Tunisian Solar Thermal Market

“PROSOL Program”

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National Agency of Energy Conservation (ANME)
Tunisian Energy balance

Potential and Renewable Energy Strategy in the medium and long term

National program of the promotion of Solar thermal energy PROSOL:

- Residential PROSOL– TUNISIA, key of the success and achievement
- Tertiary PROSOL – TUNISIA, hotels sector achievement and mechanism
- PROSOL Industry– TUNISIA, Industrial sector, the approach, the achievement
- The new Solar process heat program
Tunisian Energy Balance

Resources & demand

- **Ktoe (Thousand Tonnes of Oil Equivalent)**
  - 1980: 6179
  - 1990: 6933

- **Demand**
  - 1980: 3070
  - 1990: 6933

- **Deficit 1.6 Mtoe**

Independence ratio

- 1980: 100%
- 2010: 81%
Share of the final energy consumption in Tunisia

- Industry: 32%
- Transport: 34%
- Agriculture: 7%
- Services: 10%
- Residential: 17%

Total: 5.7 Mtoe in 2011
### Potential and objectives of the Tunisian Renewable Energy Strategy in medium and long term

<table>
<thead>
<tr>
<th>Fillières</th>
<th>Potentiel</th>
<th>Objectifs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eolien</td>
<td>8000 MW</td>
<td>435 MW</td>
</tr>
<tr>
<td>Solaire PV raccordé au réseau</td>
<td>140 MW</td>
<td>540 MW</td>
</tr>
<tr>
<td>Dont toits solaires (résidentiel, tertiaire et industriel)</td>
<td>5500 MW</td>
<td>60 MW</td>
</tr>
<tr>
<td>Solaire CSP</td>
<td>330 MW</td>
<td>460 MW</td>
</tr>
<tr>
<td>Pompage PV</td>
<td>24 MWc</td>
<td>0,55 MW</td>
</tr>
<tr>
<td>Bio-méthanisation</td>
<td>6 à 8 Mt de déchet par an</td>
<td>40 MW</td>
</tr>
<tr>
<td>Solaire thermique (résid. &amp; ter.)</td>
<td>4,1 millions de m²</td>
<td>0,98 Mm²</td>
</tr>
</tbody>
</table>
Impact of the Tunisian Renewable Energy strategy in medium and long term

30% of Renewable energy by 2030
Aim: to create a long-term market for solar thermal

Different components
- Financial mechanism
- VAT exemption
- Capacity building
- Awareness raising
- Carbon finance

Objectives in 1000 m²

Cumulative surface in 1000 m²

RESID
TER
INDU
Cumulative
PROSOL: Residential sector

**Incentives and credit Loan**

A subsidy financed from the National Fund for Energy Management (FNME):

- 100 € (200 TND) for the SWH collector area from 1 to 3 m²
- 200 € (400 TND) for the SWH collector area between 3 to 7 m²;

A refundable bank loan over 5 years by the STEG, through electricity bills

- **Loan amount**: 220 € (550 TND), 380 €, 450 € and 570 € (1150 TND),
- **Interest rate**: TMM+1 (6.25 %) for 2007 and TMM+1.2 for the next year

**Key of success**

**Involvement of STEG offers security**
- Guarantee of the loan payments by the STEG through the electricity bills

**Collaboration synergy** between different actors (Public Partnership – Private)

**The bases of the scale change**
- A real support of the banking sector and a strong membership with the STEG
- Commitment of "Attijari Bank" for the granting of consumer loans with a financing of 64 M€ over the period 2007 – 2012 (This period was prolonged to the end of 2016 with a 60 M€ until 2016)
- Interest rates down to 7%
- A comprehensive communication and awareness raising campaign
PROSOL: Residential sector

Achievements 2004 - 2012

- More than 50 eligible suppliers, (among 09 manufacturers)
- 1150 eligible Installers (Micro companies) and over than 400 installers are qualified “Qualisol system”
- More than 3000 direct jobs were created

Evolution of the achievements from 7000 m² the full year 2004 to a monthly rate of 7000 m² in 2010

Evolution of specific indicator to 62 m²/1000 inhabitants in 2012, against 25 m²/1000 inhabitants in 2007.

