



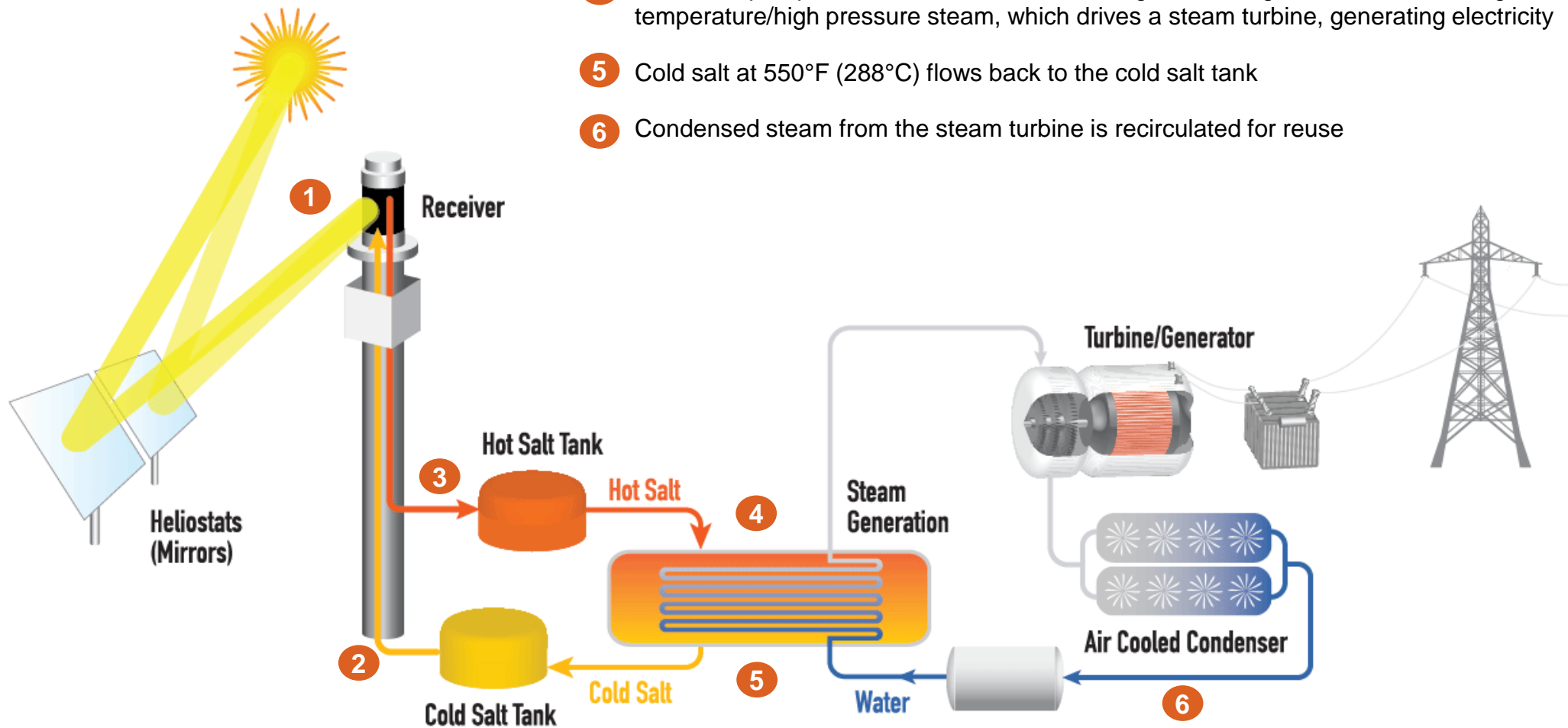
## Concentrating Solar Power with Thermal Storage

April 2018

**SOLARRESERVE**<sup>®</sup>

# SolarReserve's Technology Overview

- 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 Cold salt at 550°F (288°C) flows back to the cold salt tank
- 6 Condensed steam from the steam turbine is recirculated for reuse



