

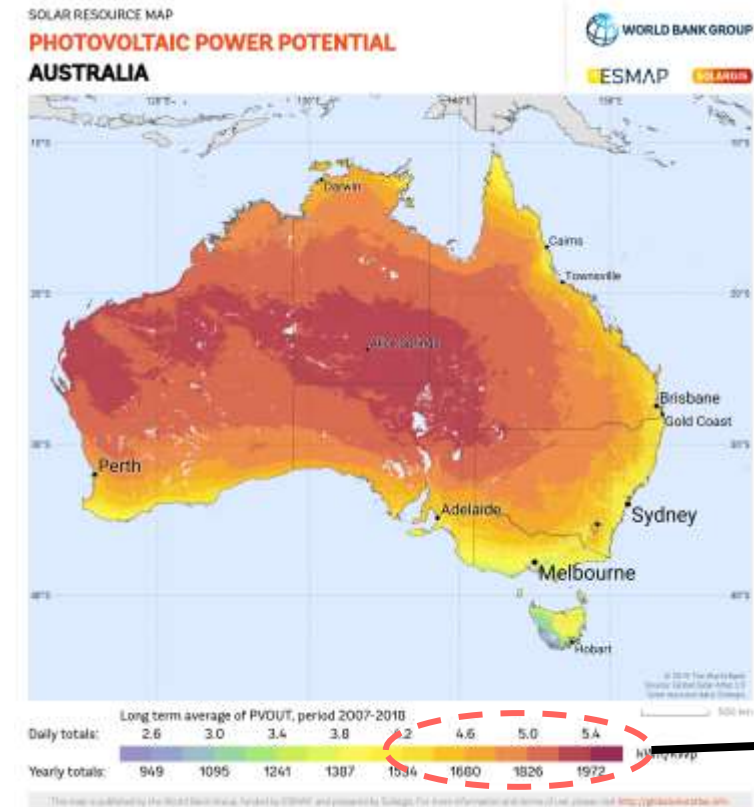
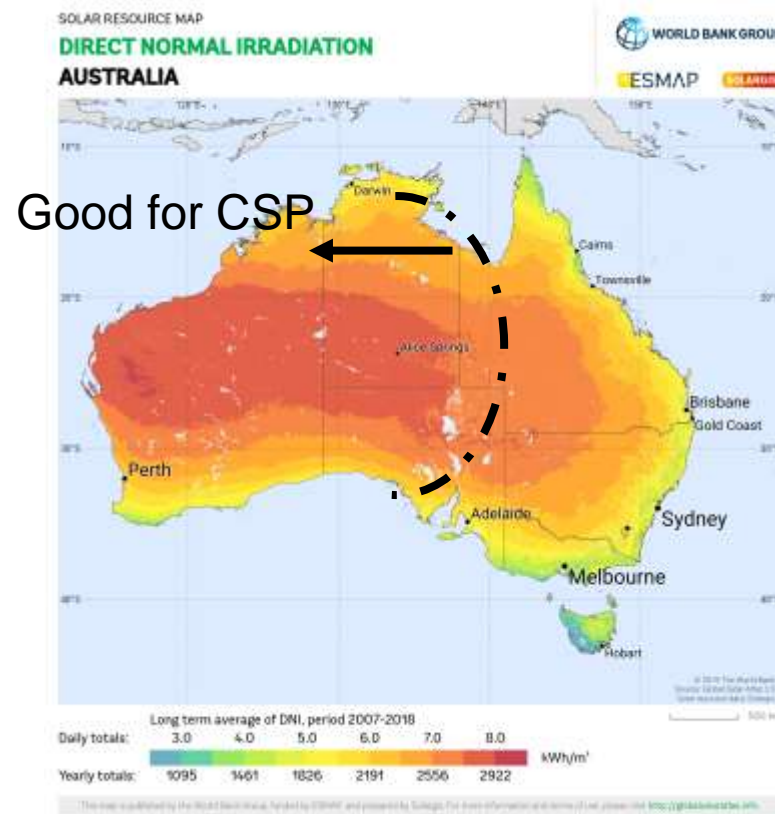
# Does a Barassi Line exist to divide CSP-MED and PV-RO in Australia?



