VAST

Back from the Dead: Why Concentrated Solar Thermal is one of the Hottest New Renewable Technologies



20 March 2024

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History

Heliostat Prototyping and Testing

2009 - 2010

Marulan 1

- First heliostat generations
- Exploratory manufacturing techniques
- Optical refinement

Modular Array Prototyping and Testing

2010 - 2011

Marulan 2

- Next generations of heliostats
- Optimal heliostat layouts
- Field comms and operations

Solar Receiver Prototyping and Testing

2011 - 2014

Back Station

- Water receivers
- Sodium receivers to unlock modularity
- Sodium operations

5 years of prototyping and testing components leading to a successful grid-synchronized demonstration plant

1.1MW Sun-to-Grid Demonstration Plant Located Near Forbes, Australia

2014 - 2020



Received International Energy Agency's SolarPACES 2019 Technical Innovation Award

- *Approximately 3,500 heliostats configured into 5 modular tower arrays*
- *Co-funded with ARENA*
- *Final-form plant first synchronized with Australian national grid January 2018*
- *Technology demonstrated, refined and validated*
- *Operability confirmed via operation for 32 months*
- *Technology scalability confirmed*

Utility Scale Project Development

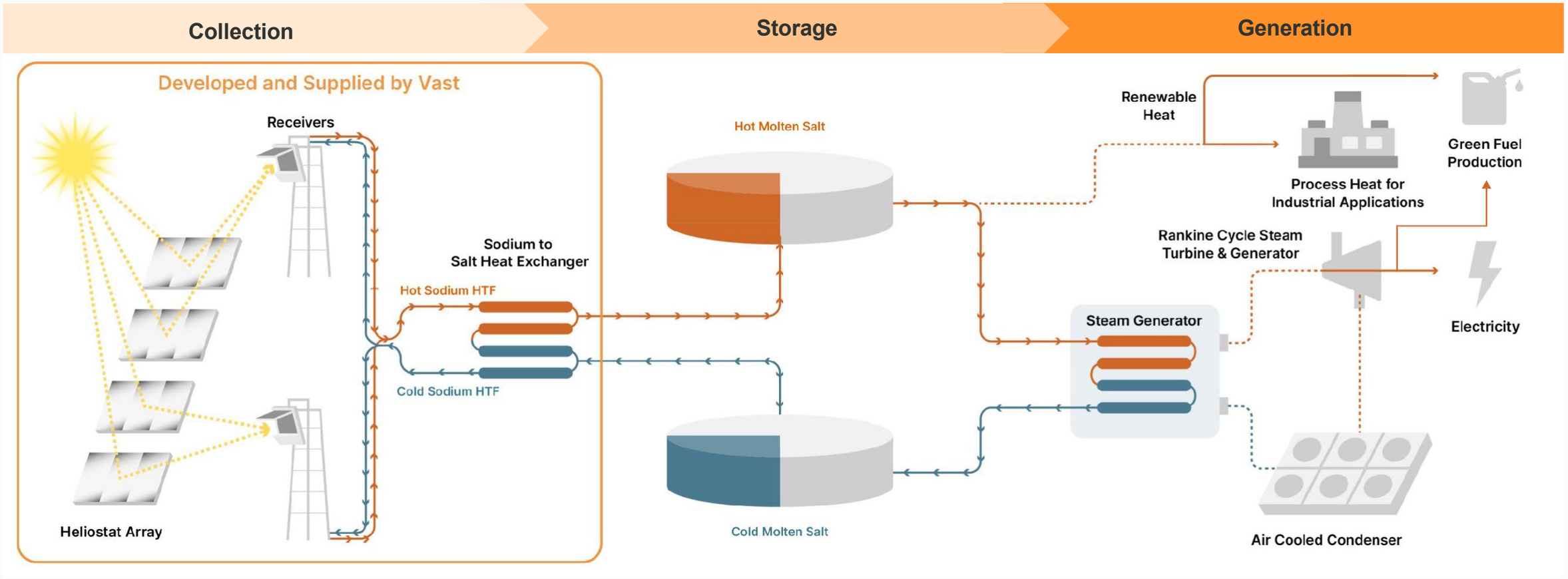
2018 - 2019

50MW Solar PV

- Development, permitting and grid connection secured
- Sold shovel-ready to Genex Limited
- Plant now built and generating

Project Sold

Vast CSP v3.0 Technology



Vast CSP v3.0 – an Evolution of Well-Established Technology Delivering Superior Performance and Cost with Lower Risk

