ASTRI Capabilities

Concentrating Solar Thermal (CST)

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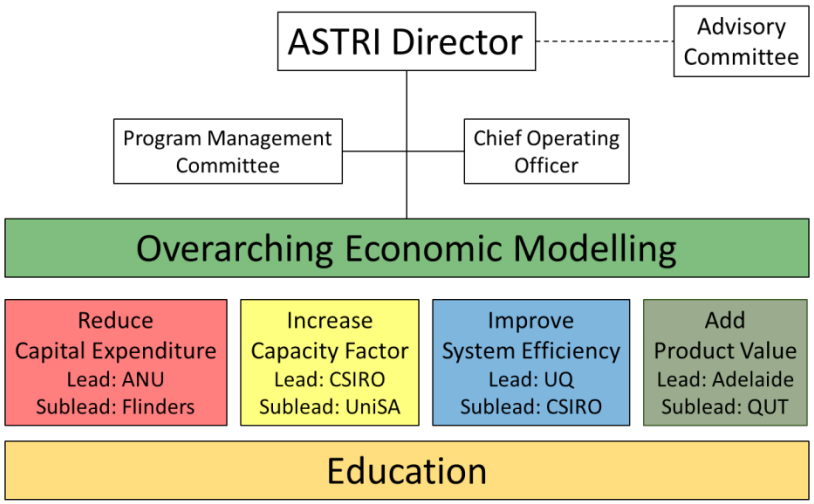
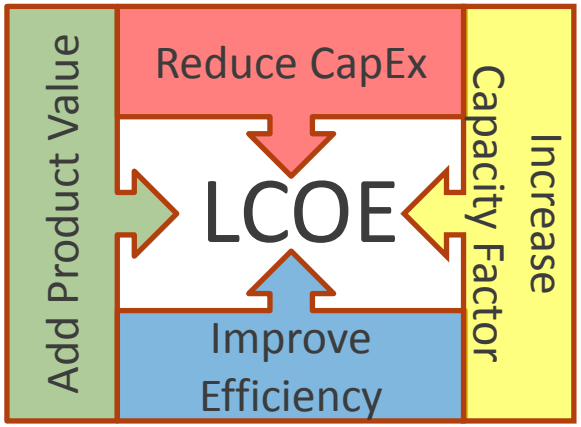
Australian Solar Thermal Research Initiative

ASTRI is committed to demonstrating a pathway for reduction in LCOE of CSP plants, targeting 20 c/kWh in Year 3 and 12c/kWh by 2020 whilst providing dispatchable firm supply