Dr. Amr Omar



# CSP or PV in Australia?



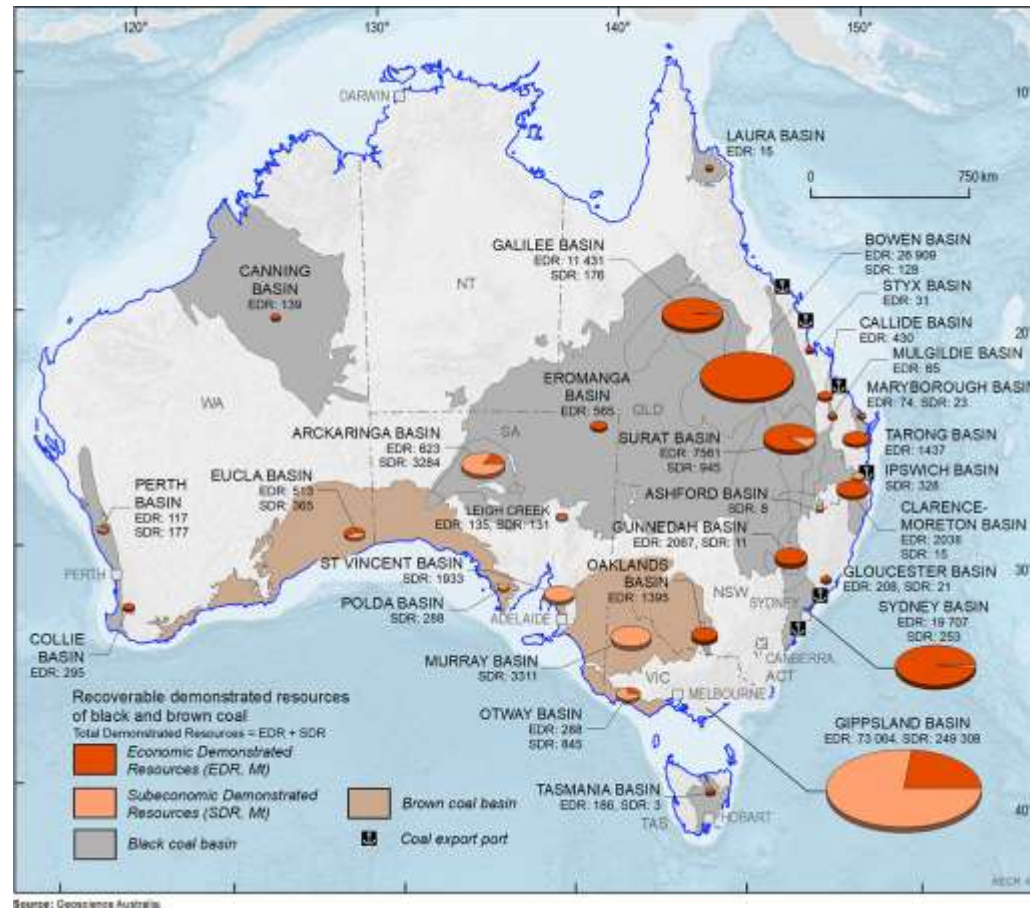
Thus, most of Australia is great for PV

# Energy– Water Nexus: Sun to H<sub>2</sub>O?

- Clean water supplies energy
- Water is used in cooling

Energy – Water Nexus

- Energy is used for desalination and wastewater treatment
- Energy is used for water transport

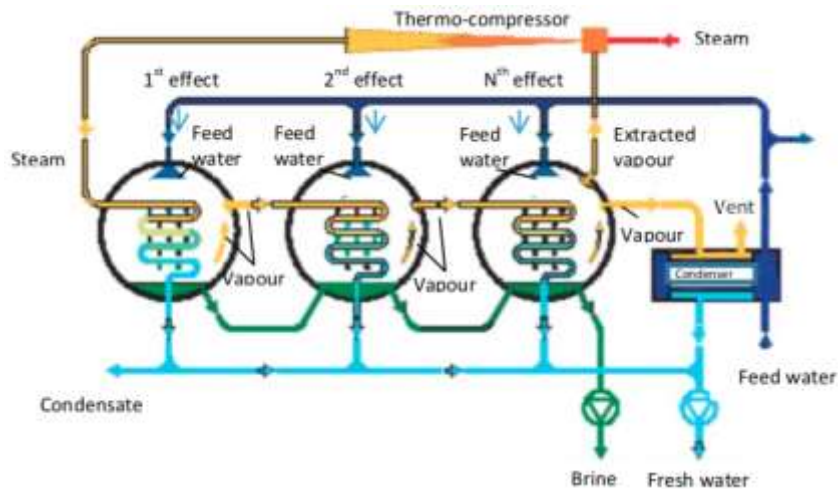


[1] <https://www.ga.gov.au/digital-publication/aecr2021/coal>

# Thermal vs Electric Desalination

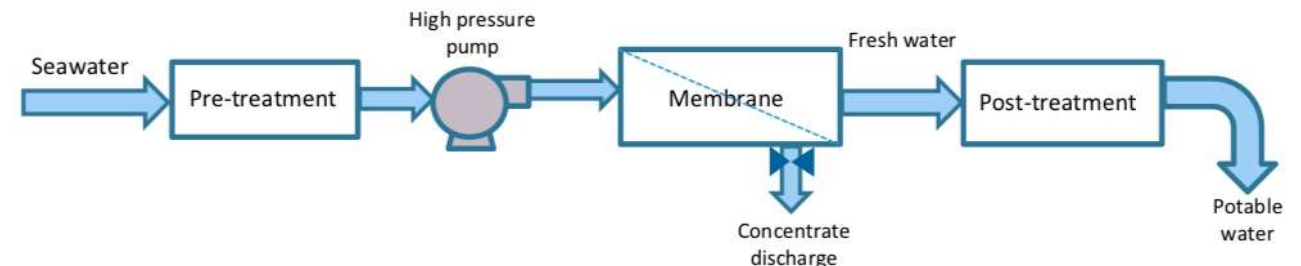
## Multi-Effect Distillation (MED)

- Mimic the Natural Water Cycle
- Thermal ( $60\text{--}110 \text{ kW}_{\text{th}}\text{h}/\text{m}^3$ ) and Electrical Energy ( $1.5 \text{ kW}_e\text{h}/\text{m}^3$ )
- Water Cost  $0.7 - 1.0 \text{ USD}/\text{m}^3$
- Treat high salinity feedwater



## Reverse Osmosis (RO)

- Membrane Technology
- Electrical Energy ( $3\text{--}7 \text{ kW}_e\text{h}/\text{m}^3$ )
- Water Cost  $0.6 - 0.8 \text{ USD}/\text{m}^3$
- Modular (similar to PV)