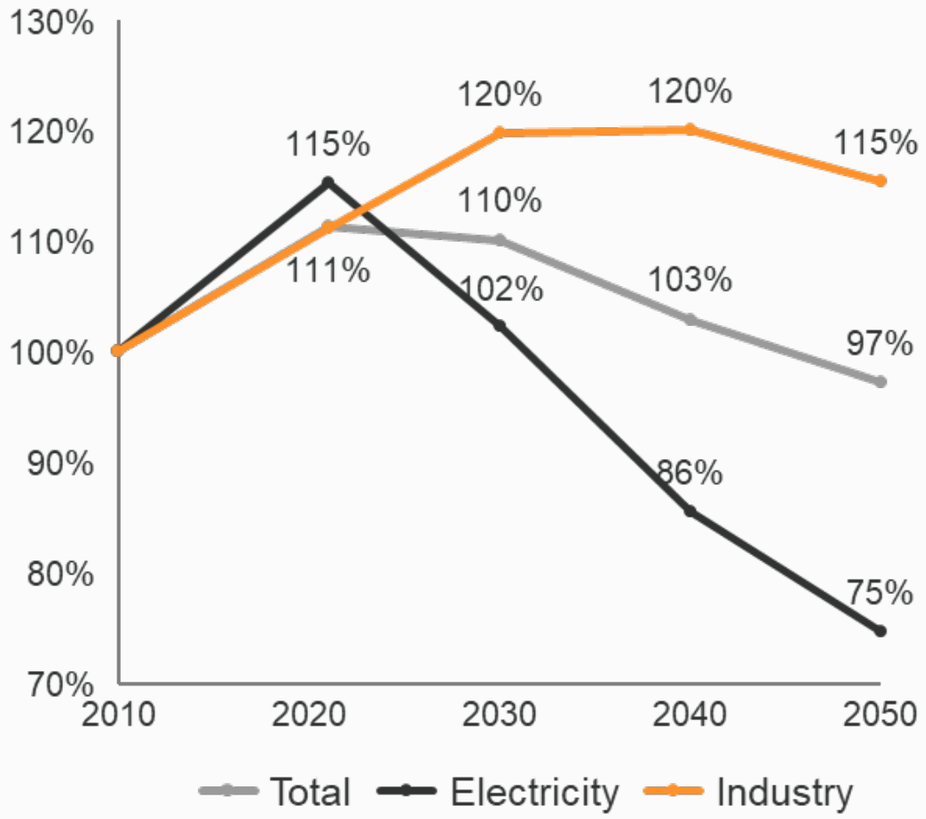






Criteria	Parabolic Trough CSP v1.0	Central Tower CSP v2.0	Vast CSP v3.0
Levelized Cost of Energy			
Project Scalability			
Storage Efficiency			
Power Cycle Efficiency			
Ease of Permitting			
Ease of Design			
Ease of Construction			
O&M Simplicity			

Decarbonization has Begun, but Emissions in Hard-to-Abate Sectors are Heading the Wrong Way



Decarbonizing industry is challenging because many industrial processes require heat that can only be efficiently generated by burning fossil fuels

The early stages of decarbonizing electricity supply are easier, but deep decarbonization requires huge long-duration storage capacity

1. Global projected CO_2 emissions under STEPS scenario for total global emissions, Electricity and Industry (in Mtpa, indexed 2010 = 100%)

