

Concentrated Solar Power (CSP) Tower Systems METU Presentation



CSP TOWER TECHNOLOGY

- One of the most efficient and versatile solar energy fields is the CSP tower. CSP tower with TES design is capable of using super-heated steam in any industrial application. As; base-loaded power plants, hybrids to any carbon-based power plant, thermal water desalination and any form of steam used in the most practical.
- Acceptance and attention will take place within a low LCOE (levelized cost of energy).



**Electricity+
Storage**



Water desalination



**Hybrid- PV gas coal+
Industrial Applications**

MERSIN CSP TOWER TECHNOLOGY

An integrated hardware and software system with the following components:

- **Cost Efficient Heliostats ,70 USD m²**
- **Direct Steam Generation Receiver**
- **Interactive Core Plant Management Software**

Greenway
CSP Solar Tower



- Proven and tested at our 5 mWTh+1 mWE , World Reference operating plant in Mersin, Turkey
- In-house R&D development & testing facility
- R&D collaboration with leading research institutes

ACHIEVED TECHNOLOGY

- Integrated real-time field data management system.
- Plant core software integrated auxiliaries to monitors the plant performance.
- Auxiliary system configurations; motion control PCB, digital and optical heliostat calibration system, cloud detection system, thermal cameras, weather station system, embedded wireless communication system, dynamic field solar input calculation system, thermal SCADA system,
- TES Sensible single tank heat storage system .

- 70% Local Production input
- Intelligent heliostat PCB. (process control board)
- Hybrid secured wireless heliostat communications. (Omni & Mesh broadcasting topology)
- Digital and optical heliostat calibration system
- Autonom motion control algorithm

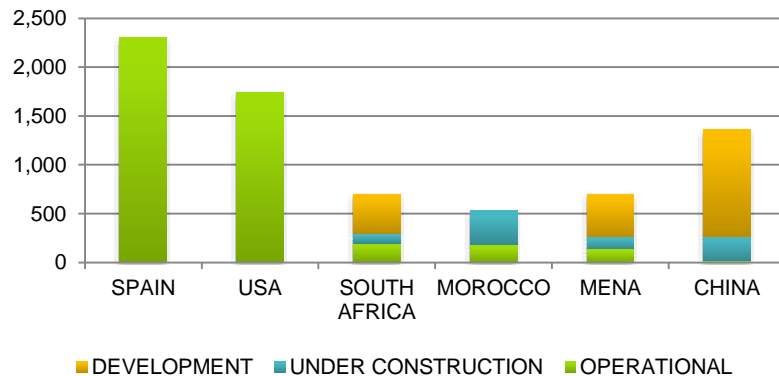


What is current market?

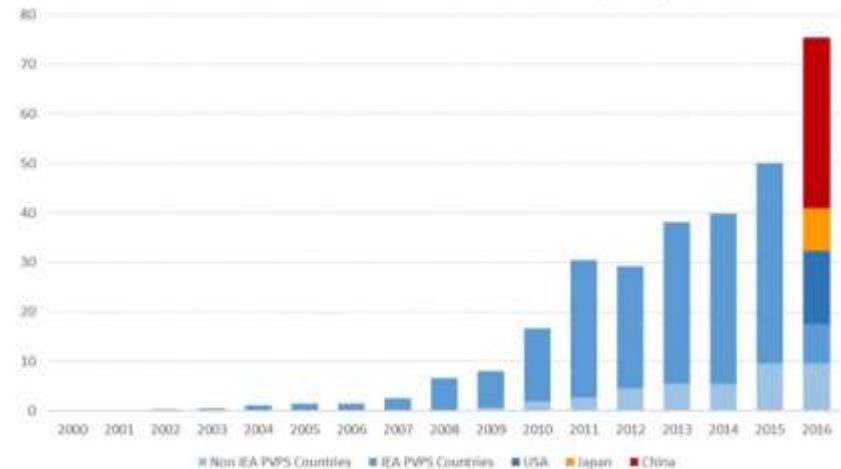
DYNAMICS

- **PV in fashion**
- **Minimum tenders for CSP solutions**
- **Handful of CSP tower players with bankable solutions, but top two in financial difficulty**
- **Market is looking to do it themselves**
- **High Costs + LOCE**

NUMBERS



PV installed capacity over 80 GW



What makes a project lucrative?

