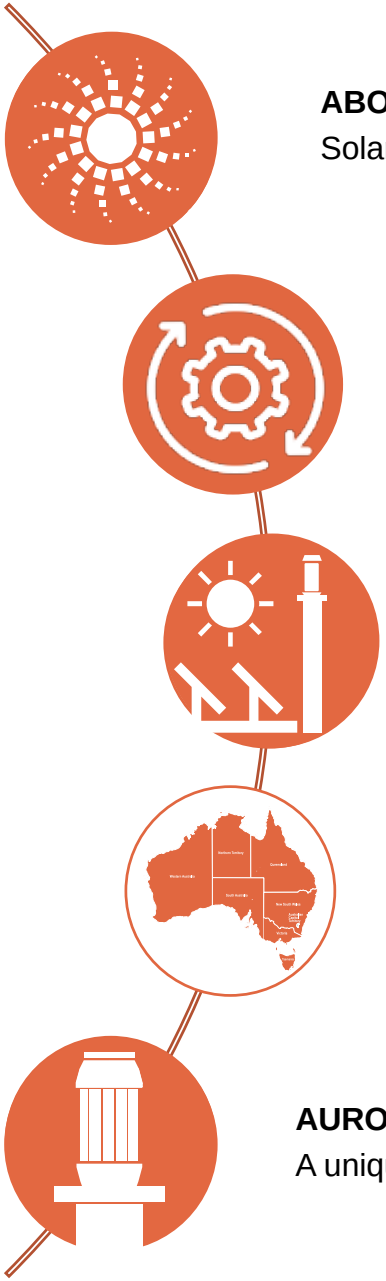
Our Mission

Advancing solar energy storage technology to accelerate the world's transition to sustainable energy, while creating jobs and economic growth for communities around the world

SOLARRESERVE®

Daniel Thompson
Vice President of Development

Agenda



ABOUT SOLARRESERVE
SolarReserve and its solar thermal market leadership

OUR TECHNOLOGY
An in-depth examination of SolarReserve's technology

CRESCENT DUNES SOLAR ENERGY PROJECT
SolarReserve's flagship project operating in the Nevada desert

AUSTRALIAN MARKET
Renewable energy programs in Australia

AURORA SOLAR ENERGY PROJECT
A unique hybridised solar thermal and solar PV project

SOLARRESERVE®

Global Reach Across Six Continents

Development portfolio of nearly 8 gigawatts across the world's most attractive, high growth renewable markets

USA
SANTA MONICA, CA (HQ)

CRESCENT DUNES
Tonopah, Nevada
110 MW +
1,100 MWh storage

SANDSTONE
Nevada
2,000 MW +
20,0000 MWh storage

CHILE
SANTIAGO

COPIAPÓ
Atacama Region
260 MW +
3,400 MWh storage

TAMARUGAL
Tarapaca Region
450 MW +
5,800 MWh storage

LIKANA
Antofagasta Region
390 MW +
5,100 MWh storage

SOUTH AFRICA
JOHANNESBURG

REDSTONE
Northern Cape, 100 MW +
1,200 MWh storage

LESEDI
Northern Cape, 75 MW

LETSATSI
Free State, 75 MW

JASPER
Northern Cape, 96 MW

HERTZOGVILLE
Free State, 50 MW

ROOIPUNT
Northern Cape, 150 MW +
1,800 MWh storage

KOTULO TSATSI
Northern Cape, 150 MW +
1,800 MWh storage

ARRIESFONTEIN SOLAR PARK
Northern Cape
75 MW - Wilger
75 MW - Arriesfontein

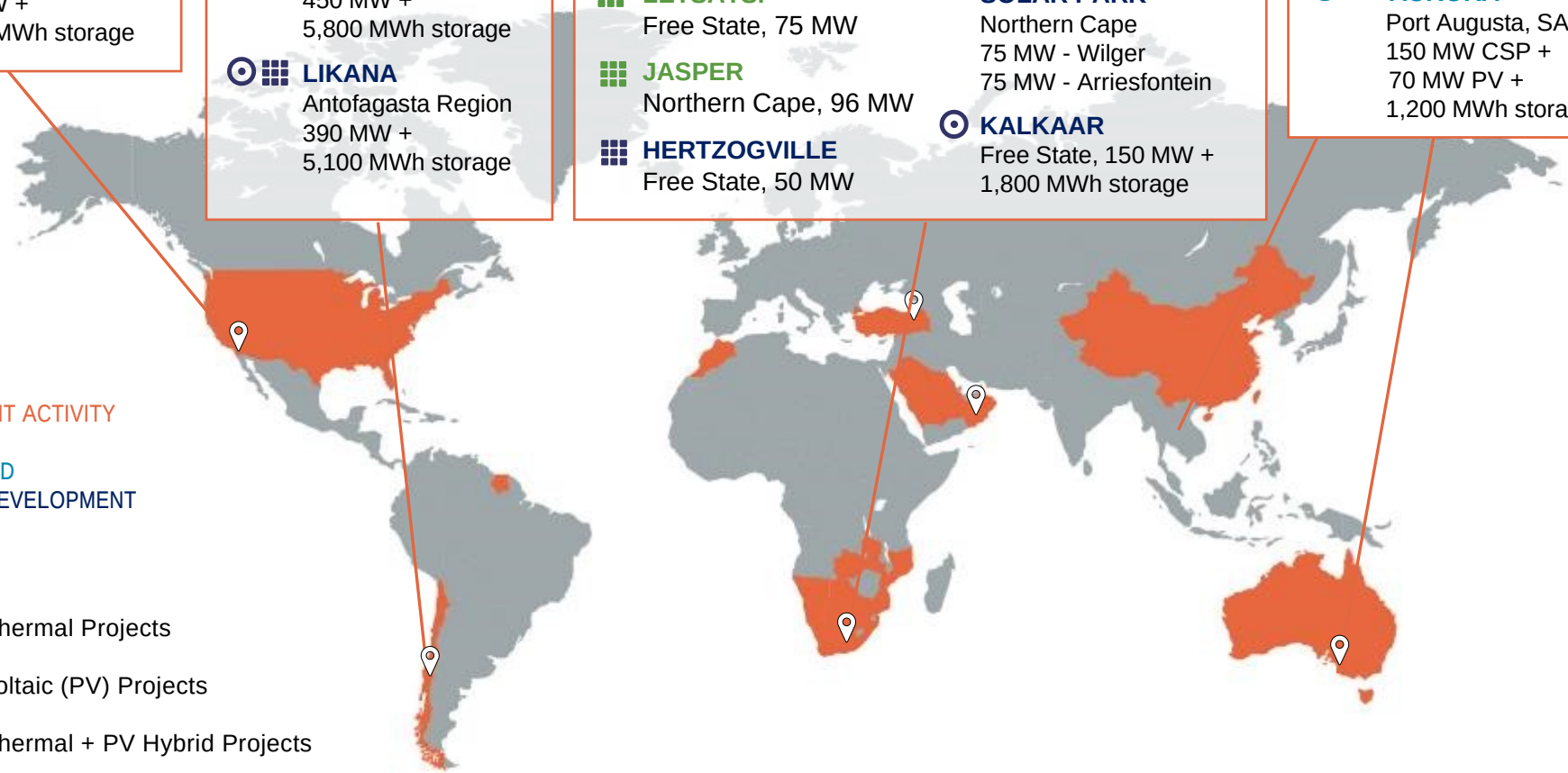
KALKAAR
Free State, 150 MW +
1,800 MWh storage