# The “Next Generation” in Solar Technology

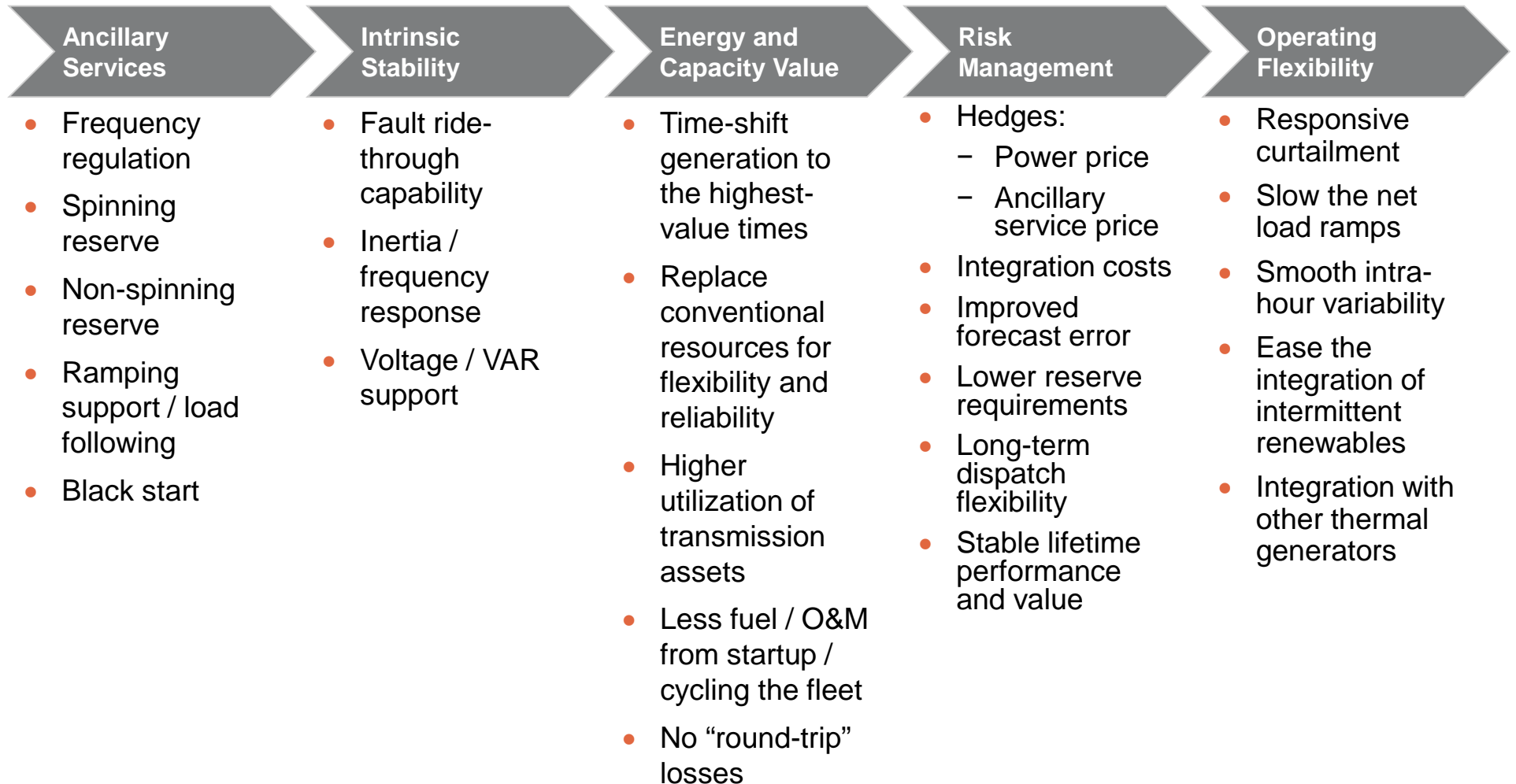
The most advanced solar energy storage technology available today

- Capacity Factors 2 - 3 x other renewable technologies
- Firm, non-intermittent supply of solar energy – day or night
- Fully integrated storage technology – not ‘bolt on’ style storage
- No requirement for natural gas or oil ‘back up’ to prop up the system
- No need to “charge” the system
- Benign nitrate salts, no replacement, degradation or disposal issues
- Large scale ‘bulk’ storage (+1000 MW-hours) with lowest capital cost energy storage system



# Framework: The Value of CSP with Storage

CSP with storage delivers multiple value streams which are increasingly important in the changing energy landscape