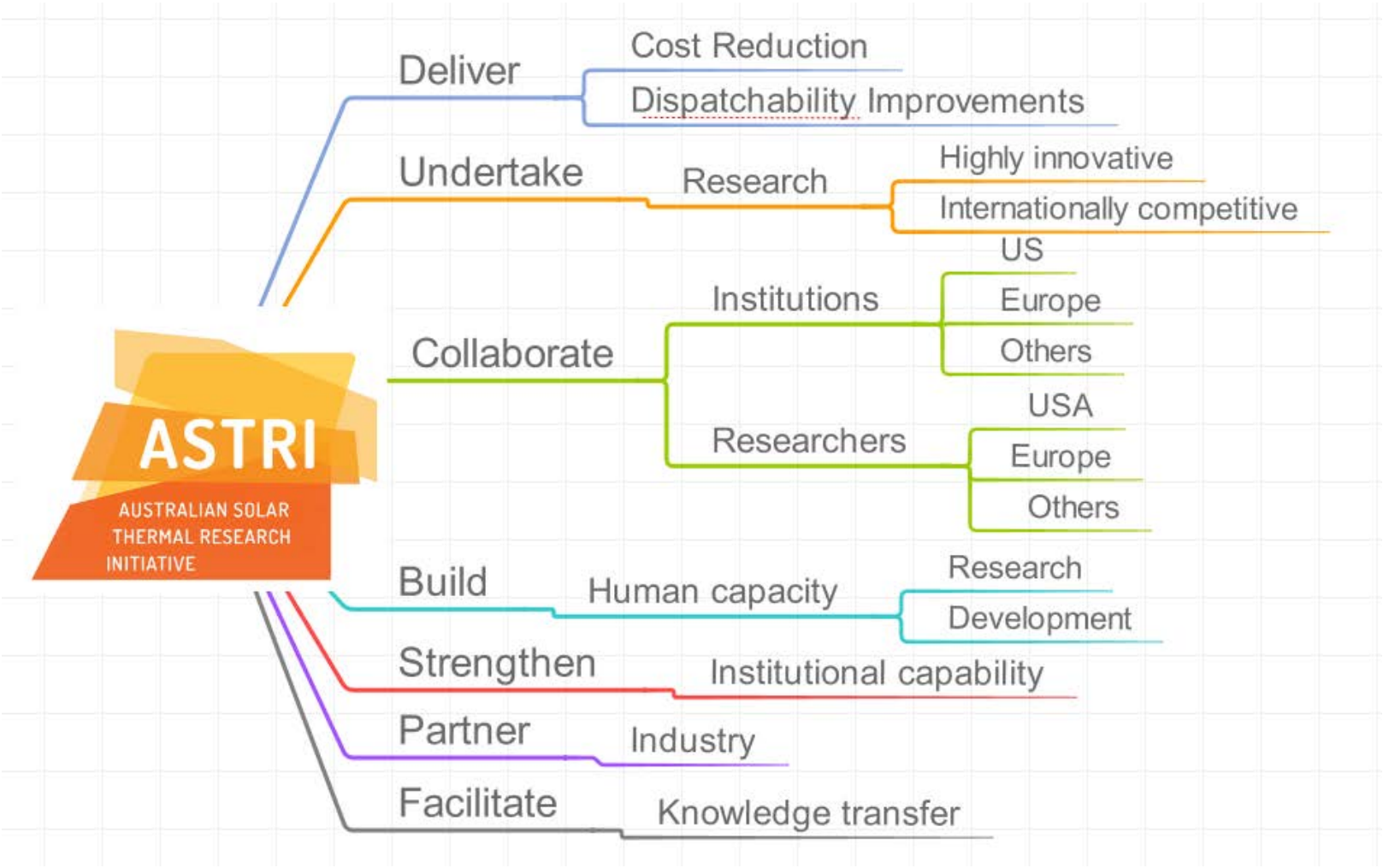
- Budget: $87m
  - ARENA $35m
  - Partners $46m
  - Industry $6m

ARENA

Australian Government
Australian Renewable Energy Agency

- Program 8 years (2013-2020)
  - with critical review in Year 4 (2016)
  - Overarching Economic Modelling
  - Research Nodes
    - Reduce CapEx
    - Increase capacity factor
    - Improve efficiency
    - Add Product Value
  - Education Program

ASTRI Objectives



Australian Partners

- CSIRO
  - Largest CSP research group in Australia with wide range of ARENA funded CST projects
- Australian National University
  - Developers of the Big Dish and ammonia thermochemical storage loop
  - Moving into heliostat optics and central receivers
- University of Queensland
  - Research partner for several Queensland CSP proposals
  - Radial turbine development and hybrid cooling
- University of Adelaide
  - Solar fuels, hybrid solar thermal and chemical looping plant, and reactor designs
- University of South Australia
  - Phase change research with strong background in materials at low temperature
- Queensland University of Technology
  - Dispatchable power, corrosion science, novel optics, polymer degradation
- Flinders University
  - Expertise in coatings and catalysis within Nanoscale Science Technology Centre