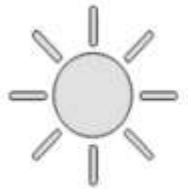


[2] P. Palenzuela, D. Alarcon-Padilla and G. Zaragoza, "Large-scale Solar Desalination by Combination with CSP: Techno-economic Analysis of different Options for the Mediterranean Sea and the Arabian Gulf," 2015

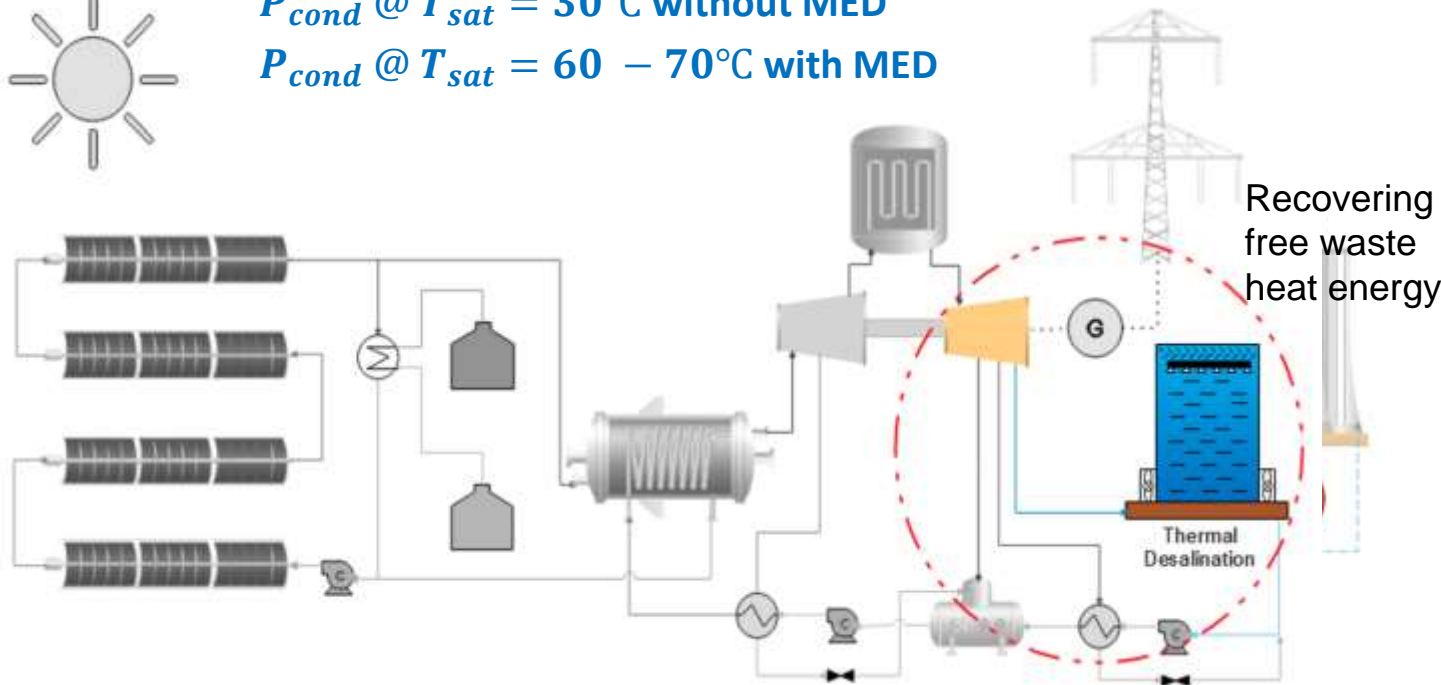
[3] Banat, F., "Economic and Technical Assessment of Desalination Technologies," 2007