CHINA

500 MW of supply opportunities into 6 GW CSP program

AUSTRALIA
ADELAIDE

AURORA
Port Augusta, SA
150 MW CSP +
70 MW PV +
1,200 MWh storage

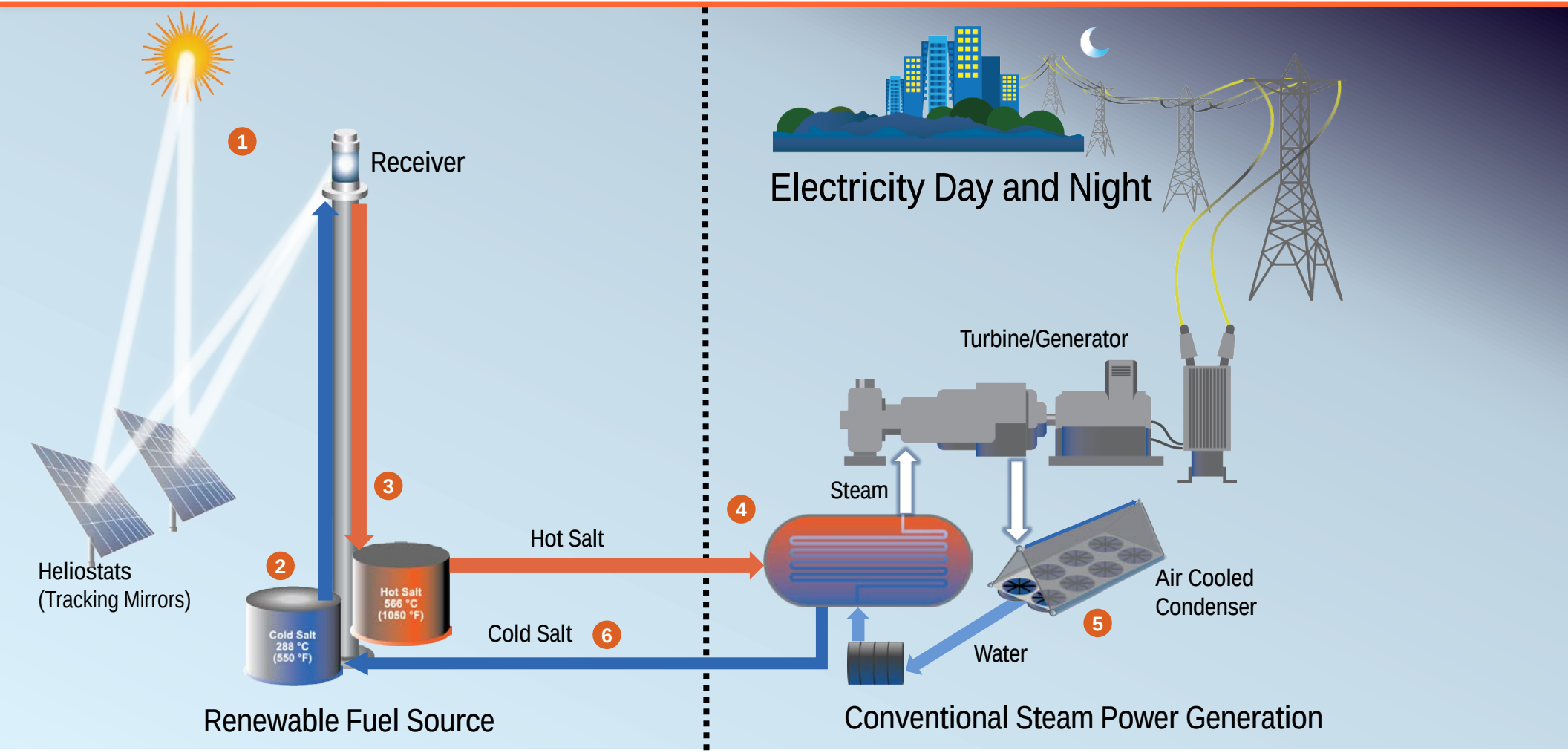


DEVELOPMENT ACTIVITY
OPERATING
PPA AWARDED
ADVANCED DEVELOPMENT

Office
Solar Thermal Projects
Photovoltaic (PV) Projects
Solar Thermal + PV Hybrid Projects

SOLARRESERVE®

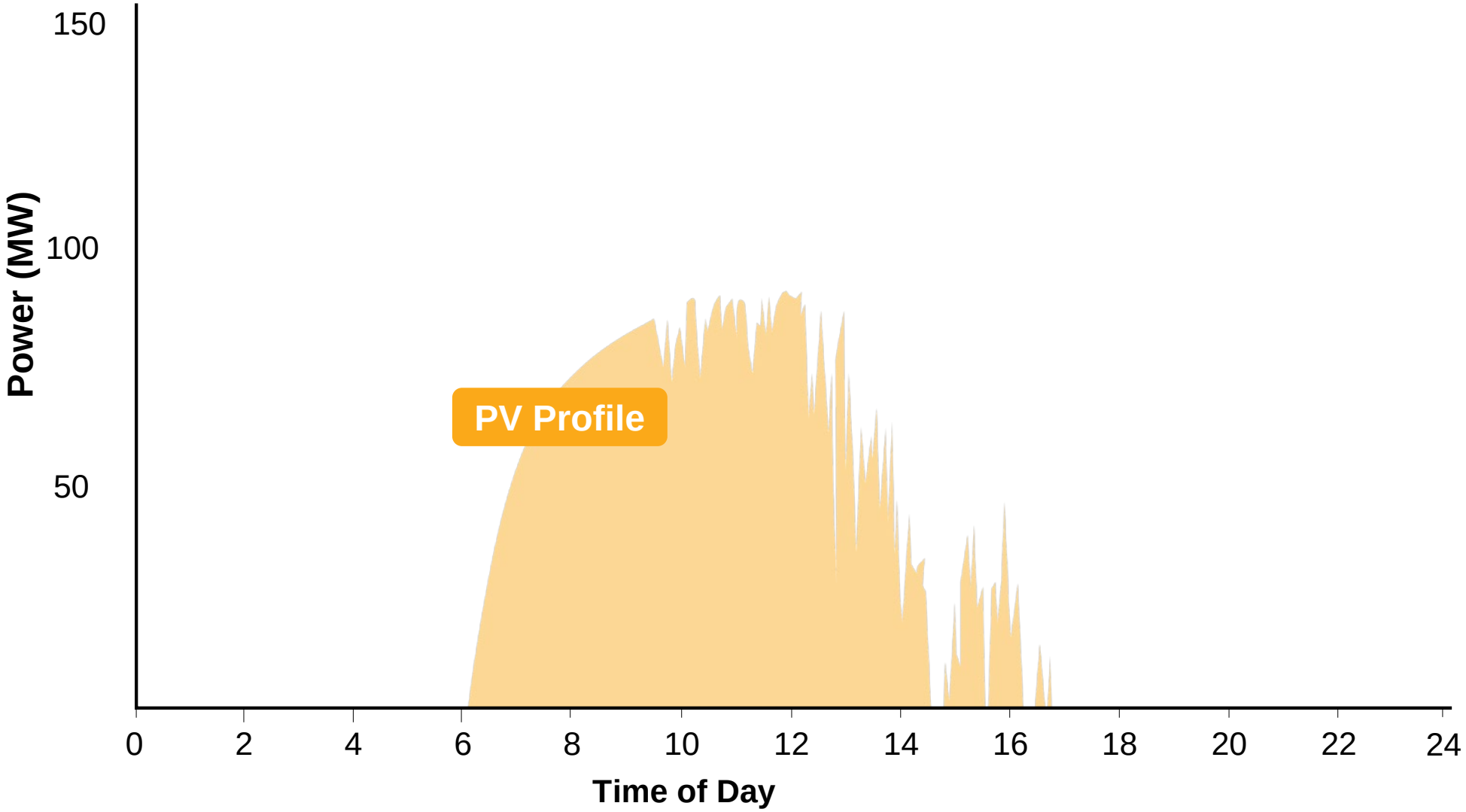
Unmatched Proprietary ThermaVault™ Energy Storage Technology



