial and industrial sectors;
- Encouraging thermal insulation of buildings.

In order to meet the listed aims, the Syrian government has adopted or is planning to adopt several regulations. In February 2009, an “Energy Conservation Law” was issued, which shall foster activities related to energy conservation, execute energy efficiency procedures in all sectors and raise public awareness and capacities for energy conservation. The law determines that industrial and commercial companies as well as public institutions and Ministries need to form energy conservation units. They shall prepare databases and reports on energy consumption and identify opportunities for energy conservation. The National Energy Research Centre (NERC) is entrusted with preparing energy efficiency regulations, standards and interaction with the concerned parties.
Besides institutionalising energy efficiency, the government has the intention to introduce standards and labels for energy consumption. In November 2007, NERC has issued a thermal insulation code, which is in force since January 2009 but is not mandatory. In October 2008, a law was passed requiring domestic appliances (e.g. refrigerators, freezers, washing machines, air conditioners) to be labelled according to their energy consumption. However, the regulation has not yet been implemented. At the time being, the next five-year plan (2011-2015) is being prepared which might foster efforts to improve energy efficiency as it is expected to contain some budget allocation for energy efficiency measures.