The objective is to reach a specific indicator of about 100 m²/1000 inhabitants in 2016.
PROSOL: Tertiary Sector (Service and Hotels)

Targets: Hotels, Swimming pool, Traditional Bath (Hammam), Collectives residences ... with a potential of about 500,000 m²

- Global potential of solar heating water in hotels
  - Needs estimated of warm water: 6,000,000 m³
  - Needs estimated of energy: 28,000 tep/an
  - Potential of solar collector: 170,000 m²
  - Energy saving estimated: 17 Ktoe/year
  - Solar Cover rate: 60%

PRIME TARGET: 3 stars and over hotels

<table>
<thead>
<tr>
<th>Hotels</th>
<th>450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface of solar collector</td>
<td>90,000 m²</td>
</tr>
<tr>
<td>Average Surface</td>
<td>200 m²</td>
</tr>
</tbody>
</table>
PROSOL: Tertiary Sector (Service and Hotels)

**Incentives**

A subsidy of **30%** of the investment with a ceiling **75 €/m²** financed by the **FNME**

70% of the cost of the study and control with a ceiling of **35000 €**

Other subsidies from the funds **IMELS-UNEP:**

- A subsidy of **25%** investment with ceiling **75 €/m²**;
- 2% bonus on the interest rate of loans
- A subsidy of **3 €/m²** in the maintenance costs over 4 years, the first year is considered as warranty;

**Support measures**

- Training leading to a qualification of
  - Engineering consulting firms (Designers and control offices)
  - Installers of solar stations
  - Maintenance responsible of hotels
- Elaboration of a membership process to the project
  - The specifications of eligibility of the operators and the products
  - Elaboration of typical documents
  - Role and responsibility of the operators
- Coaching for the first projects (study and implementation)
- Achievement of the different support of the communication plan
PROSOL: Tertiary Sector - The communication plan (Service and Hotels)
✓ **Offer evolutions (end 2012):**

- **16** Eligible Engineering consulting firms
- **12** Eligible installation companies of solar station
- **03** Eligible Offices of control
- **50** Eligible models of collector

✓ **Progress indications (end 2012):**

- **14 000 m²** was installed (hotels + others)
- **60** hotels engaged in the program
- **30** installations in hotels was realized that to say a surface of **3000 m²**
PROSOL: TertiarySector - ACHIEVEMENT(Hotels)

Collector already installed: 3000 m²

Success story: Djerba Beach Hotel

<table>
<thead>
<tr>
<th>Collector area</th>
<th>Storage Volume</th>
<th>Cost</th>
<th>Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>312 m²</td>
<td>15 m³</td>
<td>205 000 TND</td>
<td>62 KDT</td>
</tr>
</tbody>
</table>

- Energy conservation: 46 Toe/year
- Monetary gains: 42.5 KDT/year
- Payback time: 4 years

Main asset:
- Satisfaction of the expected results
- An interesting feedback
**Collector already installed:**

- **Area:** 3000 m²

**Success story: Yadis Djerba Hotel**

- **Collector area:** 150 m²
- **Storage Volume:** 10 m³
- **Cost:** 105 000 TND
- **Subsidy:** 30 KDT
- **Energy conservation:** 22 Toe/year
- **Monetary gains:** 13 KDT/year
- **Payback time:** 5 years

**Main asset:**

- Satisfaction of the expected results
- An interesting feedback
## Energy consumption share in Industry, 2010 (final toe)

<table>
<thead>
<tr>
<th>Energy</th>
<th>2010</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>toe</td>
</tr>
<tr>
<td>Electricity</td>
<td>532 151</td>
</tr>
<tr>
<td>Natural gas</td>
<td>838 170</td>
</tr>
<tr>
<td>Other</td>
<td>789 899</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>348 259</td>
</tr>
<tr>
<td>Pet Coke</td>
<td>344 100</td>
</tr>
<tr>
<td>LPG</td>
<td>34 115</td>
</tr>
<tr>
<td>Gas oil</td>
<td>62 958</td>
</tr>
<tr>
<td>Pét lampant</td>
<td>467</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2 160 220</strong></td>
</tr>
</tbody>
</table>

The thermal consumption of the sector is more than **75%**
Final Thermal energy consumption in 2010
The potential of solar process heat integration
(Final toe)

<table>
<thead>
<tr>
<th>Thermal energy consumption by Branch</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tep</td>
</tr>
<tr>
<td>Textile</td>
<td>67,958</td>
</tr>
<tr>
<td>Food</td>
<td>112,999</td>
</tr>
<tr>
<td>Chemical</td>
<td>166,136</td>
</tr>
<tr>
<td>ID</td>
<td>114,985</td>
</tr>
<tr>
<td>Total</td>
<td>462,078</td>
</tr>
</tbody>
</table>
The average of the annual solar radiation in Tunisia is more than 2000 KWh/m²

A huge potential: 3 million m²

A real potential: 430,000 m²

300,000 m² (70%) de 90°C-250°C

PROSOL Industry was launched with the support of the Italian Cooperation (IMELS, MEDREC) and UNEP in 2010.