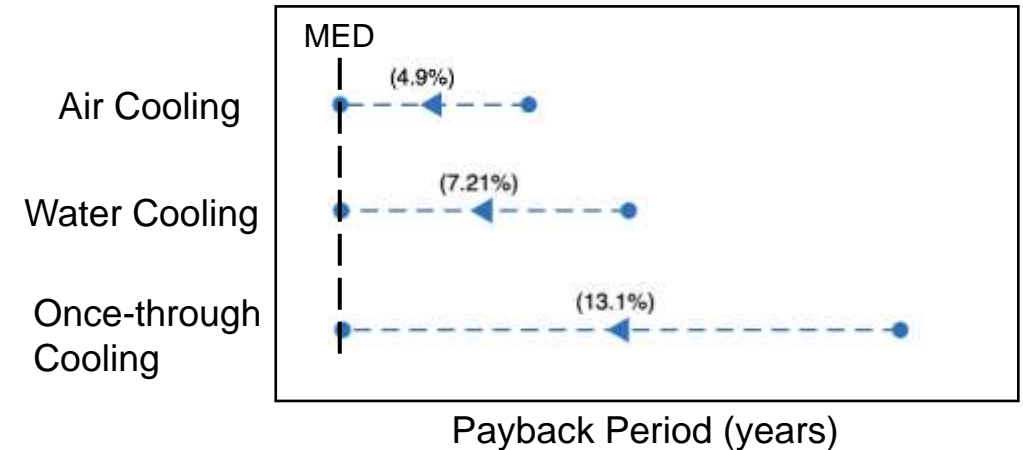
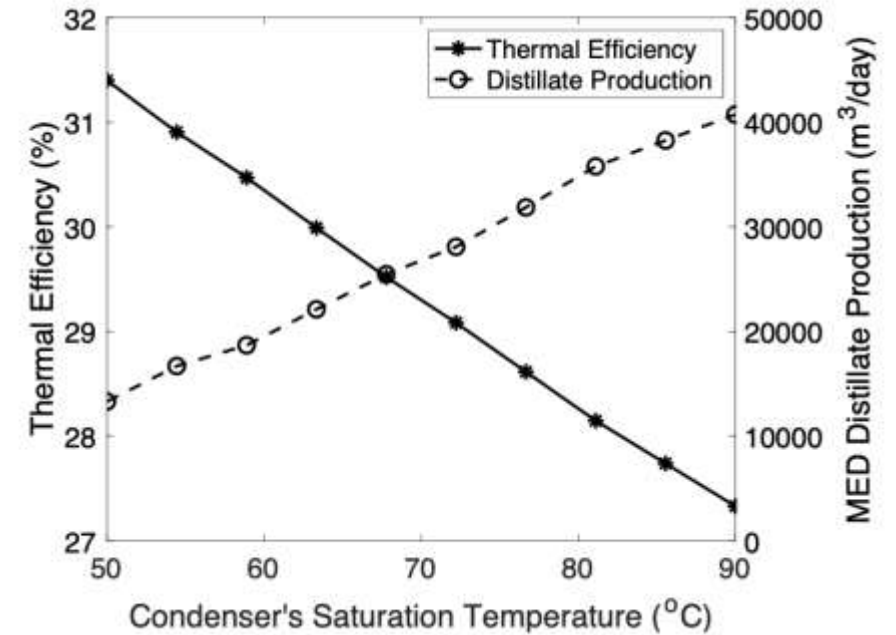
# CSP-MED



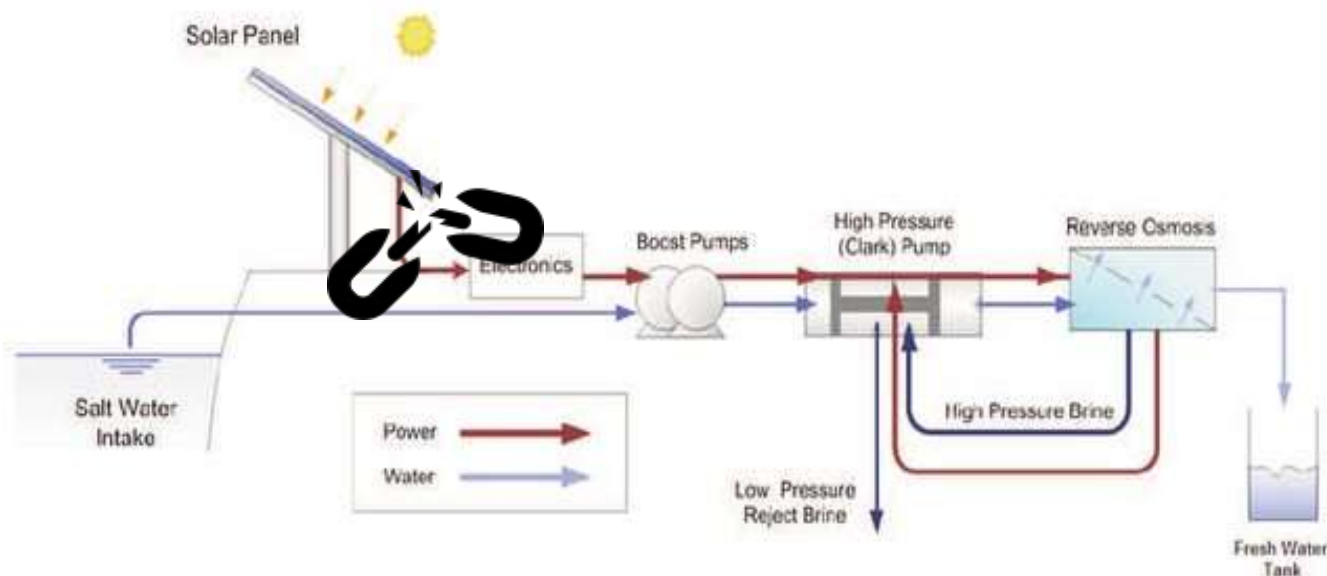
$P_{cond} @ T_{sat} = 30^{\circ}\text{C}$  without MED  
 $P_{cond} @ T_{sat} = 60 - 70^{\circ}\text{C}$  with MED



The turbine's back pressure is increased to meet the thermal energy requirement for the MED system, which reduces the thermal efficiency of the CSP system