ASTRI People

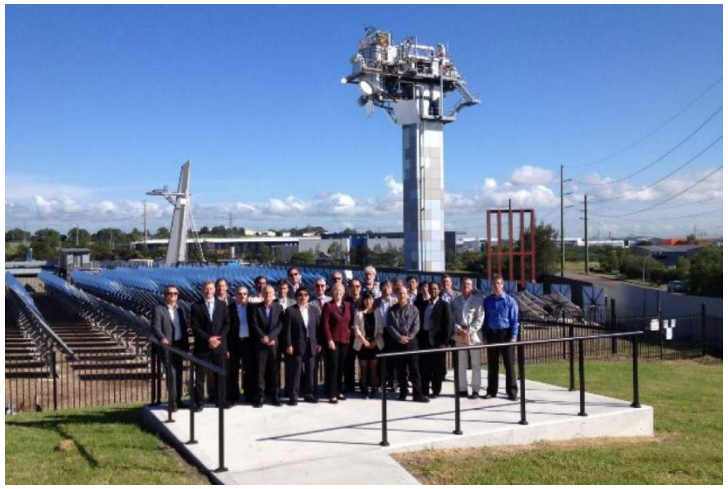
97 researchers:

- 29 post-graduate students
- 16 postdoctoral fellows
- Researchers
- Academics
- Total 38 FTE

CSIRO
Australian National University
The University Of Queensland AUSTRALIA
The University of Adelaide
University of South Australia
QUT
Flinders University

ASTRI Expertise

- ASTRI Director is also Chairman of IEA SolarPACES
- CSIRO PI is the Australian Representative in IEA SolarPACES
- Experience in feasibility studies, including for World Bank
- Experience in testing and standardisation
- Experience with 4 CST collector types
- Experience with electrical, chemical and process heat products
- Research collaboration with US and Europe



CSIRO
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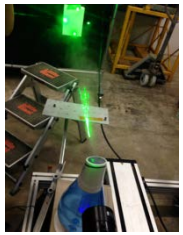
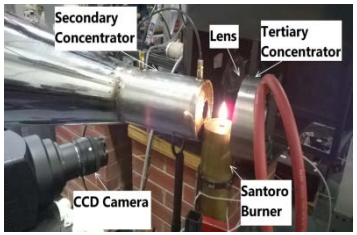
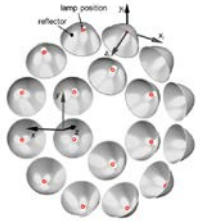
ASTRI Infrastructure

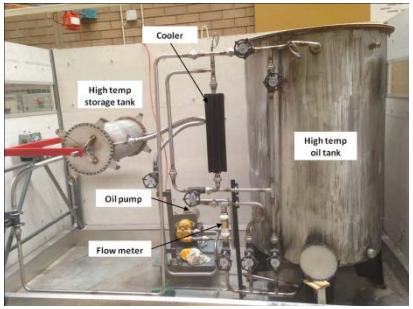


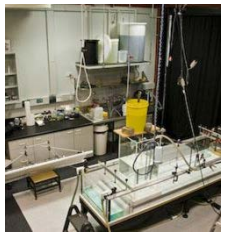



- Solar concentrators
- Solar simulators
- Optics
- Thermodynamics
- Fluid mechanics
- Wind tunnels
- Turbine test beds
- Hybrid cooling tower
- Dust characterisation
- Material characterisation
- Thermochemistry
- Weather stations

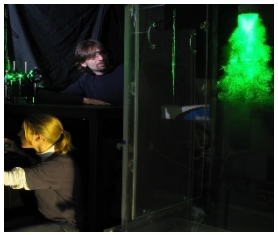




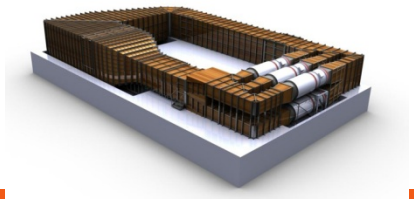
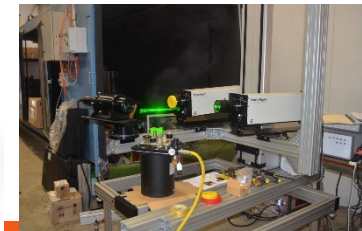











