



ASTRI

May 2016

Commercial in Confidence



Vast Solar Demonstration Facility, Forbes, NSW, Australia – December 2011

Vast Solar at a Glance

Vast Solar

Delivering solar thermal technology at a cost-point that makes large scale plants commercially viable

Technology

Modular central receiver CSP with thermal energy storage

Key differentiators:

1. Compact, modular solar arrays 27m tower with nominal power 1.6MW_{th}
2. Low cost relatively small 3.6m² heliostat <\$100/m² fully installed
3. Sodium heat transfer fluid; molten salt storage
4. Innovative receiver technology

Funding to Date

\$20M raised to date including:

- Twynam Agricultural Group
- Skoda Power
- Australian Federal Government Grants (ARENA, ASI)

Further \$100M in grant, debt and equity for first commercial 30MW plant

Progress

1. 2009-11: Field testing and prototyping facilities operated for 30 months
2. 2012-13: 1U facility
 - Phase 1: Commissioned Dec 2011 (300kW_{th} 200 heliostat field, receiver and HTF cycle)
 - Phase 2: Expansion to 1.6MW_{th} 700 heliostats completed Dec 2012
3. 2014-16: - 6MW_{th} 5-module, grid connected. Completion due mid 2016.
4. 2016 - 30MW project, planning & fundraising well progressed

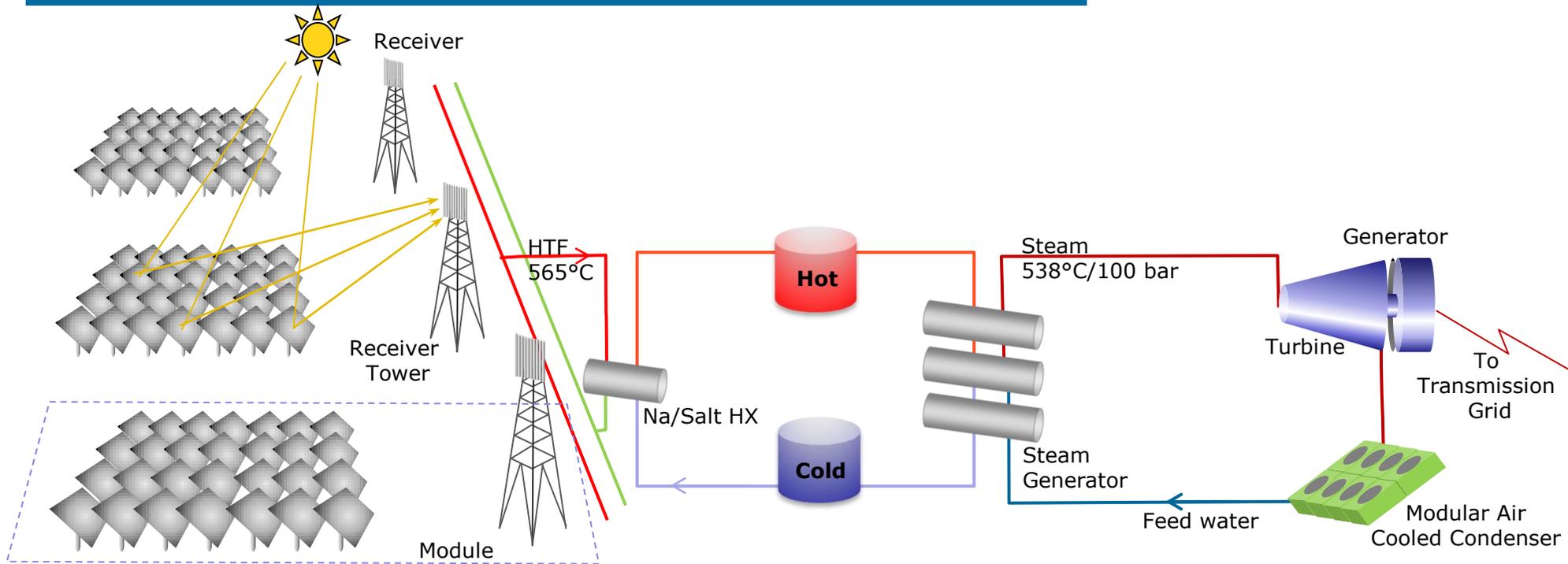
Partners Today

All organizations conducted extensive due diligence on Vast Solar before participating in our project and development activities



Vast Solar Plant Design - lower cost, higher efficiency

Competitive advantages in solar array and heat transfer systems



1. Solar Array

- 700 heliostat module
- Low cost (<\$100/m²) 3.6m² heliostats
- 27m towers
- 2.25m² high flux receivers

