CSP in Palestine
CSP Workshop
Amman
18 – 19 / September
September, 2018
Energy Situation in Palestine

- Gaza Power Plant (GPP) is the only significant generation, with capacity of 140MW.

- Palestine is considered one of the poorest countries in terms of energy resources.

- Indigenous energy resources are almost limited to solar energy for photovoltaic and thermal applications (mainly for water heating), and biomass (wood and agricultural waste) for cooking and heating in rural areas.
Energy Situation in Palestine

The Palestinian Energy sector consists of three main sources:

- Fossil Fuels & Gas: 51%
- Renewable Energy (thermal): 18%
- Electricity: 31%
Energy Situation in Palestine

- Fully dependent on the IEC (88% Electricity) (100% Fossil Fuels & Gaz).
- Electricity bill (500 M$).
- Petroleum Product bill (800 M$).
- Around 67% of population use SWH on their own houses.
- Electricity and fuel prices in Palestine are the most expensive in Arab countries.
## Energy Situation in Palestine

### Energy Average Prices in Palestine (2012-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Electricity (USD/Kwh)</th>
<th>Diesel (USD/Liter)</th>
<th>LPG (USD/12Kg)</th>
<th>Gasoline (USD/Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Bank (Excluding Jerusalem)</td>
<td>0.145+VAT</td>
<td>1.9</td>
<td>20</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>0.10 + VAT</td>
<td>1.33</td>
<td>13</td>
<td>1.51</td>
</tr>
<tr>
<td>Jerusalem</td>
<td></td>
<td>2.4</td>
<td>26</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.53</td>
<td>25</td>
<td>1.56</td>
</tr>
<tr>
<td>Gaza Strip</td>
<td></td>
<td>1.9</td>
<td>20</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.33</td>
<td>13</td>
<td>1.51</td>
</tr>
</tbody>
</table>

The price of electricity is published by PERC (Industry and Commerce).
Palestinian Potential Solar Energy

Potential of Solar Energy in Palestine

- it has about **3000 sunshine hours per year**
- annual average of solar radiation amounting to **5.4 kWh/m² - day (19.44MJ)** on horizontal surface, which classified as a high
- in December, it amounts to **2.63 kWh/ m² - day**.
- In June: **8.4 kWh/m² - day**

**Year 2017**

**Total Installed capacity is:**

- **25 Mwatt**
- **42.5 Gwh/ Potential Year Production (1700 kWh/kWp)**
- = **0.4-0.5% of total yearly energy consumed**
Energy Balance in Palestine
(All Types of Energy)

- Transport: 36%
- Households: 47%
- Commercial & Public Service: 10%
- Industry: 6%
- Others: 1%
Industrial Sector in Palestine

- Industrial sector is one of the main contributor sectors in Palestinian GDP, the percentage of the contribution is around 16%.

- The total number of the manpower in the sector, average, is 81,586, around 13% of the Palestinian manpower are working in Industry.

- The Industrial sector is one of the main consumers of Energy the consumed electricity in 2010 in industry was 348,919Mwh, which is around 7.5% of the total consumed Electricity in Palestine. The total consumed Diesel in the Industry in 2010 was 38,327,000 L, around 9.88% of the total consumed Diesel in Palestine.
Sources of Energy in Industrial Sector

- **Electricity**: 51%
- **Diesel**: 27%
- **LPG**: 14%
- **Others**: 8%

Fossil Fuels in Industrial Sector is used mainly for steam generation.
CSP Program in Palestine

Activities that done for CSP Program are:

- Technical presentation, discussion of information requests, clarification of local technical support, identification of relevant equipment's and processes from World Bank through International Expert.

- Training on site measurements for thermal audits from International Expert.
Site Visit to three Sites:
- Birzeit Pharmaceutical Company (BPC).
- Al-Arz Company.
- Ramallah Hospital.
CSP Program in Palestine

- Initial site visit was taken for one day in each sites.

- Meet the personnel concerned, to familiarize him with the site and to assess the procedures necessary to carry out the study.

- During the initial site visit the team carry out the following actions:
  - Analyse the major energy consumption data with the relevant personnel.
  - Obtain steam generation and distribution.
  - Tour the site accompanied by top manager.
  - Identify any existing instrumentation/ additional metering required.
  - Identify the instrumentation required for carrying out measurements.
  - Collect macro data on plant energy resources, stem boiler, ….etc.
CSP Program in Palestine

Data Collection

The information that collected during measurement process:

- Energy consumption by type of energy.
- Energy cost and tariff data
- Process and material flow diagrams
- Generation and distribution of site services for steam.
- Sources of energy supply.
- Technology, processes used and equipment details.
- Steam consumption.
- Other inputs such as SWH, production area, cooling system…..etc.
CSP Program in Palestine

- Measuring devices

  - Ultrasonic Flow Meter:

    Water and other fluid flows can be easily measured with this meter.

    A flow meter is a device used to measure the flow rate or quantity of a gas or liquid moving through a pipe.

