Large Trough Dimensions,
Huge Cost Savings

Ultimate Trough® Solar Collectors for Concentrated Solar Power (CSP)
25 Percent More Cost Effective: New Ultimate Trough®

The Ultimate Trough® is the latest development in solar collectors. It will be about 25 percent more cost effective relative to our current standard parabolic trough, the Eurotrough, by lowering specific costs (€/m²) and improving performance.

The Ultimate Trough® will be optimized for large solar fields in the range of 500,000 to 2,500,000 m² of aperture area. A larger diameter of the heat collection elements, supported by improved selective coatings with lower emissivity, allows a solar field design with lower specific parasitic consumption and less piping in the solar field. Also, the number of units to be assembled, checked, mounted, aligned and commissioned will be reduced by larger solar collector elements.

The number of drives, sensors and controls is reduced by more than 60 percent. Additional cost savings will result due to its better optical efficiency.

Series production of the Ultimate Trough® will start in June 2012, and planning based on this can already begin.

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Comparison of the Ultimate Trough® and the Eurotrough for a 250 MW plant:

<table>
<thead>
<tr>
<th></th>
<th>Eurotrough</th>
<th>Ultimate Trough®</th>
<th>UT / ET</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF area</td>
<td>1,239,330</td>
<td>1,141,629</td>
<td>92.1%</td>
</tr>
<tr>
<td>No. Of loops</td>
<td>379</td>
<td>169</td>
<td>44.6%</td>
</tr>
<tr>
<td>Total Incident Solar Radiation MWh/a</td>
<td>3,059,270</td>
<td>2,818,090</td>
<td>92.1%</td>
</tr>
<tr>
<td>Solar Field Output</td>
<td>1,277,985</td>
<td>1,260,564</td>
<td>98.6%</td>
</tr>
<tr>
<td>h_SF</td>
<td>41.8%</td>
<td>44.7%</td>
<td>107.1%</td>
</tr>
<tr>
<td>Gross Electric Output MWh/a</td>
<td>484,268</td>
<td>484,480</td>
<td>100.0%</td>
</tr>
<tr>
<td>Net Electric Output</td>
<td>436,575</td>
<td>436,575</td>
<td>100.0%</td>
</tr>
<tr>
<td>Efficiency (net)</td>
<td>14.3%</td>
<td>15.5%</td>
<td>108.3%</td>
</tr>
<tr>
<td>Solar field part list (exemplarily)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCE</td>
<td>18,192</td>
<td>6,760</td>
<td>37.2%</td>
</tr>
<tr>
<td>Drives / Sensors / Controls</td>
<td>1,516</td>
<td>676</td>
<td>44.6%</td>
</tr>
<tr>
<td>Pylon foundations</td>
<td>18,950</td>
<td>7,436</td>
<td>39.2%</td>
</tr>
<tr>
<td>Swivel joints</td>
<td>3,032</td>
<td>1,352</td>
<td>44.6%</td>
</tr>
</tbody>
</table>

Dimensions of one Solar Collecting Element (SCE). One Solar Collector Assembly (SCA) consists of ten SCEs.
Additional Engineering and Supply Services

In addition, FLABEG's scope related to parabolic trough technology will extend from reflective panels to:

- Engineering services and project development support (conceptual design & performance estimate, cost estimates and LCoE calculation, site surveys & meteorological data evaluation)
- Supply of key components (reflective panels, solar field control system)

- Collector technology package (collector drawings, jig drawings, specifications and support services like construction supervision and commissioning support)

Optical Performance

Photogrammetry and deflectometry methods confirm the increase of the Ultimate Trough® collector efficiency. The measurement results of the mirrors and the collector structure show an overall average focus deviation (FDx) of 7.8 mm. In consideration of the aperture width of 7.5 m and the corresponding higher focal length this value surpasses the design criterion for the optical performance and validates an optical efficiency of more than 82% of the Ultimate Trough®.
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