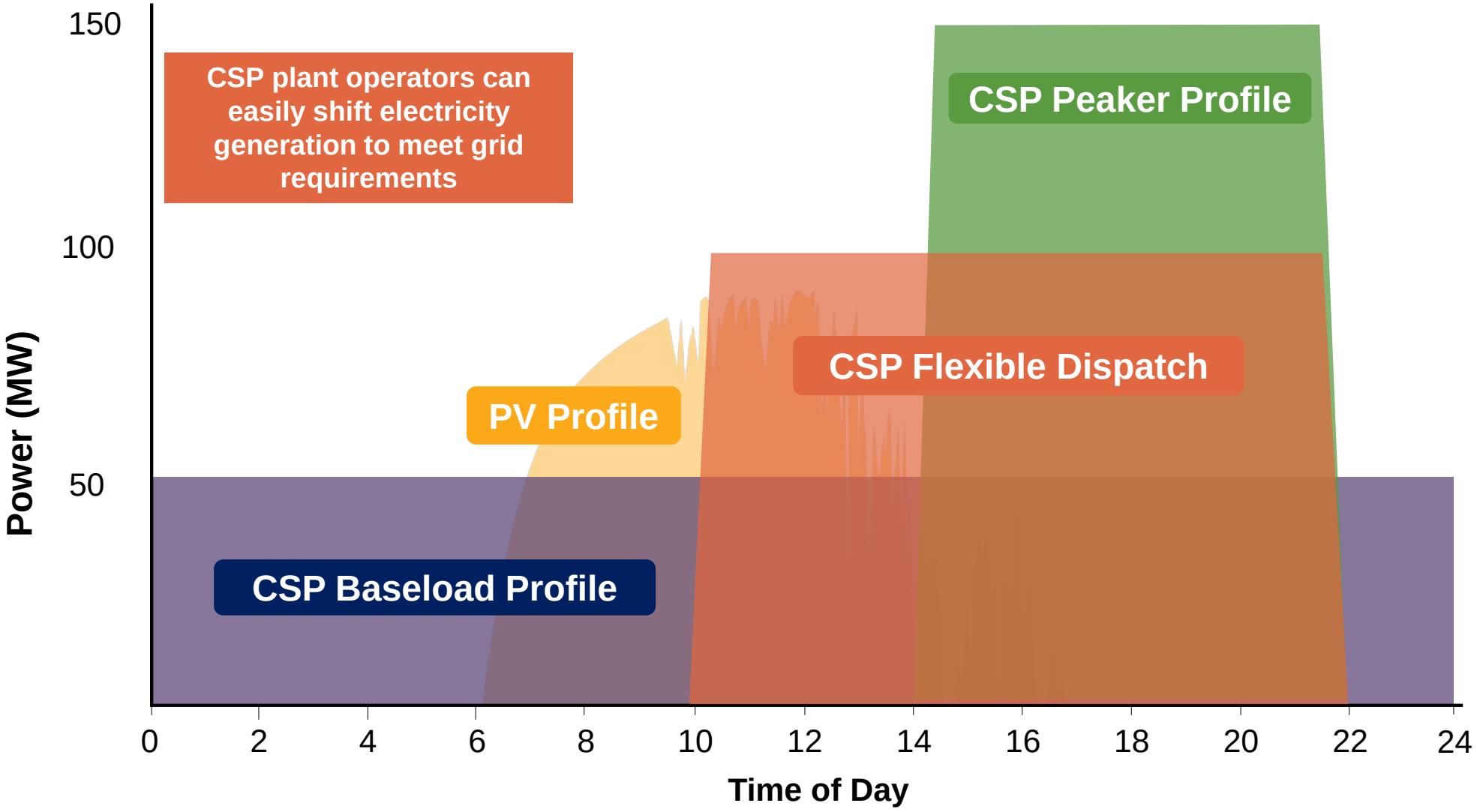
1. Sunlight is concentrated and directed from a large field of heliostats to a receiver on a 640 foot tower
2. Liquid salt from the cold salt tank is pumped through the receiver where it is heated to 1050°F (566°C)
3. The heated salt from the receiver is stored in the hot salt tank
4. Hot salt is pumped from the hot salt tank through a steam generator to create high temperature/high pressure steam, which drives a steam turbine, generating electricity
5. Condensed steam from the steam turbine is recirculated for reuse
6. Cold salt at 550°F (288°C) flows back to the cold salt tank

SOLARRESERVE®

Photovoltaics (PV) Provide Variable Generation During Daylight Hours



CSP's Dispatchable Generation Delivers Firm Output On Demand



Integrated energy storage provides the ability to shift electricity generation to meet different profile needs and deliver firm reliable power at high capacity value



CRESCENT DUNES SOLAR ENERGY FACILITY – TONOPAH, NEVADA

The world’s only operating commercial scale molten salt power tower

Crescent Dunes: Project Highlights

10,347 Heliostats
each 1,250 ft² (117 m²)

640 Foot (195 Meter) Tower

Power Block

1.75 Mile (2800 Meter) Diameter

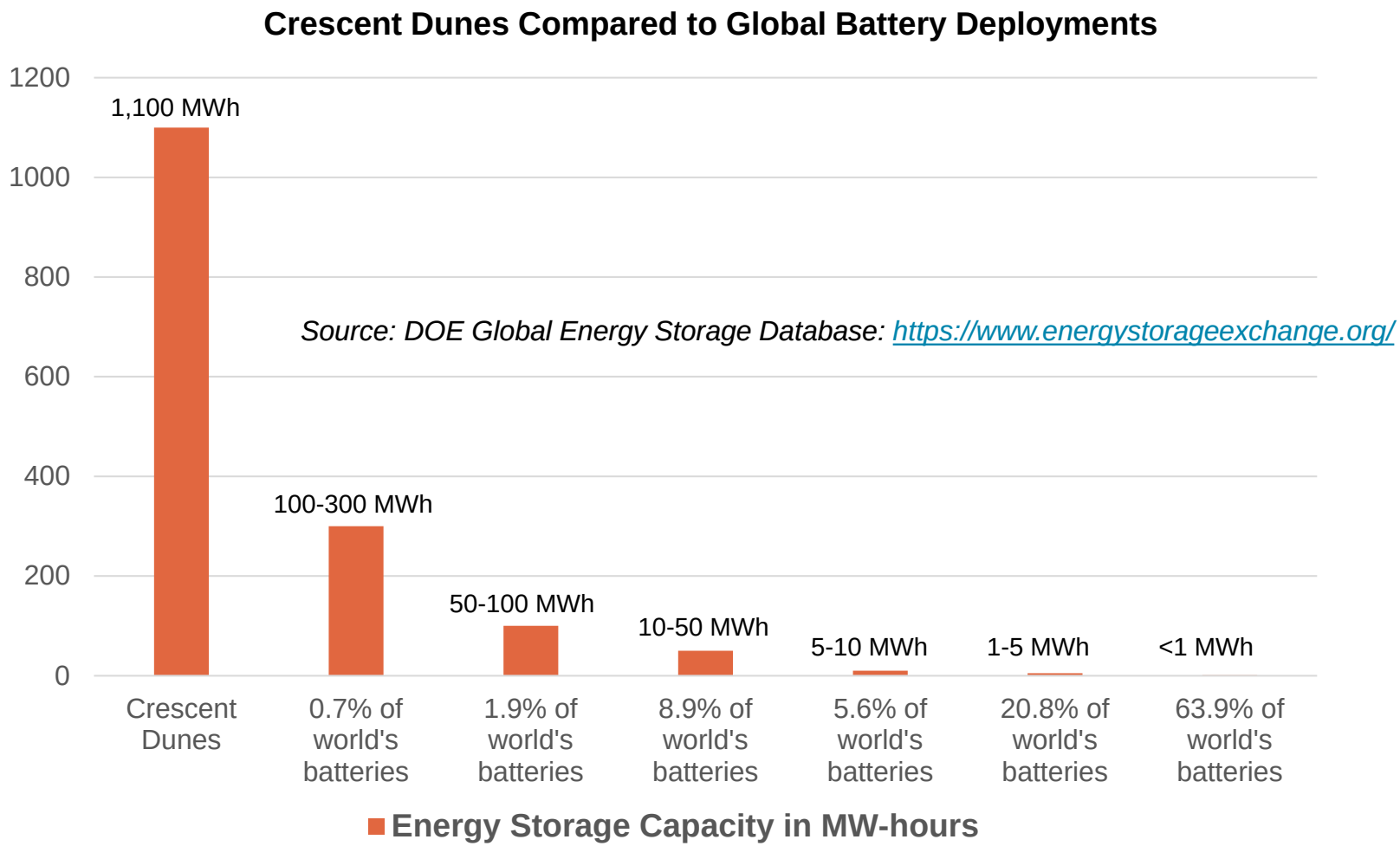
- **Electricity Production:** 110 MW of generating capacity and 1,100 MWh of storage capacity generating more than 500,000 MW-hours annually
- **Energy Storage:** 10 hours of full load electricity generation (1,100 MW-hours of storage)
- **Generation Profile:** 16 hours during summer months, powering 75,000 Las Vegas customers late into the night
- **Debt Financing:** Debt supported by U.S. Department of Energy Loan Guarantee Program
- **Equity Investment:** $260 million of private equity from SolarReserve (managing partner), ACS Cobra and Banco Santander
- **Power Purchaser:** 25-year power contract with NV Energy, Nevada's largest utility, for 100% of output at a fixed price with 1% annual escalation, regardless of world fuel prices
- **Commercial Operation**: Passed necessary tests to reach full commercial operation, under the PPA with NV Energy, in November 2015