CSP Solves These Problems in Sunny Locations

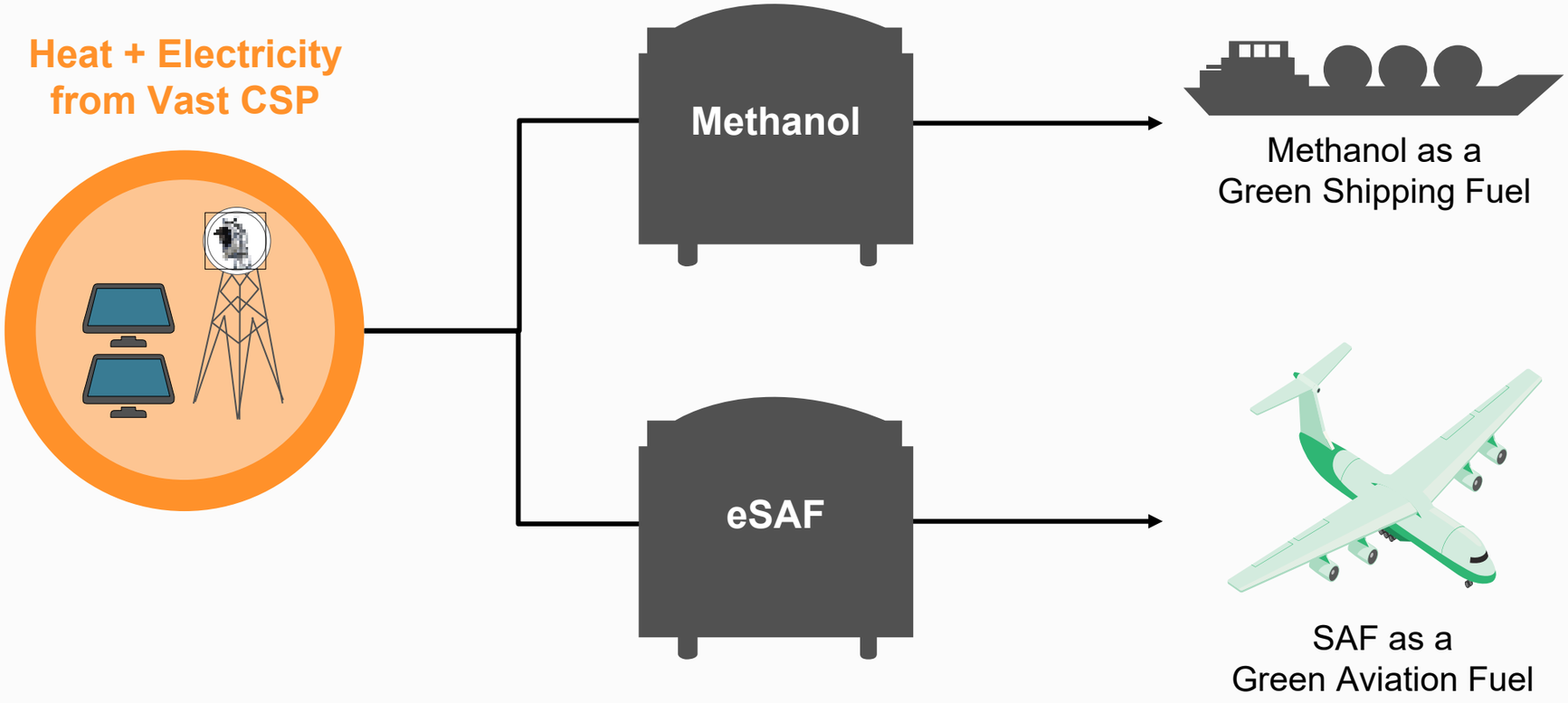
It's Dispatchable

- Wind and Solar PV are intermittent generators
- Adding battery storage allows wind and solar PV to be dispatched, but only with limited duration (i.e., 2-4 hours), at a high cost and with significant trade-offs
- CSP provides efficient long-duration storage (i.e., 8-16 hours) which makes it comparable to traditional fossil generation

It Can Generate Process Heat

- CSP can generate process heat equivalent to burning fossil fuels, allowing manufacturers to decarbonize
- A mix of dispatchable power and heat can be used to produce green fuels such as hydrogen, methanol, sustainable aviation fuels and ammonia, among others

Vast CSP Will Be Capable of Delivering Low-Cost Primary Energy to Power Solar Refineries for Methanol and eSAF Production



CSP Expected to Deliver Superior Green Fuel Economics

Key Drivers

Energy Cost

- CSP's ability to supply **dispatchable electricity and low-cost** heat unlocks the economics of processes that require energy in both forms
- CSP's **scalability drives cost down**

Return on Capital

- CSP's ability to supply **~80-90%[1] capacity factor** energy drives down contribution of capital to the fuel cost