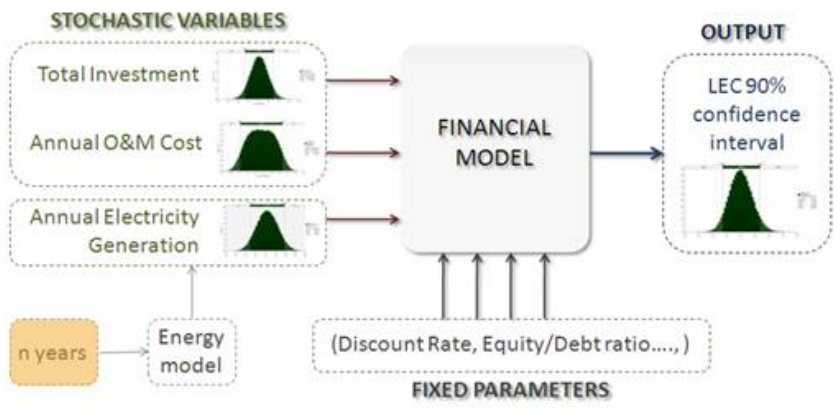




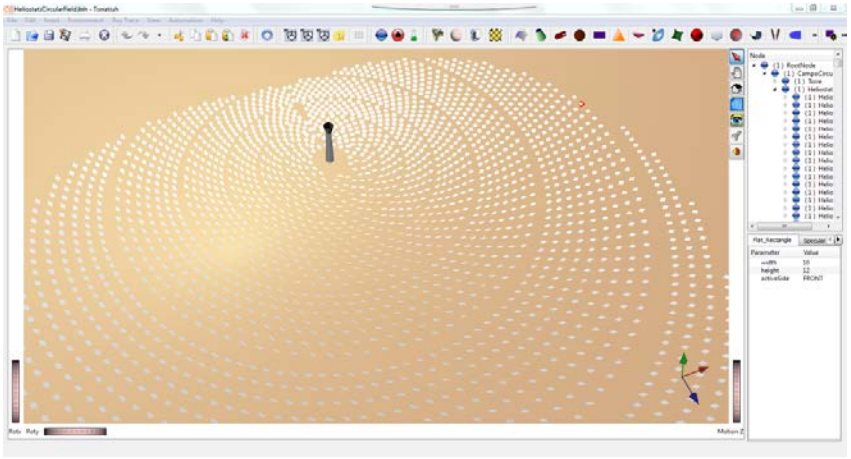
Program Overview

- **Overarching Economic Model**
  - Mainly about cost analysis
- **First world LCOF for Solar Fuels**
  - $1.20/L from fossil fuel (GHG 10% less than conventional diesel)
  - $2.50/L from renewable feedstock (GHG 50% less than conventional diesel)
- **Task Force looking at design configurations**
  - 25MW with 12c/kWh as a stretch target from 100MW with 12c/kWh
- **ASTRI Technical Model**
  - Provide a framework for ASTRI innovations to be assessed
  - Open Source for others to benefit and contribute
  - Relevant and adaptable for products other than electricity
    - Process heat, solar chemistry

Integrated Project Niches

- **Heliostats:** internal competition between 4 concepts
- **Receivers:** tubular and particle concept development
- **Storage:** sensible; latent; thermochemical
- **Power block:** sCO2 with hybrid cooling
- **O&M:** mirror cleaning; labour cost reduction
- **Solar fuels:** gasification through to liquid fuel production





ASTRI Collaboration

- ARENA: can see the influence of ASTRI on the quality of solar thermal submissions in the Solar Excellence round
- Chairman ASTRI Advisory Committee
  - *"ASTRI has brought together an array of impressive people to exploit one of Australia's most abundant and under-utilised natural resources: solar energy"*
  - *"It is good to hear everyone in the ASTRI team communicating their important research achievements, meeting or exceeding their KPIs, and collaborating effectively"*