Located in Tonopah, Nevada, Crescent Dunes is the only project in the world which can deliver dispatchable renewable power at this magnitude without supplemental fossil fuel

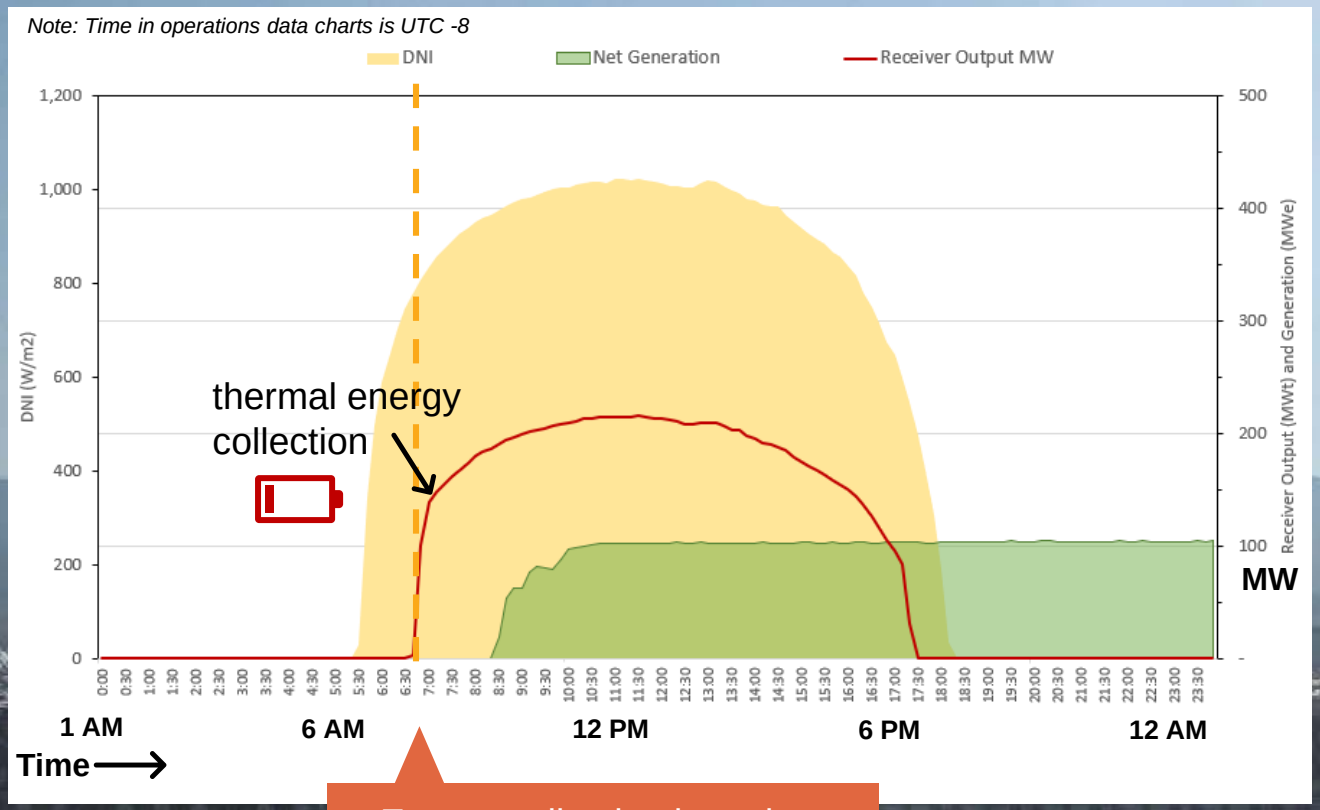
SOLARRESERVE®

Solar Thermal Provides Massive Energy Storage when Compared to Batteries

- The 1,100 MW-hours of energy storage at Crescent Dunes alone is larger that all the 300+ utility-scale battery installations across the U.S. – combined
- Globally, there are over 750 utility-scale battery projects in operation – the energy storage at Crescent Dunes, as shown in the graph below, is magnitudes larger than all installations, and 100+ times larger than the majority



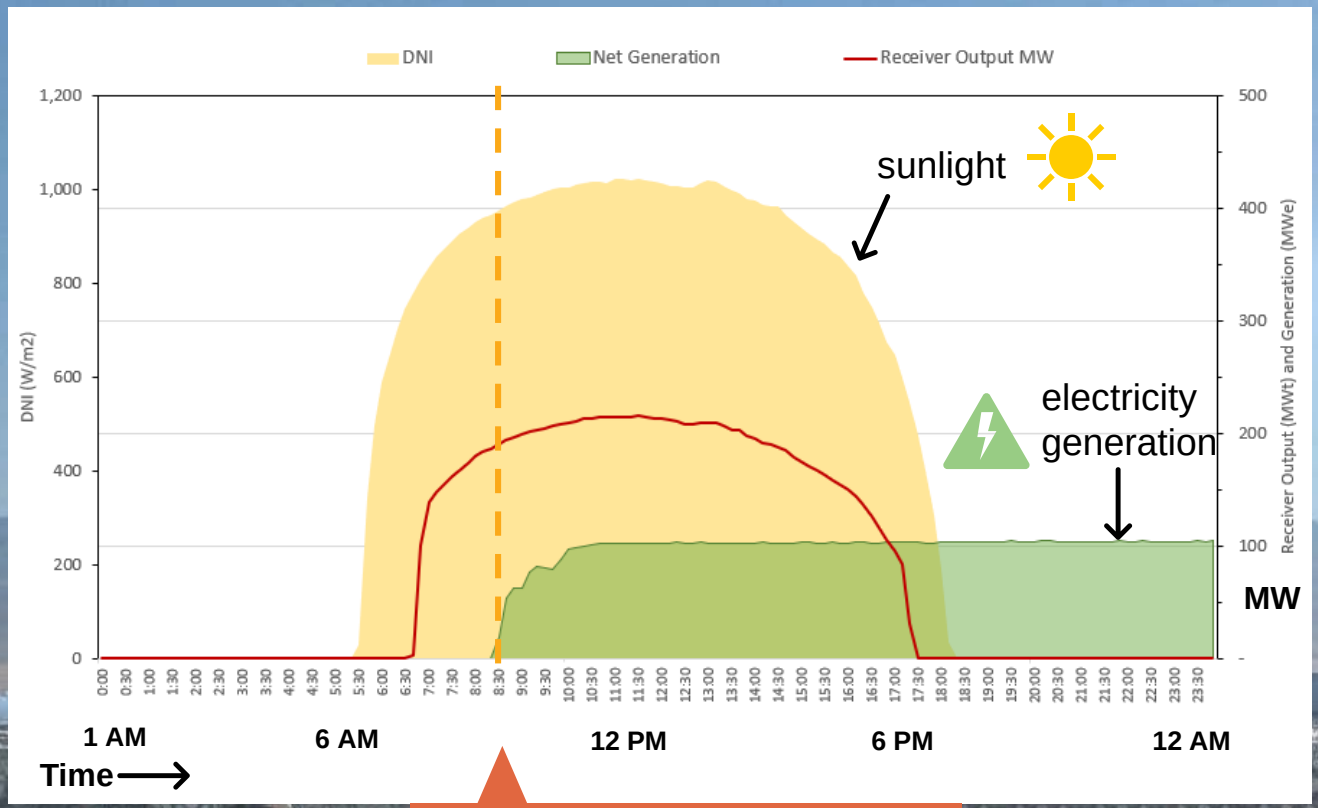
Performance Data: Steady Power Generation Throughout Peak Demand



Energy collection in molten salt commences at 7:30 AM (local time)