# PV-RO



Utilise inland hi PV power potential  
No need for water transportation

SOLAR RESOURCE MAP

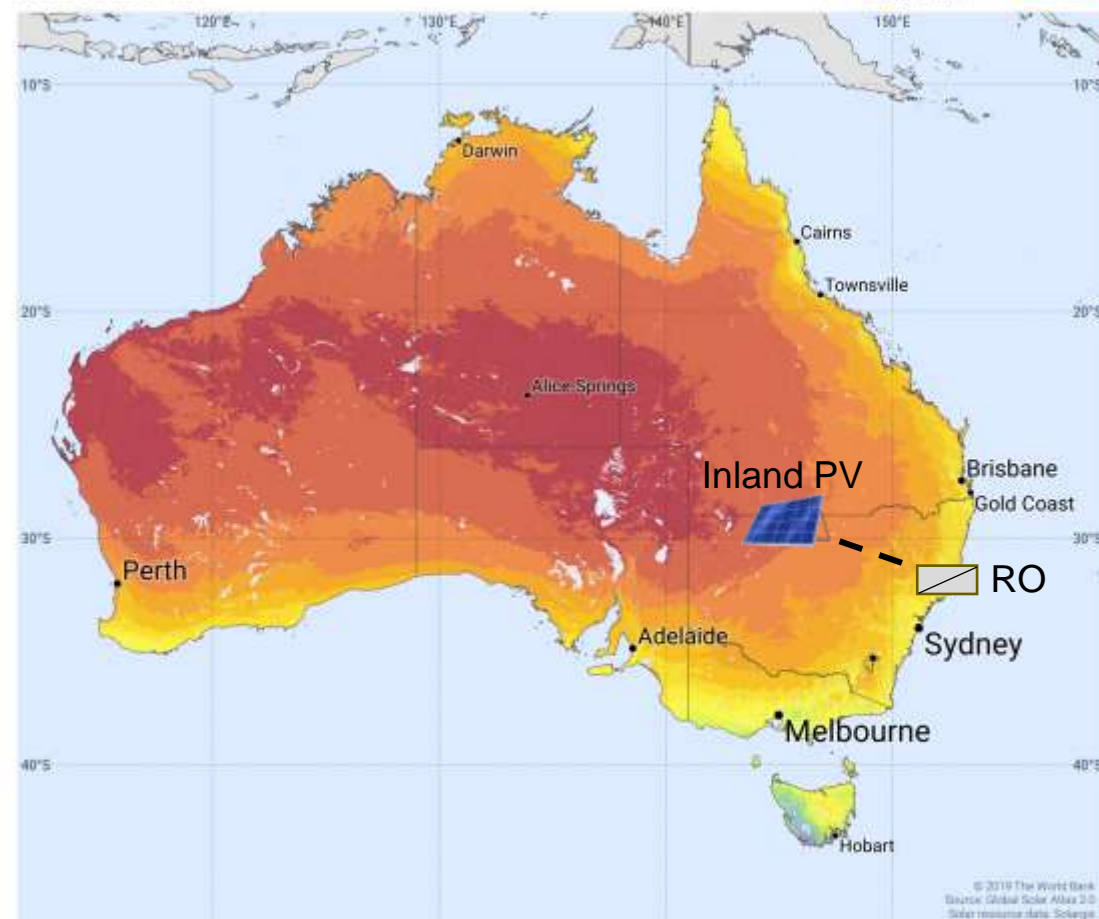
PHOTOVOLTAIC POWER POTENTIAL

AUSTRALIA



ESMAP

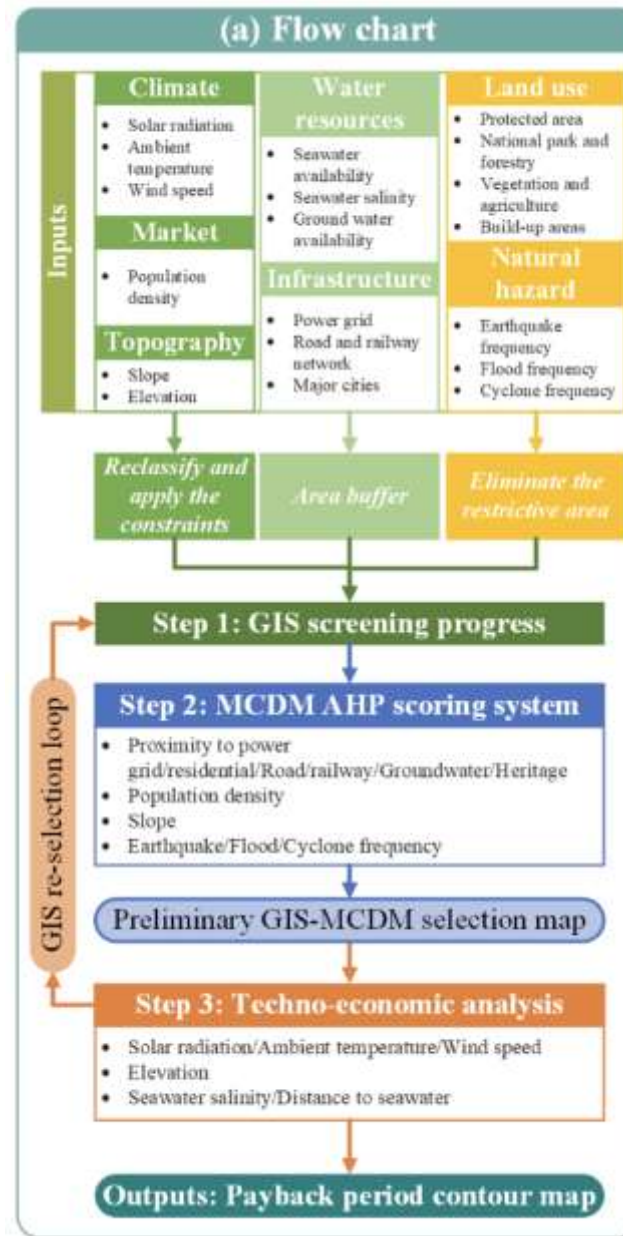
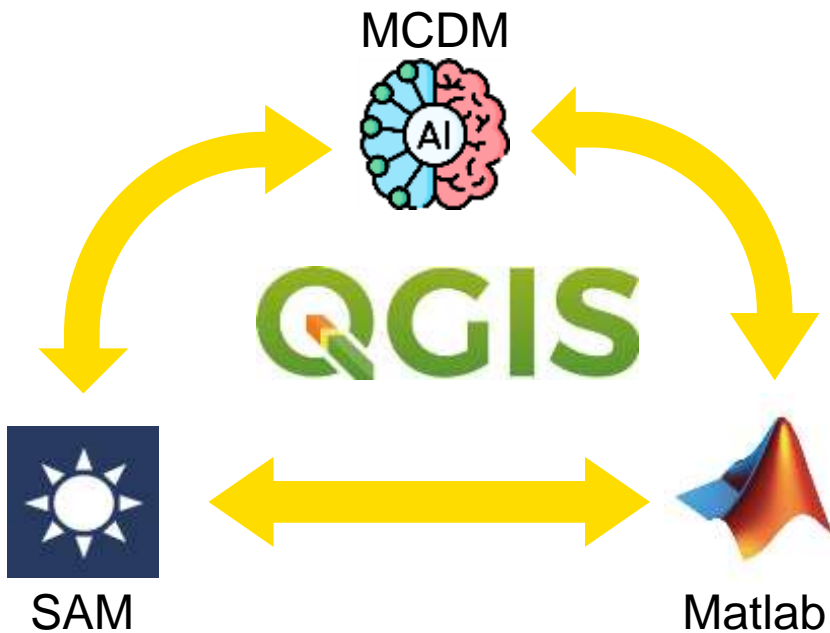
SOLARGIS