    Also this device can measure velocity, temperature and energy for the liquid.
CSP Program in Palestine

- Measuring devices
  - Temperature Data Logger:
    For measuring and logging the temperature at four different sites simultaneously.
CSP Program in Palestine

- Measurement

- The measurement process took about one month at each Site.
- Where the measurements were taken on all points and production lines using steam.
CSP Program in Palestine

Budd Pharmaceutics

Budd Pharmaceutics is located in Ramallah. The company produces and distributes products throughout the year, on a 5-day/week basis (except on Sunday and Saturday), two shifts/day, with continuous operations from 07:00 to 23:00.

Steam requirements are continuous throughout the day, with steam preparation from 07:00 to 08:00 and steam consumption for the remainder of the day.

Steam requirements are based on steam heating, (the boiler unit), as well as producing treated air for steam rooms, the injection station, and the water treatment plant for the cooling tower. Steam production occurs in a main steam boiler using 200 bars. The company has two other boilers in backup but they are seldom used.

Additional heat requirements are related to the production of hot water for heating or social use purposes and are based on a solar system (solar collectors) and is on a fraction of steam.

Cogeneration requirements are related to the production of thermal air for clean rooms and with the cogeneration of the four cooling towers running back processes. Cogeneration is produced after composition of CHP.

The company is ISO 9001 certified since 2004 and has an environmentally sound strategy. The company is willing to assess energy-related investments presented a payback of 5 to 6 years.

Missing information:

<table>
<thead>
<tr>
<th>Information</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products</td>
<td>@FENRA</td>
</tr>
<tr>
<td>Annual production per product</td>
<td>@FENRA</td>
</tr>
<tr>
<td>No. employees</td>
<td>@FENRA</td>
</tr>
</tbody>
</table>

Contact information

<table>
<thead>
<tr>
<th>Name of the company</th>
<th>Budd Pharmaceutics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of contact person</td>
<td>@FENRA</td>
</tr>
<tr>
<td>Position of contact person</td>
<td>@FENRA</td>
</tr>
<tr>
<td>Address</td>
<td>@FENRA</td>
</tr>
<tr>
<td>Fax no.</td>
<td>@FENRA</td>
</tr>
<tr>
<td>Local address</td>
<td>@FENRA</td>
</tr>
</tbody>
</table>

Production

Data on production is to be gathered by FENRA. For each product, the following information will be gathered:

- Product description (according to the following table):

<table>
<thead>
<tr>
<th>Product name</th>
<th>Type of product</th>
<th>Amount (metric tons)</th>
<th>Production unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td>Type 1</td>
<td>1234</td>
<td>Ton/month</td>
</tr>
<tr>
<td>Product 2</td>
<td>Type 2</td>
<td>5678</td>
<td>Ton/week</td>
</tr>
</tbody>
</table>

Energy sources

Steam production relies on Diesel. Hot water production relies on solar thermal energy and on steam. Electricity consumption is related to the production of cooking, not relevant for the foregoing analysis (possible heat recovery from chillers is assumed, though).

Direct steam consumption is about 40% of energy costs (44.9%) and its use is 99% related to steam production (other uses are for heating, hot water or emergency generators). A drift from Diesel to CSP might be considered in the future. Yet such drift would also imply additional investments regarding storage, distribution and safety requirements.

Monthly production values for the last full year for which information is available.

<table>
<thead>
<tr>
<th>Month</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>3315</td>
<td>2070</td>
<td>2430</td>
<td>1800</td>
<td>3950</td>
<td>1400</td>
<td>1630</td>
<td>1800</td>
<td>1630</td>
<td>1630</td>
<td>1630</td>
</tr>
</tbody>
</table>

Solar-related data

The company building does not dispose of any available surrounding area. Hence, the installation of solar collectors might rely only on rooftops. The main building rooftops (concrete, flat) is already occupied with the cooling solar systems and with a number of air cooling units for the chillers.

The installation of a CSP system would have to rely on the use of a simpler rooftop covering the hanger, in the South of the main building.

Solar-related data

Available area

<table>
<thead>
<tr>
<th>Area</th>
<th>Area doctor</th>
<th>Area number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area 1</td>
<td>@FENRA</td>
<td>Area 1</td>
</tr>
<tr>
<td>Area 2</td>
<td>@FENRA</td>
<td>Area 2</td>
</tr>
<tr>
<td>Area 3</td>
<td>@FENRA</td>
<td>Area 3</td>
</tr>
<tr>
<td>Area 4</td>
<td>@FENRA</td>
<td>Area 4</td>
</tr>
<tr>
<td>Area 5</td>
<td>@FENRA</td>
<td>Area 5</td>
</tr>
</tbody>
</table>

Access to and within the facility

<table>
<thead>
<tr>
<th>Distance to heat delivery point</th>
<th>@FENRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to power supply</td>
<td>@FENRA</td>
</tr>
</tbody>
</table>

The following Table is a partial list of the facility’s illegal activities and potential actions.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Access to water and electricity</th>
<th>@FENRA</th>
</tr>
</thead>
</table>

*The Energy and Fuel Data Set*, Clarenct Enery (aggregate data from 2010-1000 Data)
Thanks