AUGUST 31, 2018 07:30 AM

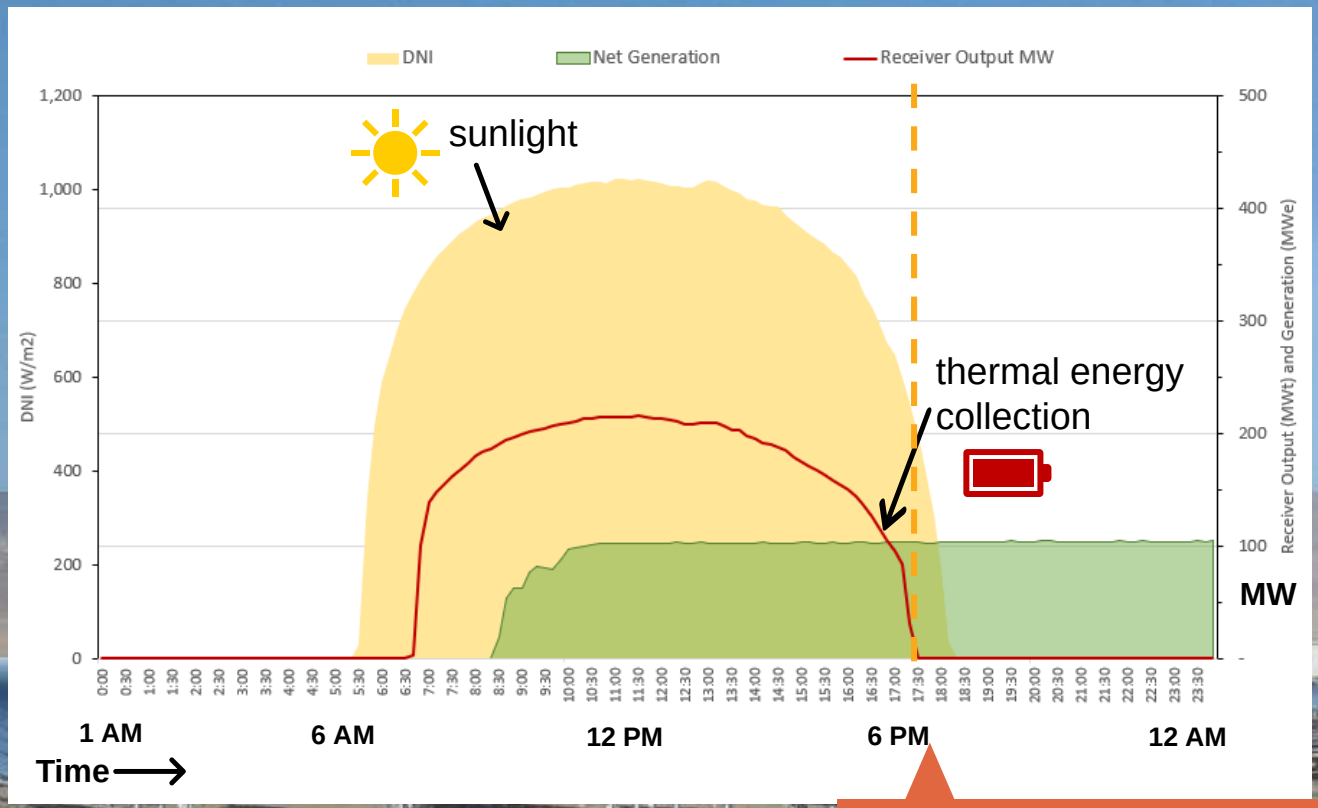
Performance Data: Steady Power Generation Throughout Peak Demand



Electricity generation commences at 9:30 AM

AUGUST 31, 2018 09:30 AM

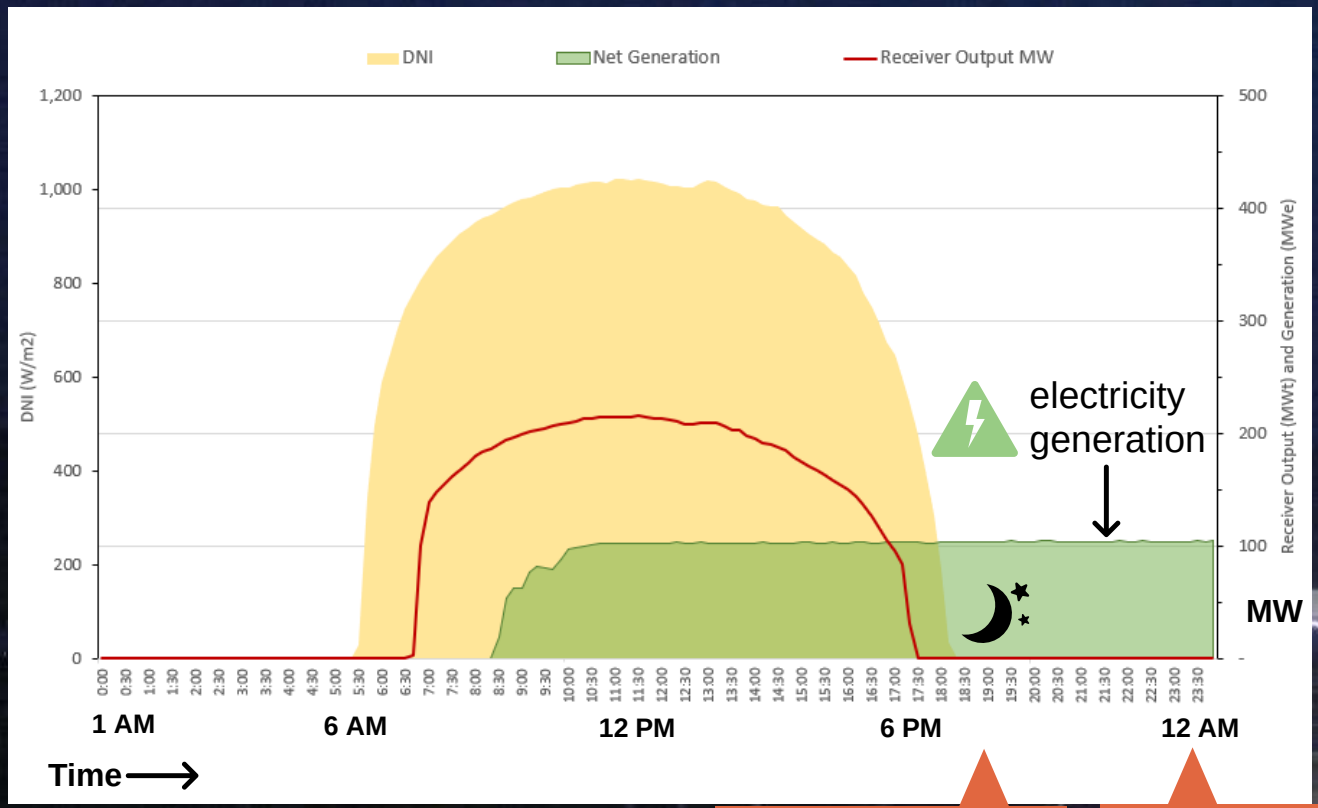
Performance Data: Steady Power Generation Throughout Peak Demand



Energy collection in molten salt concludes at 6:30 PM (tank is full)