2. Sodium HTF

- High thermal conductivity
- 800C vaporization, 98C freezing point

3. Molten Salt Storage

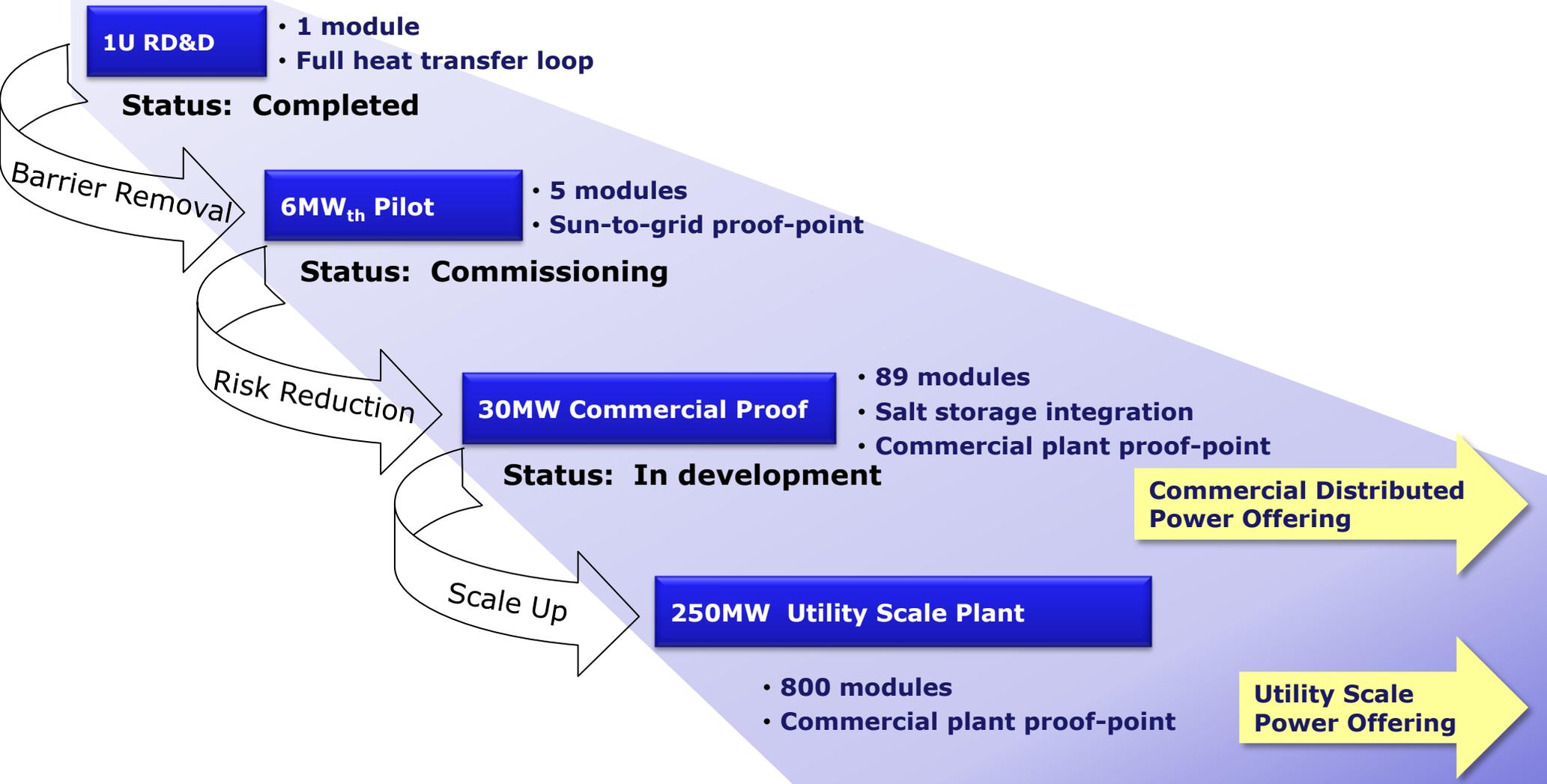
- Proven technology
- High heat capacity
- Operating range 550 to 288C

4. Conventional Steam Cycle

- Proven technology
- Wet or dry cooling options

Commercialisation Program

Phased approach progressively reduces risk and opens market opportunities



The Value of Storage is Now being Recognised

- Without storage CSP could not compete
- Storage is recognised as critical thanks to the work of the PV community
- Lazard LCSA November 2015 - PHES, CAES, Li-Ion, Lead Acid etc. Costs of traditional storage range from \$100/MWh and up
- CSP molten salt thermal storage – 99% round trip efficiency, highly scalable, no degradation over a 30 year plant life, safe and environmentally friendly
- When the plant is finally decommissioned you can sell the salt for fertiliser

Where Can the LCOE of CSP Get To?

- Our first 30MW will have an LCOE ~15c.
- 30MW is a small plant. Soft costs make up 30% of the overall budget
- The 5th 30MW plant will get to 10c and the 5th 250MW plant will get to 7c and lower in good solar resource areas
- What is stopping CSP;
 - Extremely long and expensive path to commercialisation
 - Small doesn't work, projects need to be \$100M and up
 - No supply chain > need to develop everything
 - Risk mitigation often leads to greater CAPEX
 - Strong government support required to traverse 'the valley of death'

Thank you