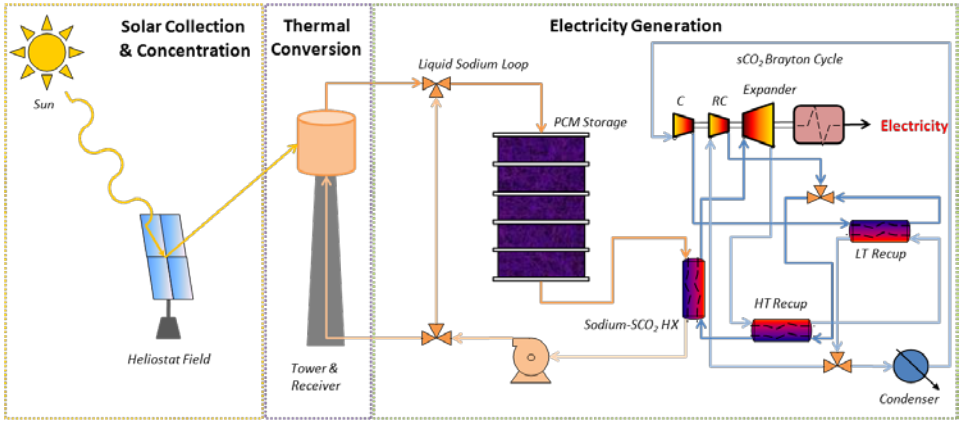
ASTRI Collaboration

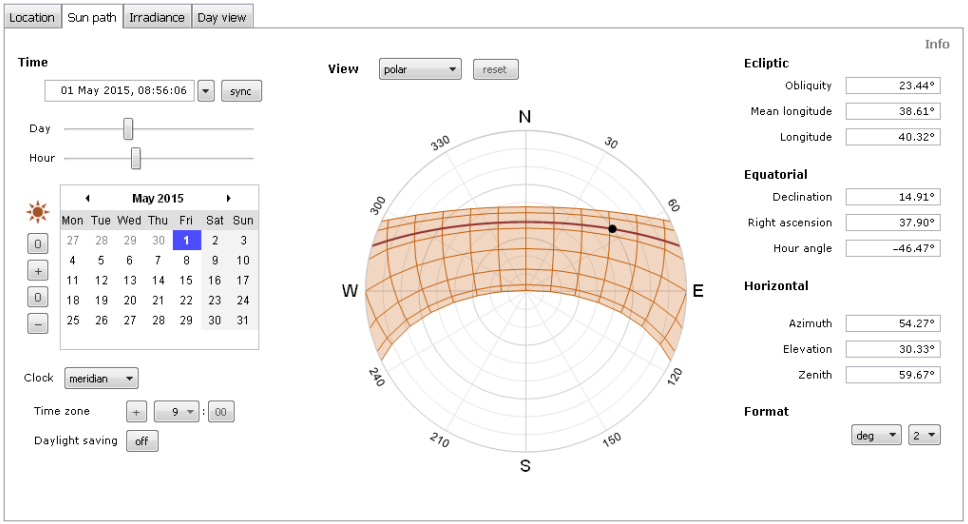
Self Assessment by ASTRI Program Management Committee

- First large scale integration of CST research in Australia
- Good diversity across research career stages of students, postdocs, researchers, academics
- Understanding CST holistically as well as the niche research needs/opportunities to achieve significant cost reductions

Underlying CST Philosophy

- The critical challenge for CST is to increase its competitiveness by reducing cost (CAPEX and OPEX) while increasing efficiency
- If you reduce the cost of CST collectors, receivers, and storage for producing electricity, the cost of most other CST applications will reduce
- If you use CST to store useful thermal energy, processes can approach isothermal operation





Summary

This presentation was to increase industry awareness of:

- Diverse CST technical capabilities within ASTRI
  - Focus on achieving technical and economic goals
  - Existing multi-institutional teams, network, facilities and tools
- Readiness of ASTRI to partner with industry on ARENA Rd 2 projects in:
  - Solar thermal technologies for industrial processes
  - Balance of systems
  - Benefits of CST to networks
  - Power generation
  - Meeting specific needs

Acknowledgements

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http://www.astri.org.au/wp-content/uploads/2014/08/ASTRI_ARENA_Rd2-20150515.pdf