AUGUST 31, 2018 06:30 PM

Performance Data: Steady Power Generation Throughout Peak Demand



Sunset at 7:20 PM

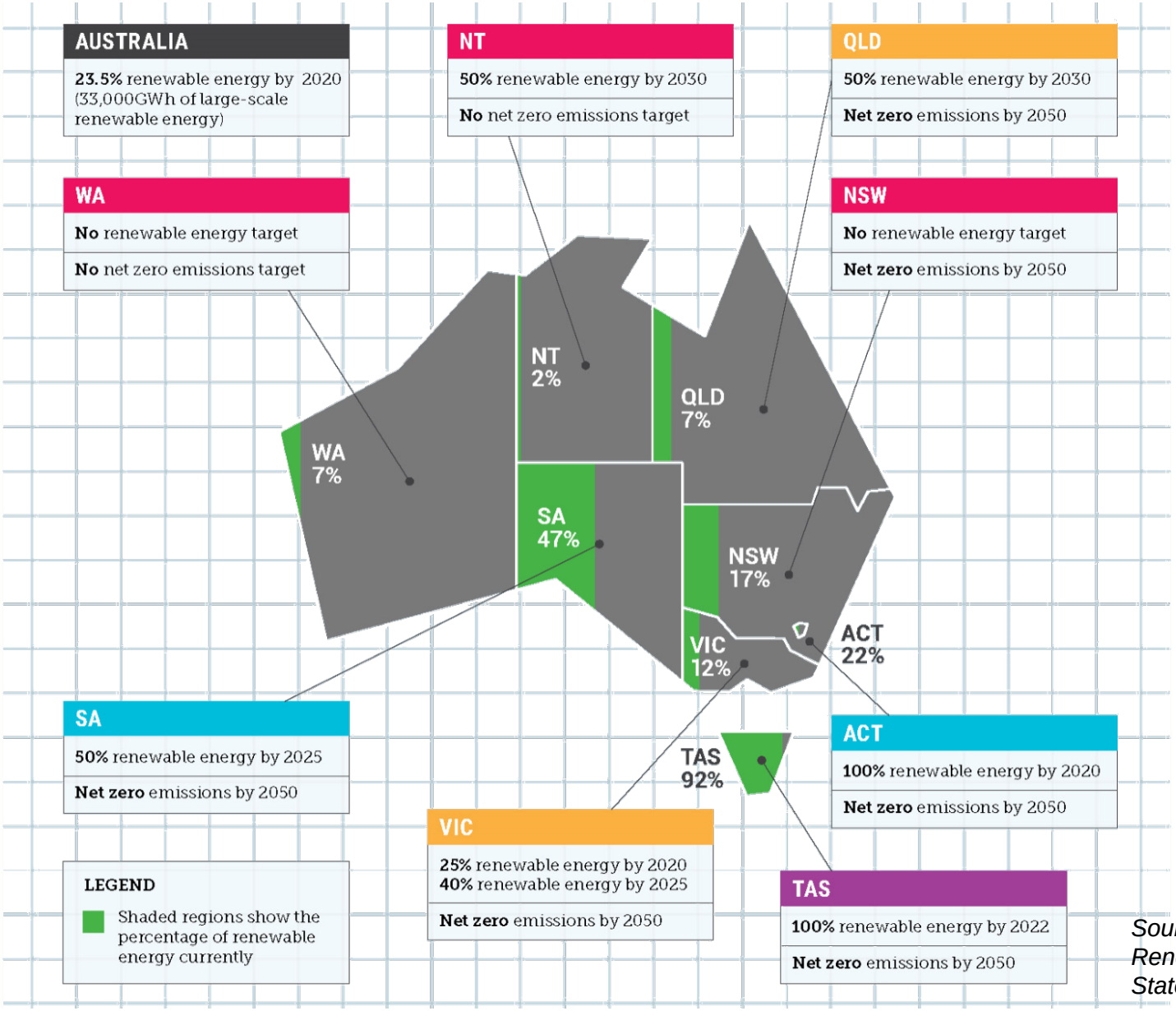
Electricity generation continues after sunset