# SolarReserve's Advanced Development Projects in Chile



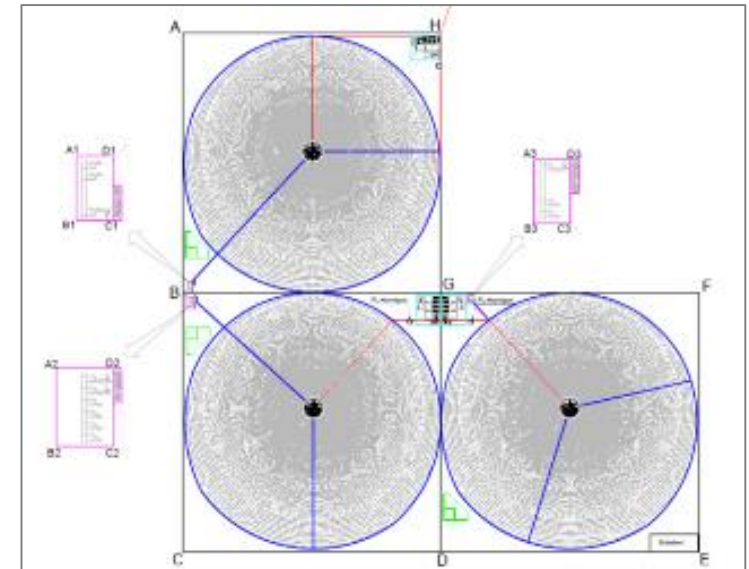
# Example: Likana – Project Highlights

Facility provides 390 MW of reliable and cost effective 24/7 baseload power



Rendering

<b>Location</b>	Antofagasta Region of Chile
<b>Technology</b>	SolarReserve's proprietary ThermaVault with solar PV expansion option
<b>Project Details</b>	Three 130 MW solar thermal towers with energy storage, resulting in 390 MW of continuous baseload output
<b>Electricity Production</b>	390 MW of firm capacity delivering over 2,800 GWh annually,
<b>Storage</b>	13 hours of full load electricity generation (5.1 GW hours of thermal energy storage)
<b>Project Status</b>	Advanced development



Three-tower configuration with PV expansion opportunity



Advanced Development; permitting in process

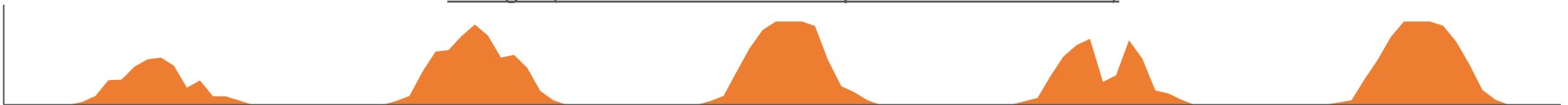
# Mines Typically Require Baseload / High Reliability Solutions

Molten salt storage enables fully reliable CSP or CSP+PV solutions for mines

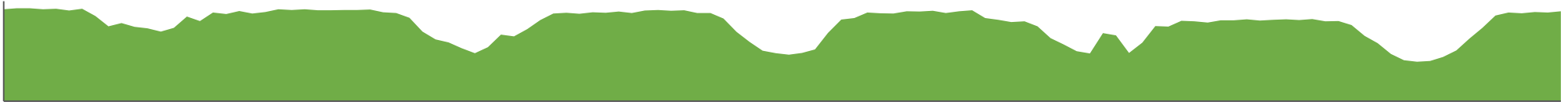
Actual Mine Load



Sunlight (Scales with both PV Output and CSP Collection)



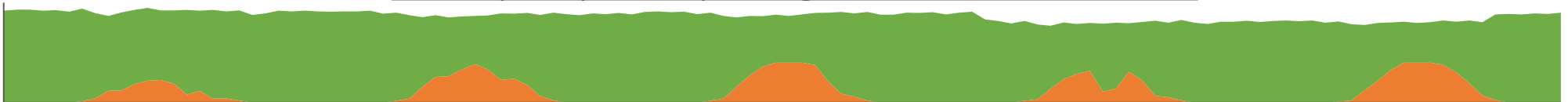
CSP Output Dispatched to Meet Net Demand (Net of PV)



