



Dispatchable Solar Power: Perenjori Study

ASTRI Symposium, Brisbane
February 2015

Abengoa Solar

Perenjori Dispatchable Solar Thermal Project

Key Findings and Recommendations

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Our solar plants in operation

Abengoa Solar CSP plants in commercial operation

Spain	MW	
Solnova 1,3,4	3x50	Trough
PS10	11	Tower
PS20	20	Tower
Ecija Solar Complex	100	Trough
Carpio Solar Complex	100	Trough
Extremadura Solar Complex	200	Trough
Castilla-La Mancha Solar Complex	100	Trough
Algeria		
ISCC Hassi R'mel, Algeria	150	ISCC
Abu Dhabi		
Shams-1	100	ISCC
USA		
Solana, Arizona	280	Trough
Mojave, California	280	Trough
Total CSP in operation	1,491	

PV Plants in operation

Spain	MW
Sevilla PV	1.2
Casaquemada PV	1.9
Las Cabezas PV	5.7
Copero PV	1
Linares PV	1.9
Total PV in operation	11.7



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Our solar plants in construction & pre-construction

Abengoa Solar CSP Plants in construction

South Africa

Khi Solar One	50	Tower
Kaxu Solar One	100	Trough

Chile

Project in Atacama Desert	110	Tower
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Total in construction

260



Abengoa Solar CSP Plants in pre-construction

South Africa

Xina Solar One	100	Trough
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Israel

Project in Ashalim of Negev Desert	110	Trough
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Total in pre-construction

210



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Technology as a competitive advantage for Abengoa

R&D

Pilot Plant or Real Test

Commercial Project

- +150 in-house researchers
- R&D center in Denver, CO
- R&D center in Seville, Spain
- Abengoa Research
- Collaboration with key research institutions and companies worldwide



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Perenjori Dispatchable Solar Thermal Power Plant



- 20 MW net capacity
- 7 hours molten salt storage
- ca. 230,000 m² heliostat field
- ca. 92 GWh production per yr
- 24 - 30 month construction period
- 25 year operation period

Perenjori Dispatchable Solar Thermal Power Plant

■ The Challenge

● Replicability

Potential for the widest possible replicability and relevant learnings for future CSP project applications.

● Plant Capacity

Logical minimum capacity for a CSP plant to minimize requirement for Government support whilst maintaining relevance for future development.

● Dispatchability

The Project should include a thermal energy storage (TES) system which will allow the CSP plant to generate electricity when needed, and to provide the benefits of firm capacity to the local transmission network.

● Pathway to Cost Reduction

Select state-of-the-art technology which offers the highest potential for cost reduction of the three compared technologies: parabolic trough, linear fresnel and tower.

Perenjori Dispatchable Solar Thermal Power Plant

■ ARENA

- Funding support for Perenjori project preparation activities / feasibility study

■ The Project Partners

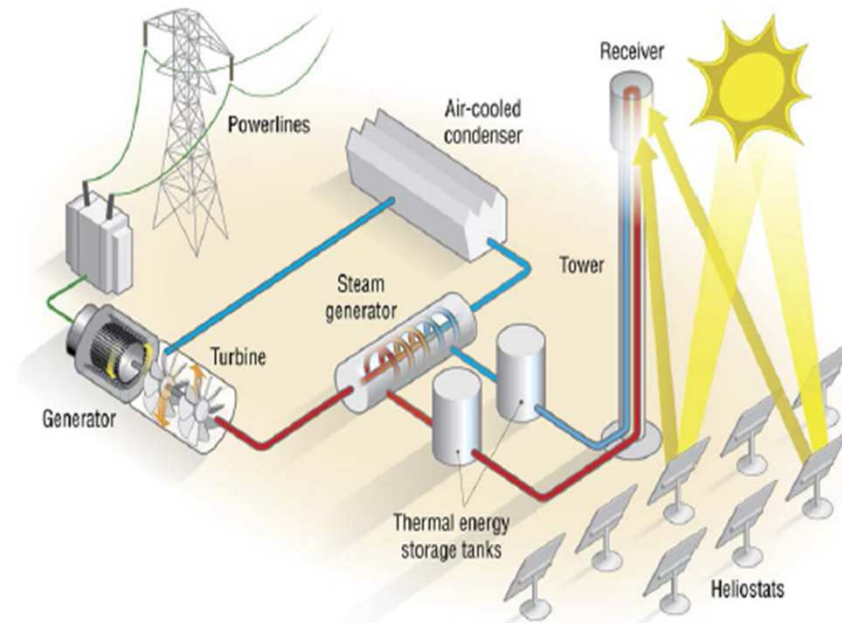
- Abengoa Solar Power Australia
- Abengoa Solar, SA
- CSIRO
- WestGen / National Power
- Institute for Sustainable Futures (UTS)

Perenjori Dispatchable Solar Thermal Power Plant

■ The Technology

● Molten salt tower overview

- ▶ Provides dispatchable renewable energy.
- ▶ Offers unique flexibility since the energy collection and energy delivery processes are decoupled.
- ▶ Energy is collected when the sun is shining, but only converted into electricity when it is demanded.
- ▶ No round-trip losses associated with storing the energy for later use.
- ▶ Higher temperature increases efficiency and reduces storage costs.



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Perenjori Dispatchable Solar Thermal Project

Key Findings and Recommendations

Perenjori Dispatchable Solar Thermal Power Plant

■ Rationale for Site Selection

- **Ideal site** for the proposed plant, including world class direct solar irradiation;
- **Fringe of grid** connection will provide significant network benefits;
- Proposed **off-take arrangements** include a combination of electricity retailers and a large iron ore mining operation;
- **WA Government** and **local community** are supportive of such activity;
- **Strong demand** for peak and especially shoulder generation;
- Excellent prospects for **further roll-out of solar thermal power** generation with storage in end of grid and off-grid applications, with an emphasis on powering the mining sector.

Perenjori Dispatchable Solar Thermal Power Plant

■ What did the feasibility study test?

- Solar radiation resource
- CSIRO heliostat design compared with Abengoa
- Optimum storage capacity
- Socio-economic, environmental and network benefits
- Cost to install a CSP plant in a remote area of Australia
- Pathway to cost reduction
- Feasibility of implementing the project

Perenjori Dispatchable Solar Thermal Power Plant

■ What were our findings?

- World class DNI
- Abengoa heliostat design has commercial maturity, CSIRO design has optical benefits
- Storage capacity increased from 3 to 6 and finally 7 full load hours
- Lack of awareness by grid operator of characteristics / benefits of CSP with storage
- Cost to install a CSP plant in a remote area of Australia
- Pathway to cost reduction – project learnings, pipeline, supply chain, and increased capacity lead to competitive LCOE
- Potential to be a feasible project

Perenjori Dispatchable Solar Thermal Power Plant

■ What are our recommendations to reduce costs?

- Create a baseline - build the first project
- Encourage market demand (through combination of RET, and ARENA/Government programmes)
- Facilitate a pipeline of projects to create a local supply chain; local technical, project and financial expertise; leading to lower costs
- Increase plant scale from 20MW to 100MW+
- Focus on value creation as well as reduced cost

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Thank You!

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