AUGUST 31, 2018 08:00 PM



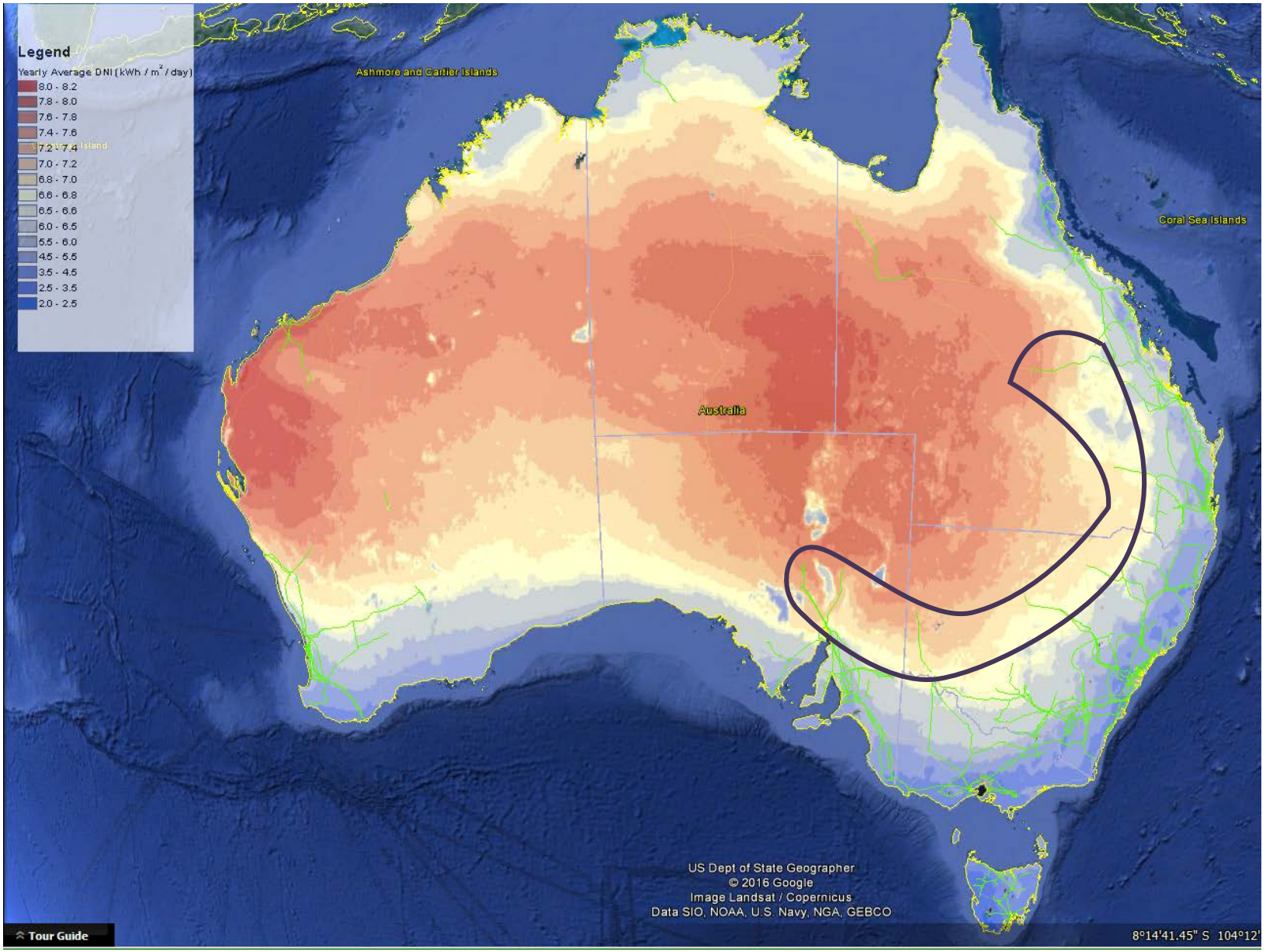
AUSTRALIAN MARKET

Australian Renewable Energy Market



Source: Climate Council Renewable Energy – States Leading the Charge

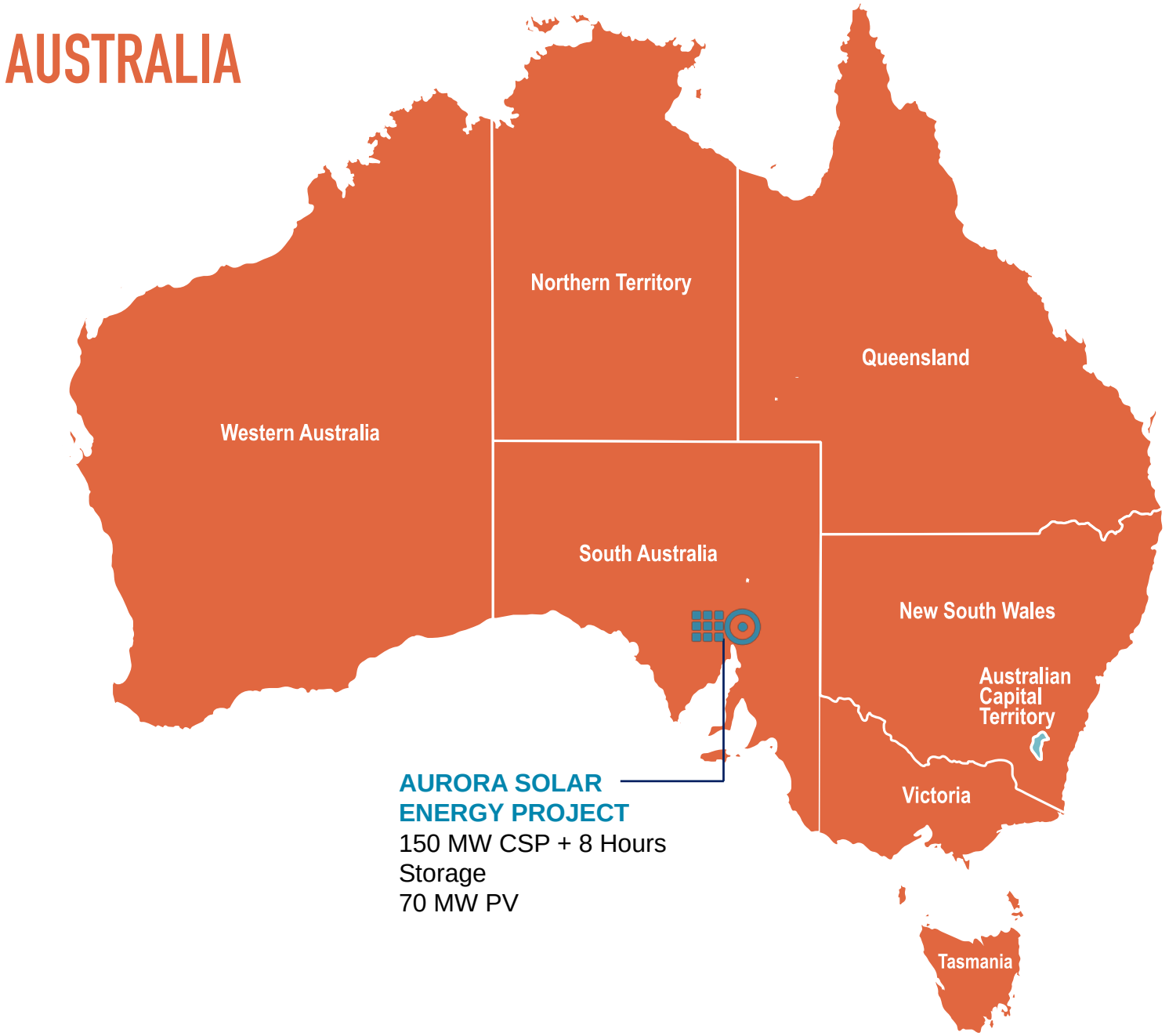
Australian DNI Resource



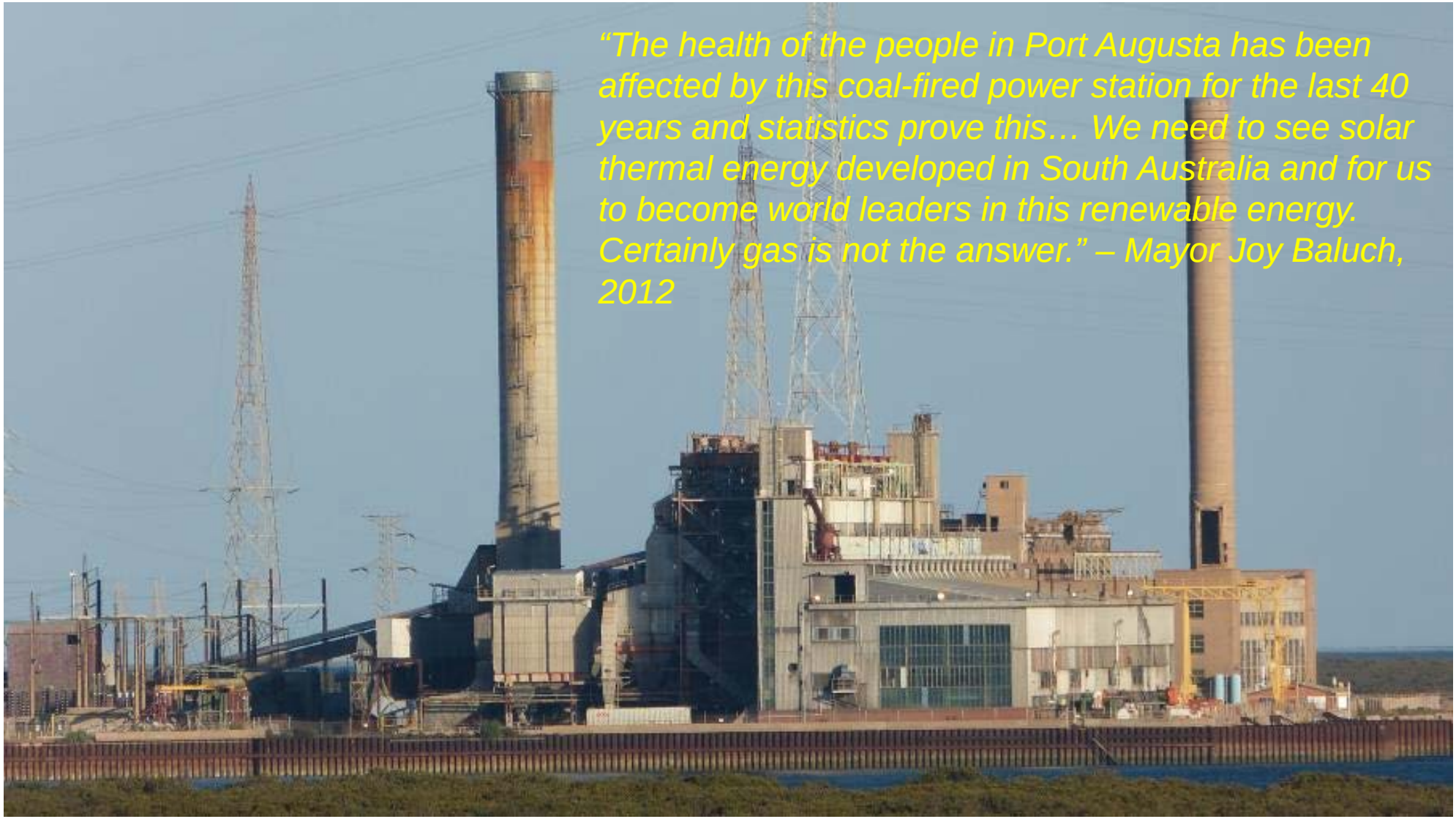
AURORA SOLAR ENERGY – PORT AUGUSTA, SOUTH AUSTRALIA

Project Overview

SolarReserve's Aurora Solar Energy Project

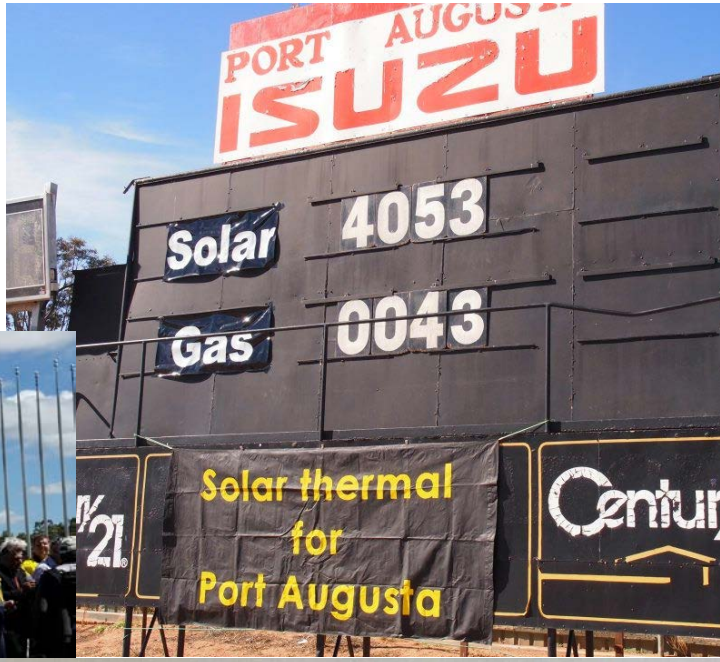


Port Augusta: The Past



Community Advocacy

REPOWER port augusta



TransNews

Locals call for solar thermal

By Ryan Smith

Port Augusta residents joined an international day of action on Saturday calling for a switch from coal to clean renewable energy.

The protesters think that Port Augusta can be at the forefront of this switch by replacing the town's ageing coal-fired power stations with Australia's first concentrated solar thermal plant with storage.

Repower Port Augusta's Elizabeth Zyla said they had community support for change.

"The age of coal is coming to an end in Port Augusta and our community needs an alternative," she said.

"We need to bring on the age of solar in Port Augusta, which is the alternative our community supports".

The Port Augusta power stations have been the subject of a community driven campaign for over a year following the release of research by energy think tank Beyond Zero Emissions.

The South Australian branch of the CFMEU have backed the campaign arguing that an investment in solar thermal would bring construction and manufacturing jobs to the region and replace the existing jobs at the coal-fired power stations.

CFMEU state secretary Aaron Cartledge said solar thermal would be a great replacement for the coal-fired power stations.

"Investment in solar thermal here in Port Augusta would be a major shot in the arm for manufacturing in this state," he said.

