SOLARRESERVE[®]

CONCENTRATING SOLAR POWER WITH STORAGE

ENHANCING ENERGY SECURITY FOR SOUTH AUSTRALIA FROM DISPATCHABLE RENEWABLE ENERGY

DANIEL THOMPSON DIRECTOR OF DEVELOPMENT SOLARRESERVE

SolarReserve Overview



- Leading global developer of utility-scale solar power projects and advanced solar thermal storage technology
- Commercialised world's leading solar thermal technology (CSP) with integrated energy storage – providing reliable and non-intermittent electricity, day or night
- More than \$1.8 billion of projects in operation globally

- Developed and secured long-term power contracts for 456 MW representing \$2.5 billion of project capital
- **Development pipeline of more than 10 GW** across the world's most attractive high growth renewable energy markets
- **Proven management team** has built more than 27 GW and financed over \$48 billion in energy projects in 25 countries

Global Reach Across Six Continents

Development portfolio of 10 gigawatts across the world's most attractive, high growth renewable markets



Leading CSP and PV Project Developer

More than 6 GW of Concentrating Solar Power Projects in Development Globally

- Lead 110 MW project in commissioning operations Crescent Dunes project in Tonopah, Nevada
- 100 MW Redstone project in South Africa to commence construction in early 2016
- Late-stage development activities represent almost 1000 MW of fully permitted projects

More than 4 GW of Photovoltaic Projects in Development Globally

- 246 MW in operation in South Africa
- Seven power contracts in North and Central America totaling 150 MW
- Development projects in a dozen other countries

Developing combined CSP and PV (hybrid) solutions to provide 24-hour baseload solar power that can compete with traditional generation



SolarReserve's Energy Storage Technology:

Sunlight heats the molten salt directly, resulting in the most efficient and economical energy storage solution



The Benefits of Solar Thermal with Integrated Storage

- Operates like a conventional power generation asset with no back-up fossil fuel system required
- Load-shifting to peak periods, ancillary services and zero fuel price risk over project life provides significant value
- A more stable and secure output alleviates intermittency issues and more fully utilises transmission assets
- Integrated molten salt in tower configuration stores energy more efficiently and cost effectively than other solar thermal storage solutions
- Storage technology is a fraction of the cost of utility scale battery storage
- Produces twice the output of similar sized solar projects without storage



Other than CSP with storage, no other solar technology can operate like a conventional power plant.

SolarReserve's solar thermal with storage facility deploys the only commercially viable renewable technology that can displace fossil fuel generation

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

SOLARRESERVE

Copyright © 2015. SolarReserve, LLC. All rights reserved.

CRESCENT DUNES

NEXT GENERATION OF SOLAR ENERGY STORAGE BECOMES A REALITY

Crescent Dunes – Power Block

Molten Salt Receiver

Water Treatment Facility

Steam Generation System

Steam Turbine/Generator

Air Cooled Condenser

Cold Salt Tank

Hot Salt Tank

SOLARRESERVE

Copyright © 2015. SolarReserve, LLC. All rights reserved.

Crescent Dunes – Project Highlights



- Technology: SolarReserve's proprietary solar thermal energy storage technology that enables reliable, on-demand energy production – day and night.
- Electricity Production: 110 MW capacity delivering more than 500,000 megawatt hours of electricity per year to the Nevada energy market.
- Storage: Market leading energy storage provides 10 hours of full load electricity generation.

- Equity Investment: \$260 million of private equity from SolarReserve (managing partner), ACS Cobra and Banco Santander.
- **Debt Financing:** Debt supported by U.S. Department of Energy Loan Guarantee Program.
- **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.

Crescent Dunes – Construction & Commissioning Highlights



- Construction Contract with ACS Cobra: Fixed price contract with guaranteed performance.
- **Construction Status**: Commissioning complete with over 3.9 million man-hours expended.
- Safety: Strong safety record with merit award for excellence in safety from Engineering News Record (ENR).
- **Workforce**: Primarily utilised Nevada and regional union and non-union subcontractors.
- **Commissioning Status**: Complete commercial operations commenced

Crescent Dunes – Local Economic Benefits

Job Creation:

- 1,050 construction workers on site at the peak period
- 4,300 direct, indirect and induced jobs created by the project during construction
- 26 states provided equipment and services
- 60% of the project subcontractors were Nevada based
- **Tax Revenues**: Project forecasted to generate more than \$73 million in local and state tax revenues over first 20 years of operation
- **Operating Expenses**: During the 30+ year operating life, the project will expend more than \$10 million per year in salaries and operating costs, much of this spent in the region
- **Capital Investment**: Project will generate in excess of \$750 million private capital cost investment in Nevada



All 1.2 million square meters of glass was U.S. sourced, with assembly completed in an on-site manufacturing facility that employed local workers.

SolarReserve's CSP projects provide local economic benefits including a high level of content & service localization

Crescent Dunes – Operation & Maintenance Status



- PIC (Atlanta-based) contracted as the O&M contractor, managed by SolarReserve on behalf of Tonopah Solar Energy
- O&M staff in place 45 positions
- 45% of staff hired from Tonopah area

Typical Operating Day – Steady Power Delivery Late into Evening



- Routine 100 MW steady generation until 10 PM at night, as requested by utility client.
- No time of day requirement under PPA, customer requested later generation accommodation to meet peak demand periods.
- Electricity generation fully dispatchable to meet utility needs, including 24-hour operations.