Molten Salt Storage Level – Charged by Sunlight, Discharged by Dispatch



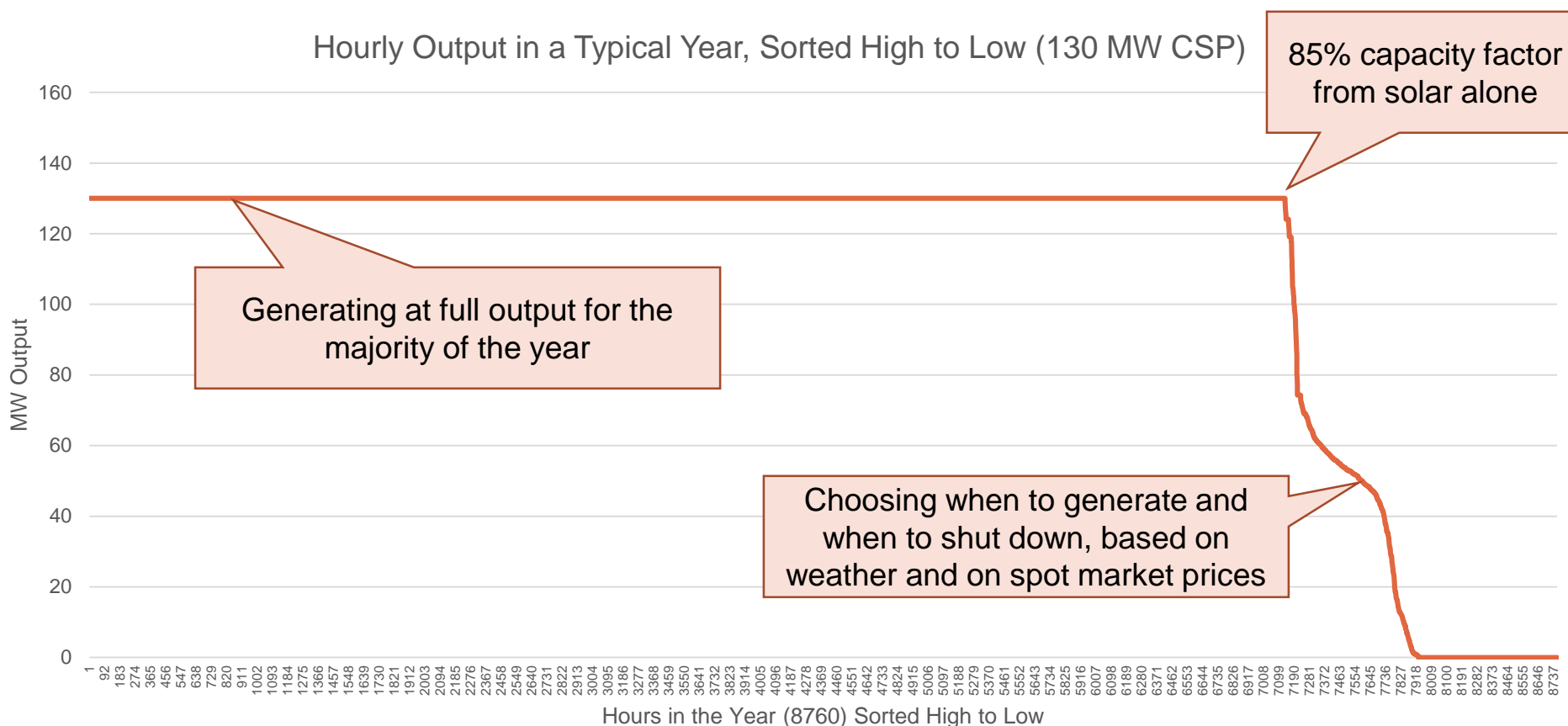
Result: Hybrid System Output Using 100% Solar to Match Mine Load



# CSP With Storage is Truly Baseload

This matches well with 24-hour exposures to the spot energy market

- A CSP facility in Chile can offer an 85% annual capacity factor
  - Reliably producing at full output during the majority of the year and during high priced times
  - Choosing low-price times of certain days to not generate



Commercial success in Chile will hinge upon product definitions in solicitations – specifically, whether it is of value to the customer to physically provide reliable energy



# Absorbing Energy from the Grid: The Electric Salt Battery (ESB)

## A new technology option for the evolving grid

- Heats molten salt **with electric heaters**, storing electricity from the grid **like a battery**
- Targets energy **arbitrage** opportunities, commonly found in areas with high renewable penetration, when daytime energy prices collapse to zero due to PV saturation
- Offers bulk energy storage at a **very low capital cost** compared to other storage technologies, with low technology risk and fewer siting challenges
- In addition to new build, **retrofitting** existing fossil or CSP plants is possible