This map is published by the World Bank Group, funded by ESMAP, and prepared by Solargis. For more information and terms of use, please visit: <http://globalsolaratlas.info>

[5] Almaktoof et al., "Batteryless PV desalination system for rural areas: A case study," 2015

# Siting Tool



## CSP-MED

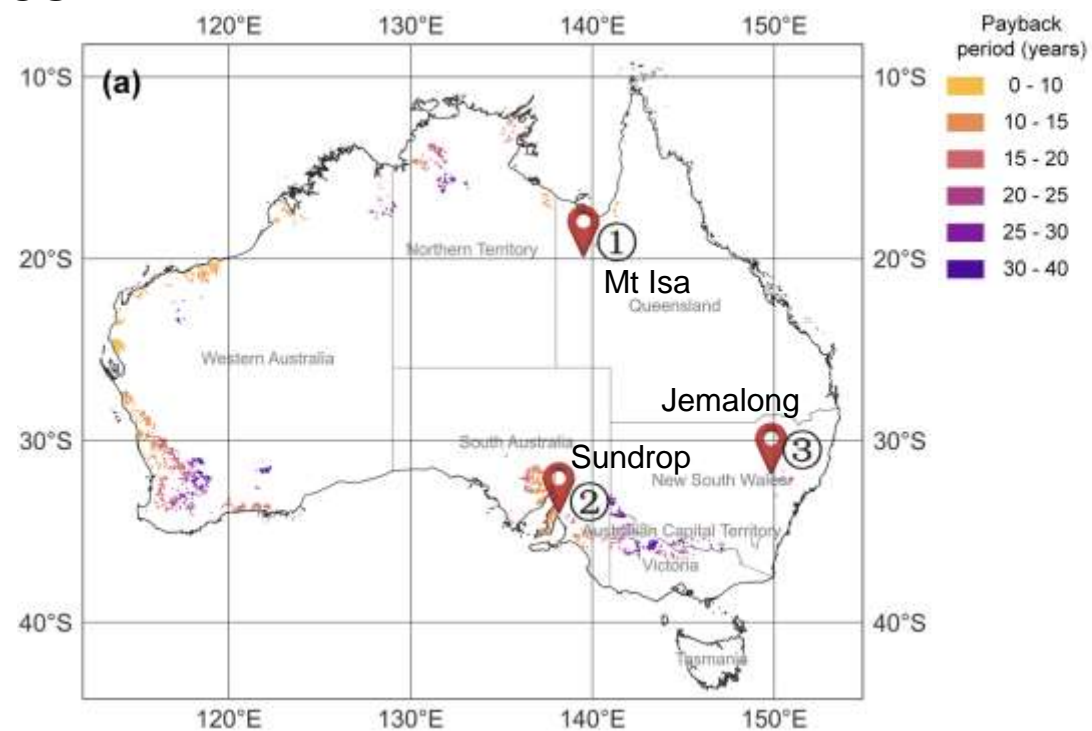
Parameter	Value
Net Power	50 MWe
Thermal Storage	6 hrs
Waste Heat	~69 MWth (70°C)
MED Production	~27,000 m <sup>3</sup> /day

