

**50MW SGS3**

**STEAM GENERATION SYSTEM**

*for Godawari Green Energy Limited, India*





# FROM IDEA

to reality



**Autumn 2011**  
Order for the SGS3 steam generation system



**Autumn 2012**  
Components arrive on site



**Winter/Spring 2013**  
Construction and installation



**Summer 2013**  
Godawari CSP plant goes operational



## India's first CSP PLANT

### PROJECT FACTS

#### GODAWARI 50MW CSP PLANT

- Parabolic trough with thermal oil
- 118,866 MWh electricity / year
- 2,500,000 households
- 1,131,600 tons CO<sub>2</sub> / year

#### SGS3 STEAM GENERATION SYSTEM

- 104 barg steam
- 385 °C steam

#### SAVINGS

- 5-10 % LCOE reduction

The Godawari 50MW plant is the first commercial concentrated solar power (CSP) plant in India which went into full operation within Phase I of the Indian Government's National Solar Mission.

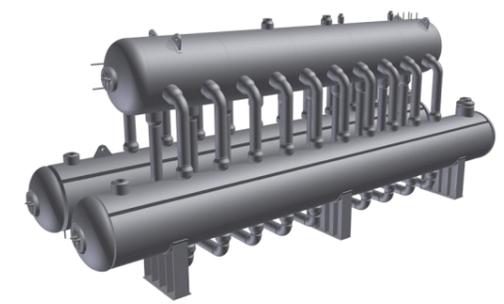
The plant benefits from the third, optimised edition of Aalborg CSP's solar steam generators, the award-winning SGS3 technology. The system was installed ahead of schedule and went into commercial operation in June 2013. Since then, it has been showcasing flawless and reliable operation.

The Godawari plant confirms excellent performance track records for the system that produces superheated steam at 385°C at 104 barg. The installed system has not required any maintenance since commissioning which was one of the key requirements for Godawari Green Energy Limited (GGEL).

*"When choosing the Aalborg CSP steam generation system, the most important factor for us was the header and coil design providing our plant with a very high reliability, high gradient performance and zero maintenance which is a key issue seen in previous CSP installations"* - said Mr. JP Tiwari, Director of Godawari.

The SGS3 steam generation system has won multiple international awards for the operational benefits it provides, such as: fast ramp-up, leakage-free design, low maintenance requirements and natural circulation in the evaporator unit.

## Harvesting the sun IN THE MOST EFFICIENT WAY



SGS3 evaporator and steam drum with natural circulation

The SGS3 system, which is also securing reliable operation of the Godawari 50MW CSP plant, is developed based on traditional boiler principles (ASME and EN standard header and coil type) not as ordinary heat exchangers (TEMA standard kettle- and shell & tube-type).

This contributes to many operational benefits and therefore has the potential to reduce levelised cost of energy (LCOE) of CSP plants by up to 5-10%:

- fast start-up (up to 9 °C/min)
- guaranteed leakage-free operation
- low maintenance requirements
- natural circulation

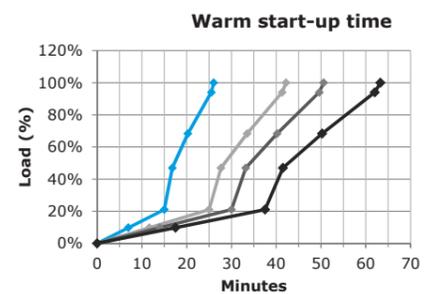
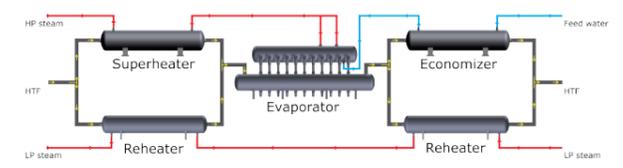


Chart illustrates the benefits of fast (9 °C/min) ramp-up



System layout of a 50MW thermal oil steam generation system consisting of five main components

# **CHANGING ENERGY** *around the world*

Aalborg CSP is a leading developer and supplier of innovative renewable technologies aiming to change the way energy is produced today. Relying on extensive experience from some of the most efficient concentrated solar power (CSP) projects around the world, the company designs and delivers green technologies and integrated energy systems to lower the cost of energy for industries and power plants worldwide.

Aalborg CSP places strong focus on R&D activities and partners with knowledge-based companies and institutions to create leading-edge technologies. As a result, the Aalborg CSP engineering design is centred on a value-adding concept providing solutions that excel in operation, increase plant revenue and contribute to a greener future.

Headquartered in Aalborg (Denmark) and with sales & service offices in Spain, the US, Australia and Indonesia, Aalborg CSP has realised more than 1,700MWth cost effective green energy solutions to a variety of industries worldwide.



**5 sales & service locations**  
**more than 1,700 MWth solar installations**

**AALBORG CSP**  
- Changing Energy

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