Government Support

- U.S. Inflation Reduction Act offers ~$600/T[2] of solar methanol for ten years

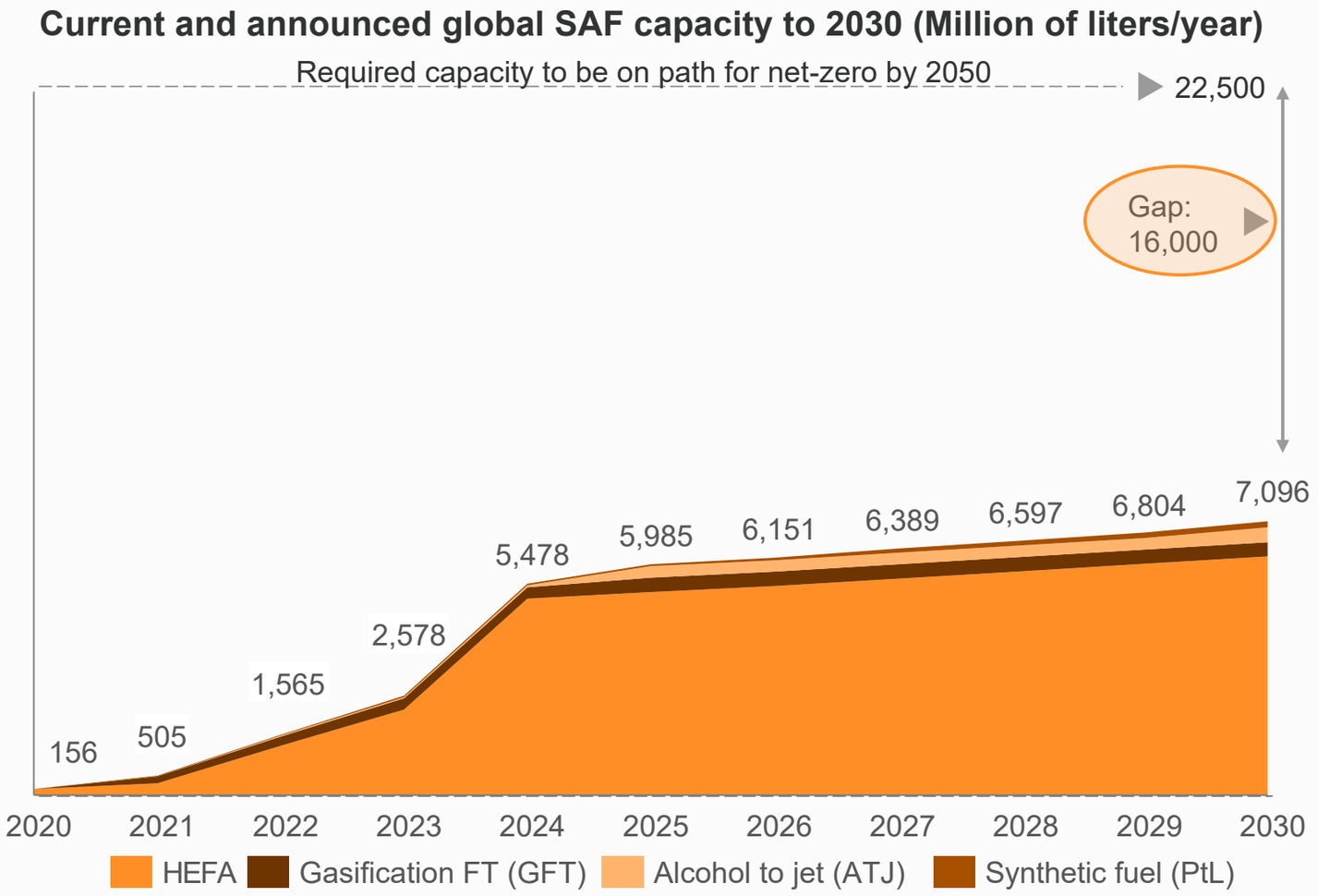
Fact: the primary driver of green fuel cost is input energy cost

Fact: powering processes that require both heat and electricity with CSP is approx. 70% cheaper than using electricity alone

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1. 80-90% capacity factor may be achieved through hybridisation with PV or day/night operation of CSP
2. Impact of IRA calculated by internal modelling in consultation with 'Big 4' advisory firm