## PV-RO

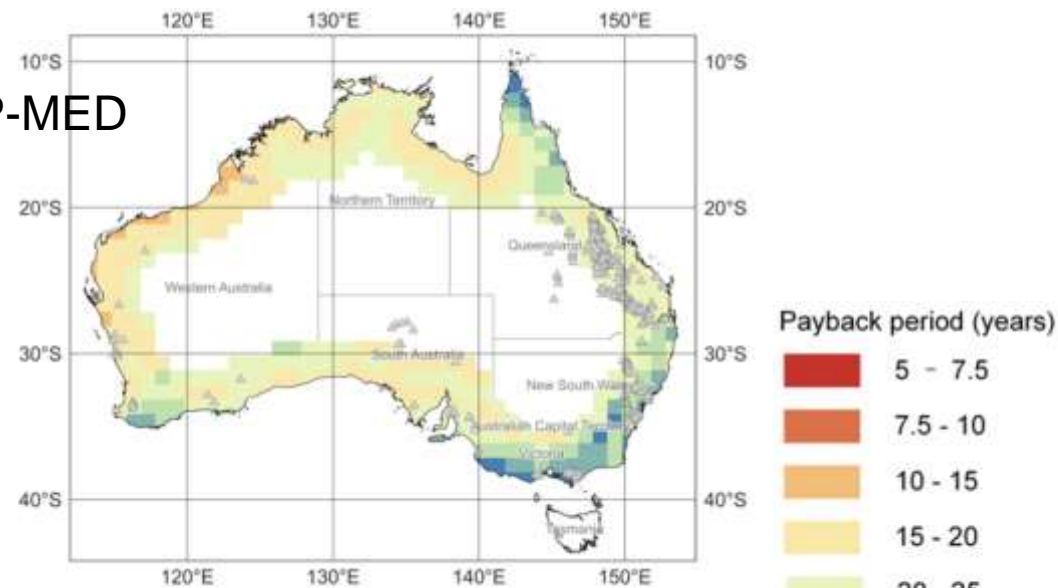
Parameter	Value
PV for RO	4.5 MWe
Total PV capacity	54.5 MWe