"Building this smart, clean, 21st century technology will create jobs and provide a viable replacement to the coal stations of the past".

Repower Port Augusta are calling on the federal government to use money from the $10 billion Clean Energy Finance Corporation, which is set to begin funding projects from July 1.

The CEFC has come under threat recently with the Coalition saying they will disband it if elected in September.

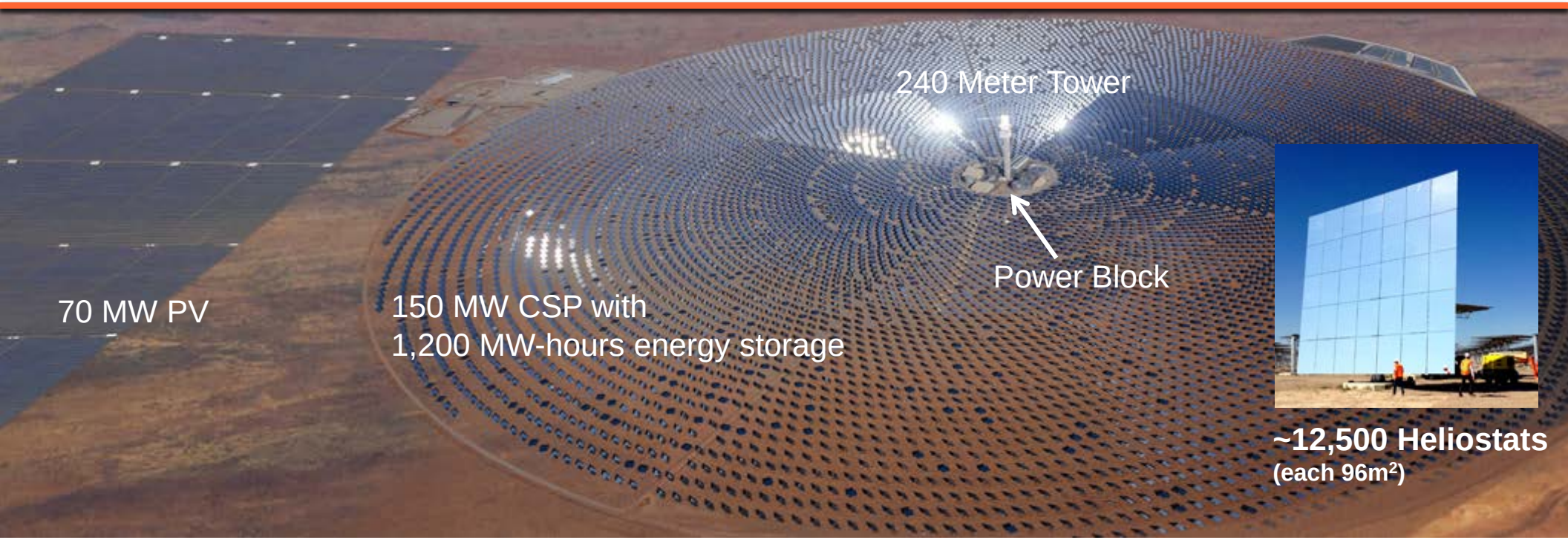
"Port Augusta deserves a slice of the clean energy fund," Ms Zyla said.

"Our community has borne the cost of generating electricity from dirty coal stations for decades.

"We want to become the centre of clean power generation in this state and we need all politicians to be supporting this investment in our future."

PROTEST: Port Augusta residents joined an international day of action calling for solar thermal to replace the coal-fired power stations.

Introducing Aurora: South Australia's CSP + PV Hybrid Energy Project



220	1,200	650	4,300	750	55	60%
MEGAWATTS	MW-HOURS ENERGY STORAGE (8 HOURS AT FULL LOAD)	GIGAWATT-HOURS ANNUALLY	DIRECT, INDIRECT AND INDUCED JOBS CREATED DURING CONSTRUCTION	FULL TIME CONSTRUCTION JOBS FOR A DURATION OF 30 MONTHS	FULL-TIME, PERMANENT JOBS FOR OPERATIONS AND MAINTENANCE	SOUTH AUSTRALIA CONTENT TARGETED FOR CONSTRUCTION PHASE

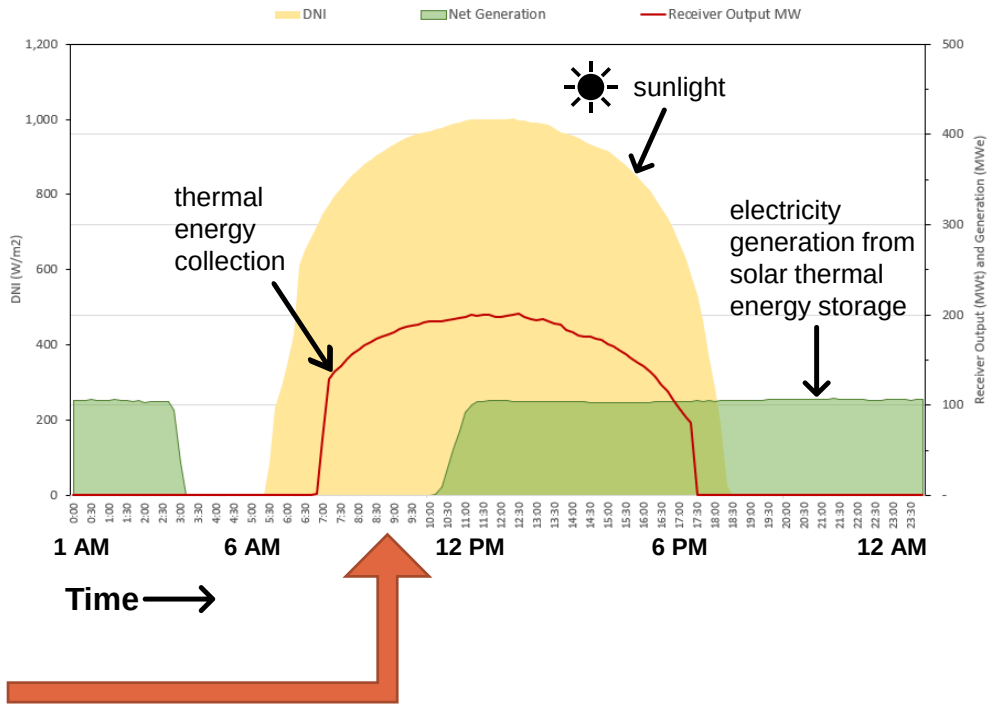
A 220 megawatt (MW) solar park consisting of 150 MW of fully dispatchable solar thermal with 8 hours (1,200 MW-hours) of full load energy storage, plus 70 MW of PV

SOLARRESERVE®

Hybrid Solar Thermal (CSP) + Solar Photovoltaic (PV) Strategy

Maximising the generation of electricity during peak demand periods, which extend into evening hours

- SolarReserve's advanced hybrid technology comprises
  - Solar thermal energy collection
  - Integrated molten salt energy storage technology
  - Conventional steam power generation
  - Solar PV technology
- The solar PV component can
  - Power the station's electricity demand
  - Enable the facility to supply more fully dispatchable electricity to the grid
  - Reduce the need to draw electricity from the grid for station power when the facility is not operating
  - Be utilised during daytime hours when electricity demand and prices are lower – and while parasitic station power requirements are higher



Adding PV to our solar thermal facilities serves to add capacity as well as turbine flexibility

Aurora Project Milestone Achievements

August 2017

20-year Generation Agreement signed with South Australian Government to meet their annual electricity consumption

November 2017

Heritage Agreement signed with the native title holders represented by the Barngarla Determination Aboriginal Corporation

December 2017

Solar thermal development approval secured from South Australian Government

January 2018

SolarReserve opens **Australian Headquarters** in Adelaide and Field Office in Port Augusta

March 2018

SolarReserve and OZ Minerals enter into agreement to commission a new high voltage power line in South Australia, **securing transmission for Aurora**

July 2018

Solar PV development approval and **vegetation clearing approvals** secured from South Australian Government

September 2018

MOU signed with Heliostat SA to work towards manufacture and assembly of 12,800 heliostats for Aurora locally in South Australia

The ongoing community support for solar thermal made Port Augusta a prime location for developing a world-class solar thermal project

Our Mission

Advancing solar energy storage technology to accelerate the world's transition to sustainable energy, while creating jobs and economic growth for communities around the world

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