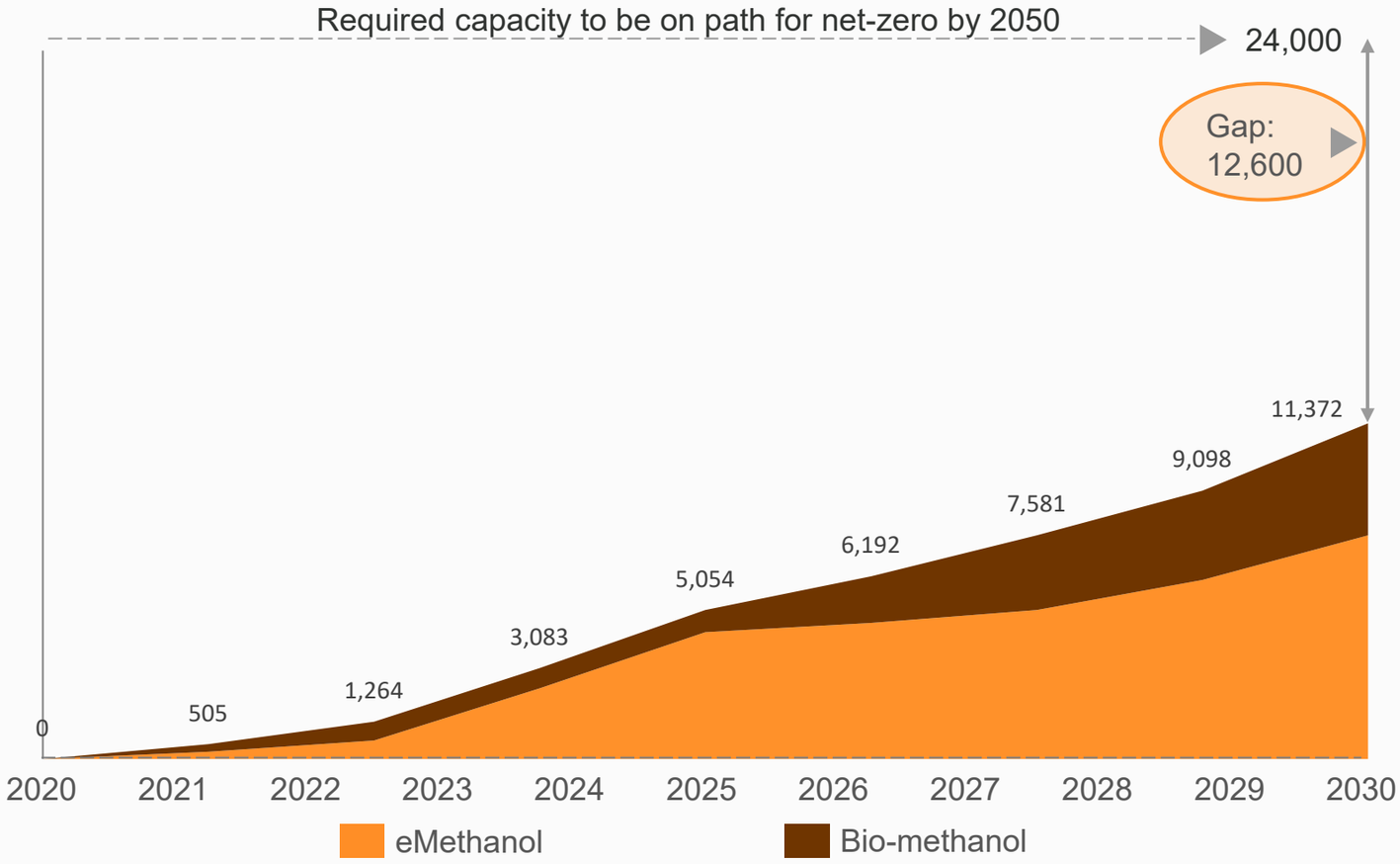
Opportunity: 16 Billion Liter Gap in SAF Market by 2030



Source: Top Tier International Management Consulting Firm

Opportunity: 13 Billion Liter Gap in Green Methanol Market by 2030

Current and expected global shipping methanol demand and production capacity to 2030 (Million of liters/year)

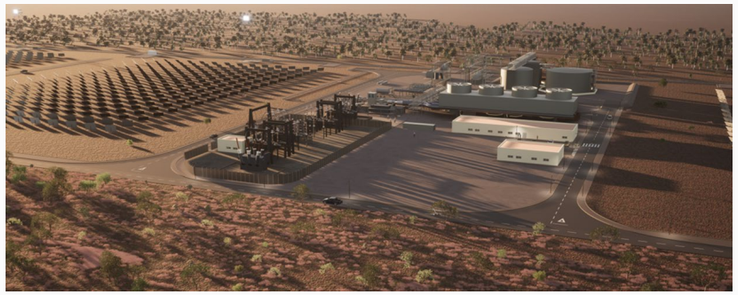


Source: Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping

Current Projects

Vast Solar 1 – Dispatchable Electricity

- Reference plant for Australian CSP
- 30MW CSP with 8 hours of dispatchable power overnight
- Energy supplied into the National Electricity Market (NEM)
- Heat offtake from SM1 for ~10 – 20% of captured energy
- Up to AUD175m of funding from the Australian government
- Target Final Investment Decision: Q3 2024
- Target Commercial Operation Date: Q3 2026



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Solar Methanol 1 – Green Methanol Production

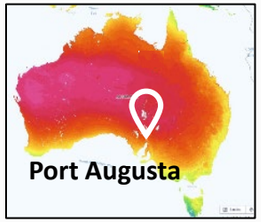
- World-leading reference project with 7,500 T p.a. capacity
- Strong consortium of German and Australian partners
- Strong offtake interest from the local maritime sector
- Calix green lime plant supplying CO_2 feedstock
- AUD40m funding secured from Australian and German governments
- Target Final Investment Decision: Q4 2024
- Targeting Commercial Operation Date: Q4 2026

