Solar Power Systems

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Company Presentation
"Over 2 billion people have no access to the electrical grid."

"The deserts of this world receive more solar energy within 6 hours, than the complete mankind consumes in one year."

Clean, sustainable and inexhaustible energy.
Fact sheet protarget AG

- protarget AG Germany was founded in 2009 to develop, produce and sell turn-key parabolic trough power plants and solar steam boilers
- Pilot plant in Bad Aibling, Germany, supplying 250 kW process heat into a district heating system. Under operation since August 2012

- The key business objectives of protarget are:
  - The decentral supply of electricity and process heat
  - Energy to be cost competitive with fossil fuels (LEC 0.08 €/kWh)
  - Modular power plant concepts with industrial produced components
  - Commercial scale rather than “grand projects”
  - Product to be capable of including local content
  - Product to support the creation of a long-term business opportunity in the target markets
CSP-Technology

- A concentrating solar power (CSP) plant employs rows of large mirrors called parabolic troughs that move about one axis in order to track the sun throughout the day.
- The solar energy is concentrated by the mirrors and heats a working fluid that is then used as a source of energy to power a conventional turbine and generator.
- In this way carbon-neutral electrical power is generated without the use of fossil fuels.
- Countries with high solar radiation values provide ideal conditions for the commercial use of this form of energy.
Solar Module CF100

- Special solar module, designed for the power range of 1-8 MW.
- Developed in cooperation with the German Aerospace Centre DLR and industrial partners.
- Modular concept with industrially produced components.
- Optimised solar tracking system.
- Length 12m, height 3.6m, weight 1.6t.
- Torsion box design; easy to assemble.
Target market: Mediterranean countries

- Ideal climatic conditions for solar thermal power generation.
- Growing population with increasing energy demand.

Customers:
- Industrial parks, food-, textile- and machinery industry, mining, agriculture, hotels, remote settlements

Applications:
- Electricity generation, process heat and cooling, water desalination, hybridisation with biomass or biogas

Advantages:
- Grid independent power supply for bulk electricity consumer (IPP) in remote areas.
- To create a technology hub for solar thermal power generation in the region.
- “Green” and sustainable energy generation as marketing strategy.
Product range

- Turnkey solar power systems for electrical power generation and the supply of process heat to industrial applications
- Solar steam generator (solar boiler) available in power steps of 0.25 MW
- Standardised plant layouts, available in 3 different models: 1 MW, 3 MW, 6 MW
- Heat storage system, allowing night time operation
- Systems can be equipped with gas or oil powered burner to allow operation during periods of bad weather
- Technical options such as process heat, cooling and the desalination of sea water are available

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<th>Type</th>
<th>Power [MW]</th>
<th>Mirror Surface [m²]</th>
<th>Number of Modules</th>
<th>Site Area [ha]</th>
<th>Elec. Output [GWhel/y]</th>
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Solar steam generator

- Two solar collector rows, 96m in length, each made up of 8 CF100 collector modules
- Fully automatic operation, minimum of supervision required
- Routine maintenance largely limited to mirror cleaning (circa 20 times per year)
- Nominal thermal power – 250 kW, Process (steam) temperature range: 80 – 300°C
- Effective annual operating hours at nominal thermal power – 2.000 hours
- Nominal steam yield – 300 kg per hour - replacing 50 tons of fuel oil per year!
- Available as hybrid with oil or gas fired boiler for full operational flexibility.
- Realisation period – 3 months from date of order
Ideal applications for solar energy or process heat generation

- **Food and beverage industry** - Drying, cleaning, cooking, baking, pasteurisation
- **Textile and leather industry** - Dying, shaping, ironing, tanning
- **Hotel and tourism industry** - Laundry, heating, cooling
- **Paper industry** – Bleaching, thermo mechanical pulping, drying
- **Pharmaceutical and chemical industry** - Process specific applications, distillation
- **Mining and oil industry** – Undeveloped oil recovery, cleaning, process applications
- **Plastics and rubber industry** - Heating, cooling, vulcanisation
- **Water treatment** - Desalination and water purification projects
- **Slaughter houses** – Cooling and refrigeration of meat and meat products
Concentrating solar thermal power plant

• Turn key parabolic trough solar power plants for independent electricity generation
• A 1 MW power plant consists of 40 rows of mirrors, 96m in length with 320 CF100 collector modules to **supply 4,000 people with sustainable electricity**
• Through largely automatic operation and design for minimum maintenance, operating costs are kept at the lowest possible level
• Routine maintenance largely limited to mirror cleaning (circa 20 times per year)
• Additional options such as process heat, cooling and water desalination available
• Realisation period – 12 months from date of order
Competitive advantages

• Standardised power plant layouts » minimum effort in planning and logistics.
• Industrial methods of manufacturing » cost efficient high-quality components.
• Modular concept » scalable solar plant layout.
• Smaller project size » low financial expenditure, less interfaces.
• Decentral power generation at the customer » low transmission and heat losses.
• Complete CO₂ free energy generation » „Green labelling“ as marketing strategy.
• Energy security » independent of electricity price developments.
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