Performance Highlights

- Crescent Dunes has proven out key performance metrics as the leading solar with storage project in the world
- Energy Capture in receiver proven at greater than 100% of target
- Power generation uninterrupted for 120 hour run in July, although normal generation requested by utility is peak 12-14 hours per day
- Collection through intermittent solar resource and wind conditions



SOLARRESERVE



Copyright © 2015. SolarReserve, LLC. All rights reserved.

The Aurora (Port Augusta) Solar Energy Project



Copyright © 2016. SolarReserve, LLC. All rights reserved.

Port Augusta: The Past



Northern Power Station



Community Driven: Repower Port Augusta



Solar Resource



SA Power Grid



Energy Security

- Aurora is non-intermittent. It operates like a coal or gas fired power station but without the fuel price risk and greenhouse gas emissions
- The facility incorporates a large synchronous generator, which provides ancillary services including:
 - Spinning Reserve
 - Voltage and frequency control
 - System Inertia
- The facility can provide black start services following an outage of part or all of the grid
- It can supply firm dispatchable energy to the grid, or can absorb energy from the grid if needed, like an interconnector or a massive battery
- The facility doesn't rely on the current weather to determine output. Generation is scheduled in advance and will help to **reduce wholesale price volatility**
- These benefits are captured within the project cost and are not socialised to all electricity users like an interconnector would be

Aurora Solar Energy Project – Key Information

- 110MW Capacity
- 8 hours of full load storage (880MWh)
- 214m tall tower
- 11,838 Heliostats, each at 96m²
 (1.13 million m² of mirror)
- Approximately 30,000 tonnes of molten salt
- Generating 480GWh p.a.
- Supplying more than 90,000 SA homes
- Displacing more than 200,000 tonnes of CO₂ p.a.





Aurora Solar Energy Project - Location

Aurora Solar Energy Project A87 Port Augusta hees Hommay Google earth © 2016 CNES / Astrium 2016 Googl Image © 2016 Digital erometrex Ptv

Beyond Aurora

- SA has a tremendous solar resource which should be exploited
- We envisage 6 utility scale CSP facilities built over the next decade
- Equivalent capacity to the Heywood Interconnector ~650MW
- More than 5GWh of energy storage
- Supplying around 25% of SA's entire load
- Creating 24,000 jobs

SOLARRESERVE

• 300 permanent operations roles

Aurora is the first step in a bigger picture for South Australia



SOLARRESERVE: A STRONG TRACK RECORD OF SUCCESS ACROSS RAPIDLY GROWING GLOBAL MARKETS

Baseload Solar Power Plants

Reliable and cost effective solar technology as an alternative to traditional generation



- Fully integrated PV + CSP power plants with energy storage deliver reliable and cost effective 24/7 baseload generation
- Solar thermal storage solves PV intermittency at a fraction of the cost of batteries and other storage technologies
- SolarReserve was the first company worldwide to initiate development on integrated PV + CSP projects

- Combining the two technologies reduces overall LCOE
- Balancing CSP with PV "inside the fence" eliminates the intermittency issues associated with PV
- Baseload Solar power plants operate at a high capacity factor and availability percentage to fully utilise transmission infrastructure

Redstone, South Africa – Project Highlights



- Technology: SolarReserve's proprietary solar thermal energy storage technology that enables reliable, on-demand energy production – day and night.
- Electricity Production: 100 MW capacity delivering more than 480,000 megawatt hours of electricity per year to the Eskom grid.
- Job Creation: More than 4,000 jobs during the construction phase including site workers and equipment supply, manufacturing, engineering, transportation and other services.

- **Storage:** 12 hours of full load electricity generation.
- **Financing:** R2.4 billion equity investment and R5.6 billion of debt provided by local and international lending institutions. Financial close expected late 2016.
- **Preferential Procurement:** Over 40% of total project value will be provided by South African suppliers, a portion of which will support BBBEE activities.
- Enterprise and Socio-Economic Development: Above 1% of revenue.

Copiapó, Chile – Project Highlights

Combined CSP + PV System Provides Reliable and Cost Effective Baseload Power



- Technology: SolarReserve's proprietary CSP tower technology with Molten Salt Thermal Energy Storage combined with solar photovoltaics (PV).
- Project Details: Two 130 megawatt (MW) solar thermal towers with energy storage, combined with 150 MWs of PV – resulting in 260 MW of continuous output.
- Baseload Power: Operates at capacity factor & availability percentage equal to that of coal fired power plant.

- Electricity Production: 260 MW's of firm baseload (24/7) power delivering more than 1,700 gigawatt hours annually, powering the equivalent of 560,000 homes.
- **Storage:** 14 hours of full load electricity generation.
- Financial Close: Expected early-2017.

DRIVING INNOVATION FORWARD

SOLARRESERVE

Copyright © 2015. SolarReserve, LLC. All rights reserved.

Technology Innovations and Project Optimisations Resulting from Lessons Learned at Crescent Dunes

Operating, construction, and procurement experience along with continued R&D activities resulting in substantial capital cost reductions and efficiency improvements = lower electricity costs for future projects



U.S. DOE SunShot CSP Roadmap



Cost Reductions: Receiver



Copyright © 2015. SolarReserve, LLC. All rights reserved.

Cost Reductions: Heliostat Field



Cost Reductions: Balance of Plant



SOLARRESERVE°

CONTACT INFORMATION

Daniel Thompson Director of Development

SolarReserve Level 25 108 St Georges Terrace Perth, WA 6000 Phone: +61 428 928 894 Email: daniel.thompson@solarreserve.com www.solarreserve.com