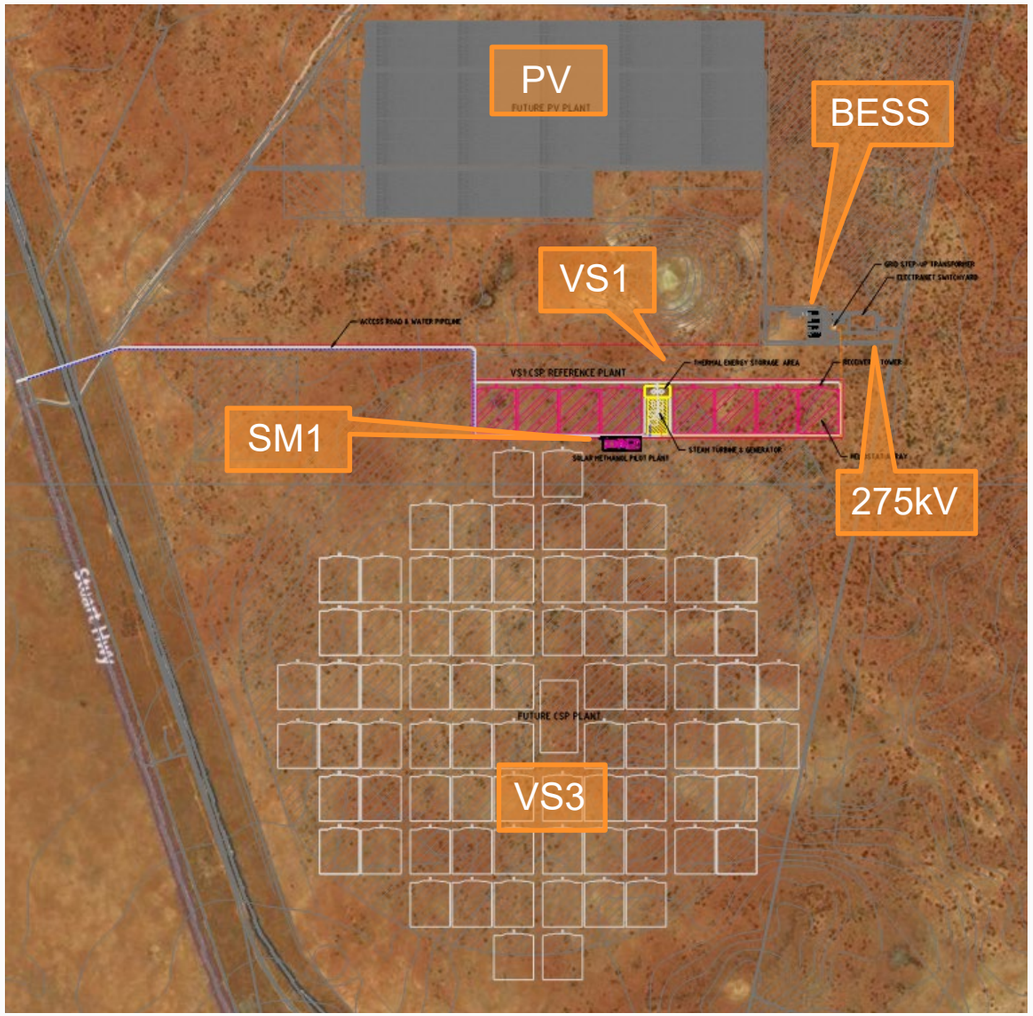


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Aurora Precinct Overview

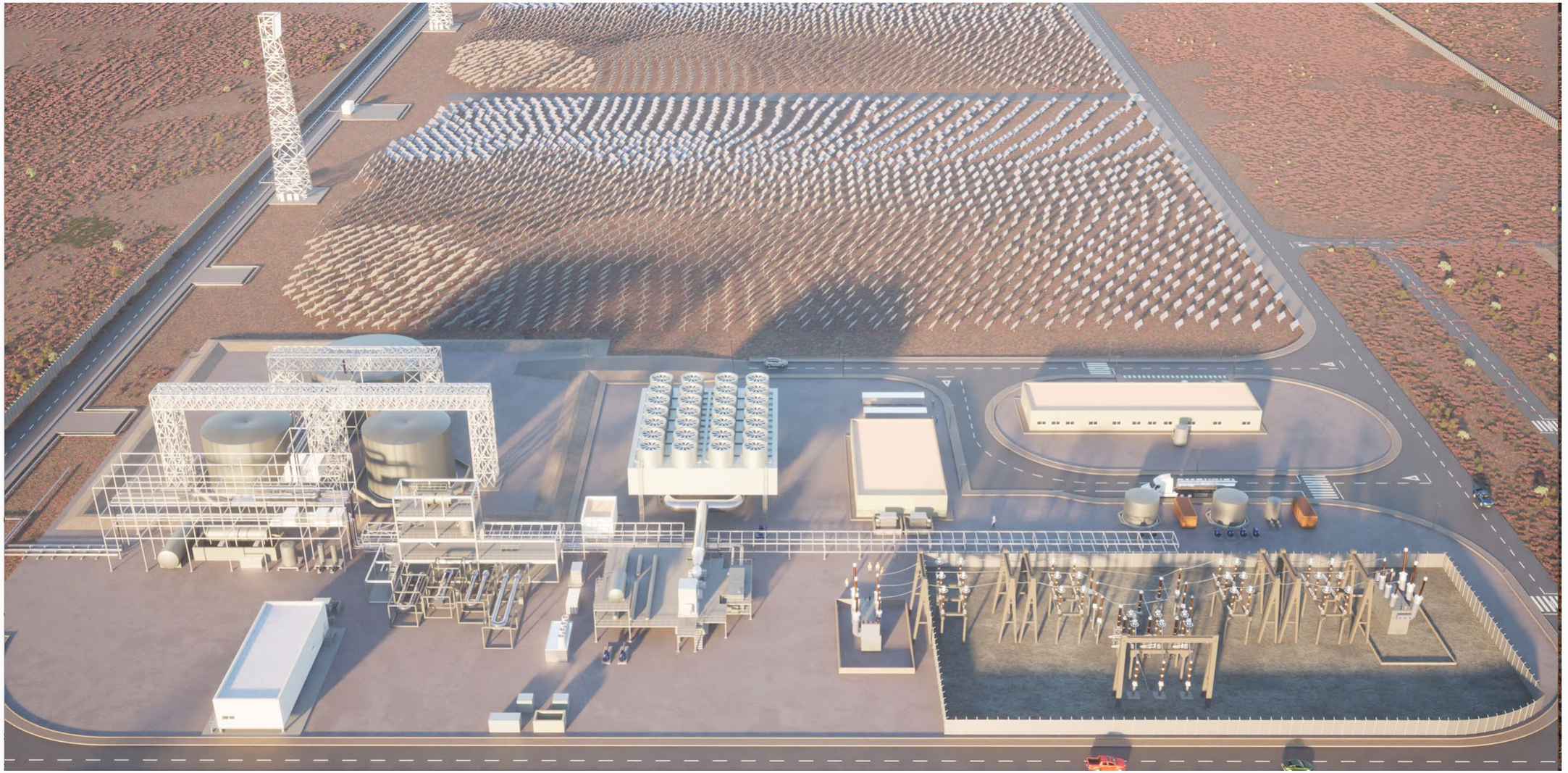
Located 30km north of Port Augusta, South Australia





- 1,580ha site with 40 year tenure
- Staged development
  - VS1: 30MW CSP plant with 8 hours storage