A subsidy of 30% of the investment with a ceiling 75 €/m² financed by the FNME
The determination of the potential of using solar systems in 80 industrials institutions belonging to the branches of food, textile, chemical and papers industry,

The realization of a survey to identify the degree of the commitment of the industrial for the SHIP,

Identification of 40 industrials the most interested to the project

The achievement of 40 prefeasibility studies for the 40 industrials establishments the most interested and motivated to invest in the solar thermal technology,

Information and awareness to identify the industrials interested to invest,

The finalization of 10 detailed feasibility studies

Organization of a workshop to disseminate the results of the studies and identification of the industrials to realize pilot project,

The implementation of a pilot project in the SHIP,

The establishment of a financial mechanism for the industrial PROSOL program,
84 industrial

- 35 Food
- 33 Textile
- 5 paper industry
- 11 chemical

Share of the selected Industry
- Food 39%
- Textile 34%
- Chemical 17%
- Paper Industry 10%

Degree of commitment

<table>
<thead>
<tr>
<th>Degree of commitment</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Industrial</td>
<td>38</td>
<td>8</td>
<td>13</td>
<td>25</td>
<td>84</td>
</tr>
<tr>
<td>Pourcentage (%)</td>
<td>45</td>
<td>10</td>
<td>15</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

A: Very interested
B: Interested
C: Indifferent
D: Refusing
Typology of selected industrial

Total thermal consumption: 345 ktoe/y

- Electricity and Natural Gas: 222 ktoe/y
- Fuel: 115 ktoe/y
- LPG: 4.7 ktoe/y
- Diesel: 3.5 ktoe/y

Energy use for heat:
- LPG: 123 ktoe/y (4%)
- Diesel: 115 ktoe/y (3%)

Natural gas was not taken into account.

Fuel: 93%
Recommendation for the first step

- Focus on Low temperature process heat to use matures technologies and to reduce the complexity,
- Focus on LPG and fuel oil (decrease the payback time which was between 7 and 26 y),
- Establishment of a financial mechanism (increase the economic profitability);
Currant action in the PROSOL INDUSTRY

- The achievement of a demonstrative solar plant in a low temperature industrial process (by the end of the 2013)
- Carry out a study for the setting up of a sustainable long-term regulatory framework for the promotion of the integration of solar thermal energy in the Industrial sector in Tunisia
- The analysis of the feedback from the pilot plant in low temperature
- Designing a financial mechanism appropriate to the Tunisian context for the development of the SHIP
New program of the promotion
Of innovative solar thermal application in **Industry**
Financed by the BMU
**ANME/GIZ**
**DASTII**

**Project: Distribution of innovative solar thermal applications in the Tunisian industries (DASTII)**

- **Basis:** Project Bid signed between GIZ and BMU
- **Runtime:** 09/2012 – 03/2017
- **Sponsor:** German Ministry of Environment (BMU)
- **Fund:** Internationale Klimaschutzinitiative (IKI)
- **Budget:** 2.500.000 €
- **Project Partners:** ANME, Fraunhofer ISE
DASTII

Aim to create a sustainable market of solar process heat in Tunisia

<table>
<thead>
<tr>
<th>Specific Objectives (Output)</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Training of Tunisian experts and companies in the field of solar process heat</td>
<td>At least 80 Tunisian experts participate in trainings in the field of solar process heat</td>
</tr>
<tr>
<td>2. Execution of at least one solar process heat demonstration project in the Tunisian industry</td>
<td>A solar process heat system is installed in at least one industrial company in Tunisia</td>
</tr>
<tr>
<td>3. Set-up of a national program for solar process heat</td>
<td>The national program is operational</td>
</tr>
<tr>
<td>4. Sensibilisation of the public and dissemination of the project results</td>
<td>Project results are presented at one international conference in Tunisia</td>
</tr>
</tbody>
</table>
Conclusion

The PROSOL Program has a positive impact in all level with an approach “winner - winner” making possible to ensure a durability of development of this program.

- For the State, the financial support which he gives solar thermal energy is not translated by an additional budgetary effort considering the public allocation is largely compensated by the amount of subsidy avoided on the consumption of the LPG for the heating of warm water;

- For the banking sector, the implementation of the program PROSOL creates a large wallet credit. This wallet is also of high quality, because of its security through the repayment of loans through the electricity bill;
Conclusion

 For the suppliers, it is clear that the program PROSOL is a unique business opportunity, taking into account the volume of the market which it generates.

 For the consumer, the program allows him to improve his comfort enjoying a hot water service quality and payment terms are particularly advantageous. According to the investigation of satisfaction customer carried out by a specialized office, 87% of the customers are completely satisfied with the use of SWH;

 Finally, the ANME plays an important role of regulation and control in order to preserve the interests of all the actors by a quality approach QUALISOL and standard Solar Key mark which the ANME is setting up in collaboration with the various actors.
Thank you for your attention