Attractive DNI

- Optimum solar input for efficient field design and maximum power generation

Attractive Location

- Readily available land with good soil conditions for economic civil works
- Minimal distance between CSP plant and fossil fuel plant to ensure economic steam line connection

Cheap Financing

- Bankable to obtain Project finance
2 year grace period,
fixed low rate, 10- 15 year term

The combine-cycle design

Brayton Cycle + Rankine Cycle + Thermal energy storage (TES) + Thermal Water Desalination systems + PV

Demonstrate the reduction of the electricity price LOCE based, below 5 US ¢/kw/h.

- CSP solar technology is developing rapidly. However, in order to expand this technology in electricity generation, it is necessary to develop high efficiency and low-cost systems. Usually, steam turbines (Rankine Cycle) are used for electricity generation at the CSP plant, so efficiencies are limited.
- There are still serious problems due to the molten salt circulations TES systems. Therefore, commercially but cannot be competitive in the electricity market due to high operation and investment costs.
- (CSP) tower system. An integrated facility, includes low cost single tank sensible thermal energy storage (TES). The idea is combining existing technologies within a touch of the new look criteria.
- Multipurpose combine cycle philosophy.
- High efficient and low-cost/LOCE renewable power plant design.

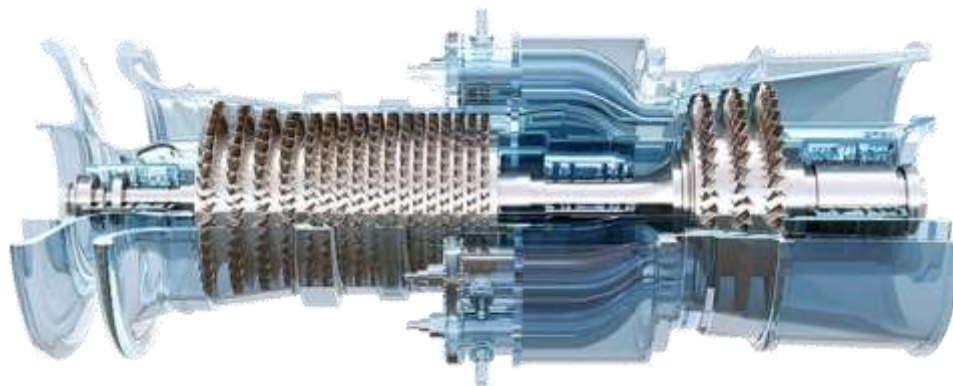
- **TES Low Cost**
- **High Efficiency**
- **No Maintenance Required**
- **Up to 12 hour extra operations in a day**



Combined Cycle CSP Tower Power Plant at USA

To achieve the highest efficiency rate in the simplicity.

- Next-gen (CSP) tower system is the combined Brayton Cycle + Rankine Cycle + Thermal energy storage (TES) + Thermal Water Desalination system+PV .
- We are collaborating equipment manufacturers , scientific institutes and DOE together. Main considerations are the past experience and equipment durability values and available product integrations to lower the cost .
- The process schematic is; heated air through air tube receiver to run the gas turbine (Brayton Cycle) and hot air exhaust output to the heat exchange to steam production. Steam from the heat exchange to charge the TES. TES to charge second turbine (Rankine Cycle) and charge to the thermal desalination unit.



Improve Our Technological Skills

- **High efficient and low-cost/LOCE renewable power plant design.**
- **- Multipurpose combine cycle philosophy.**
- **- Old fashion proven low-cost TES design.**
- **- Reduction of the carbon emissions.**
- **- To achieve the highest efficiency rate in the simplicity.**
- **- The overall combined plant efficiency is aimed to very high . The impact will be revolutionary.**