  - SM1: 7,500 T p.a. solar methanol plant
  - BESS: 140MW / 280MWh (50/50 with 1414 Limited)
  - VS3: 150MW CSP plant with 12+ hours storage
  - 70MW PV (50/50 with 1414 Limited)

VS1 – 30MW Port Augusta CSP



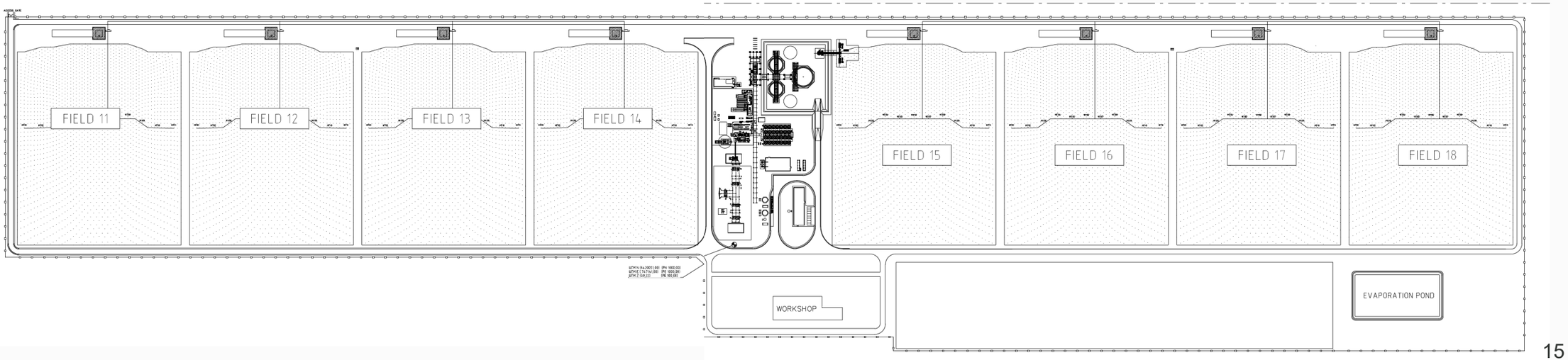
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VS1 – 30MW Port Augusta CSP

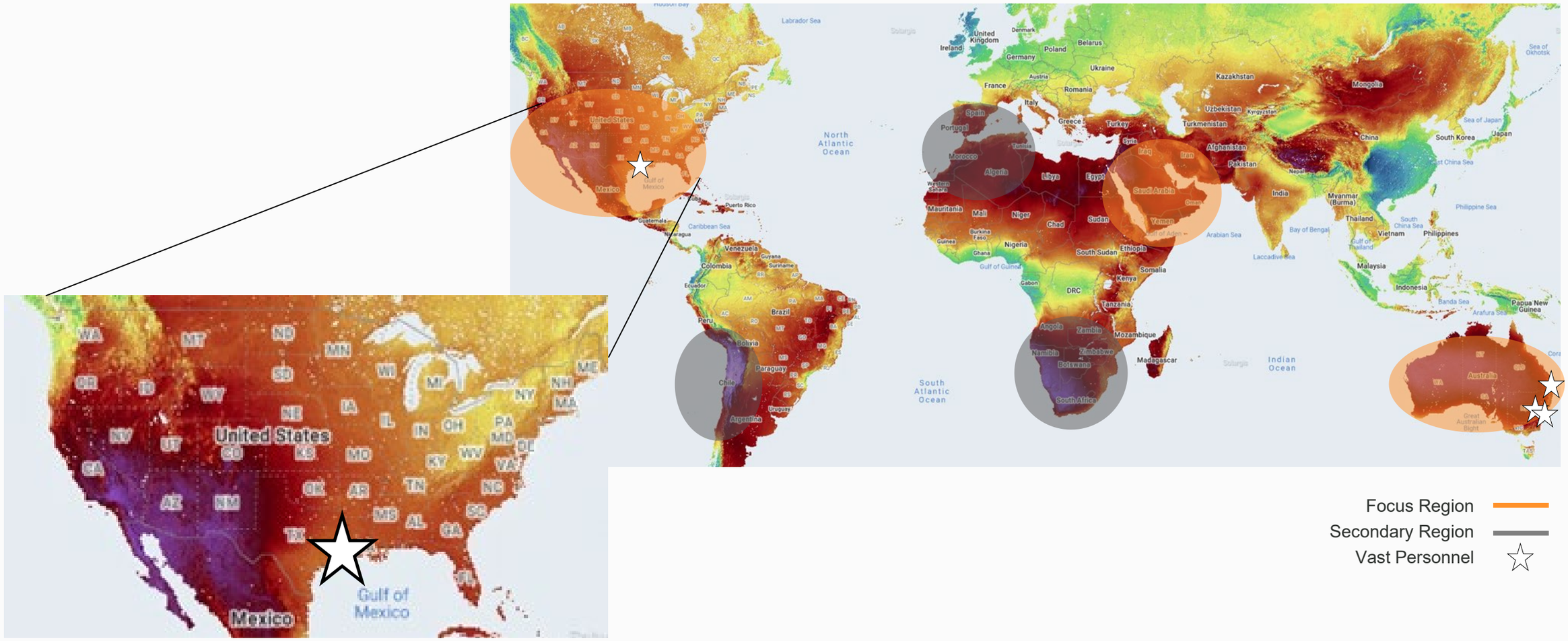
- Configuration
  - 8 solar fields each of ~2,400 heliostats
  - 8 hours of thermal storage in 3 tanks
  - Preassembled steam generator (SGS)
  - Preassembled 30MW steam turbine pkg
- Status
  - Pre-FEED completed
  - FEED underway
  - HV connection application progressing
  - Target FID: Q3 2024



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Vast Pipeline – Target Geographies



Source: SolarGIS; dark red and purple areas indicate higher potential output



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