# Potential Sites

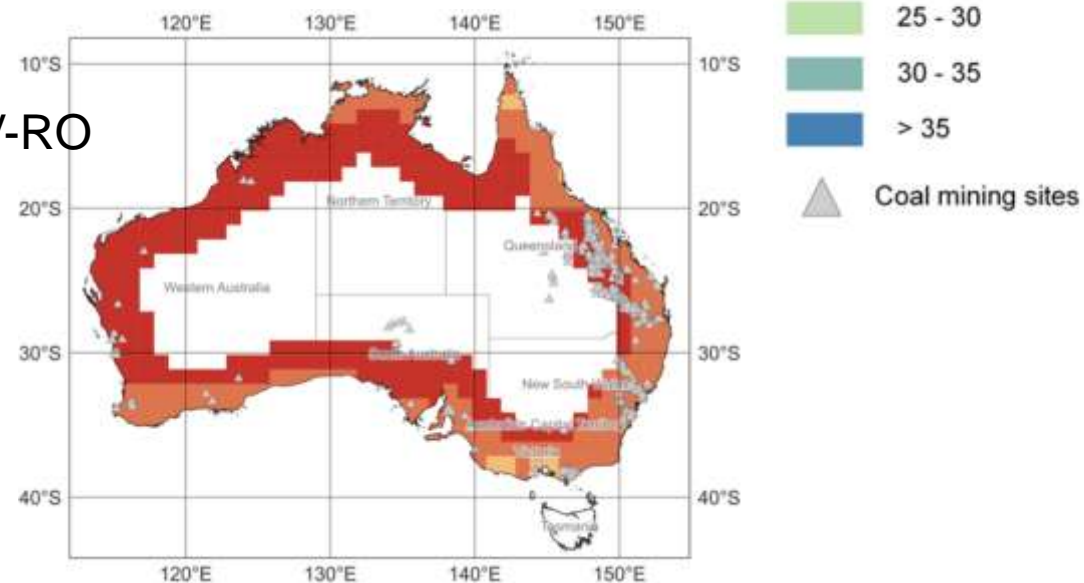
CSP-MED



CSP-MED



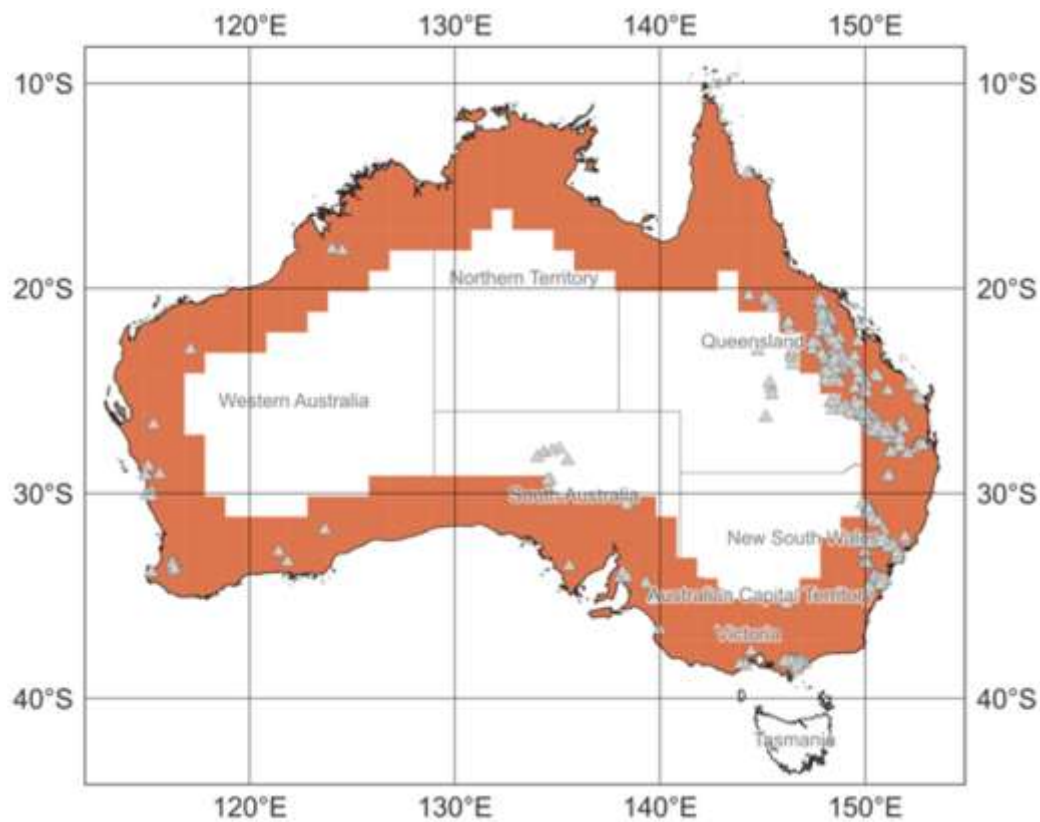
PV-RO



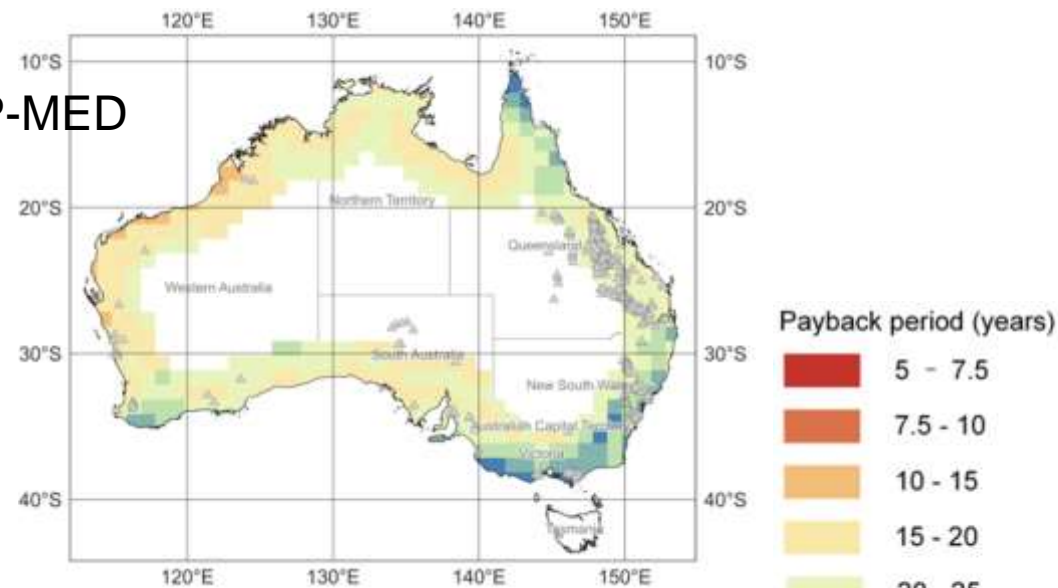


# Potential Sites

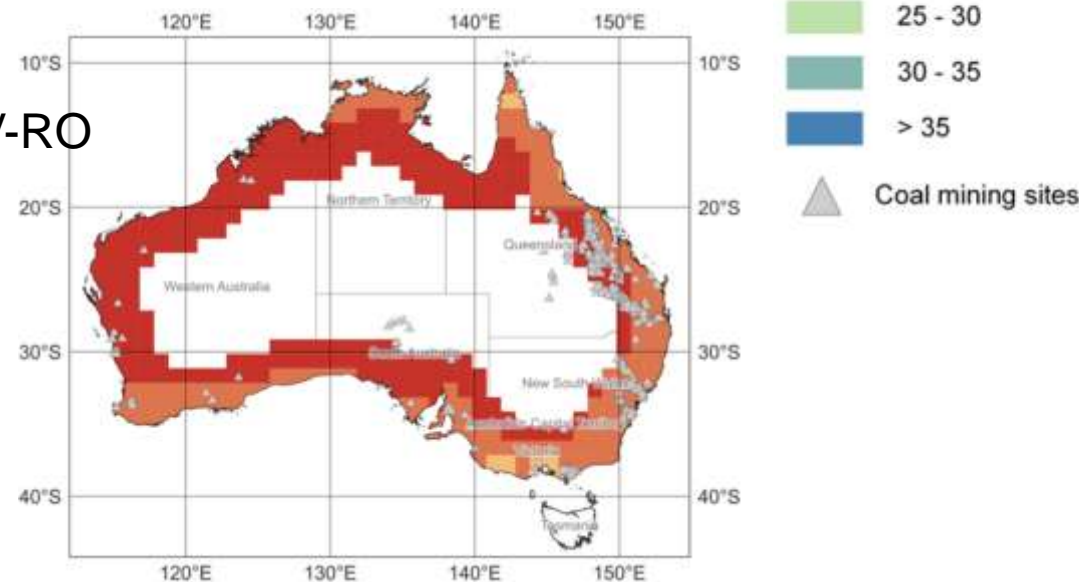
PV-RO (Water Production Only)



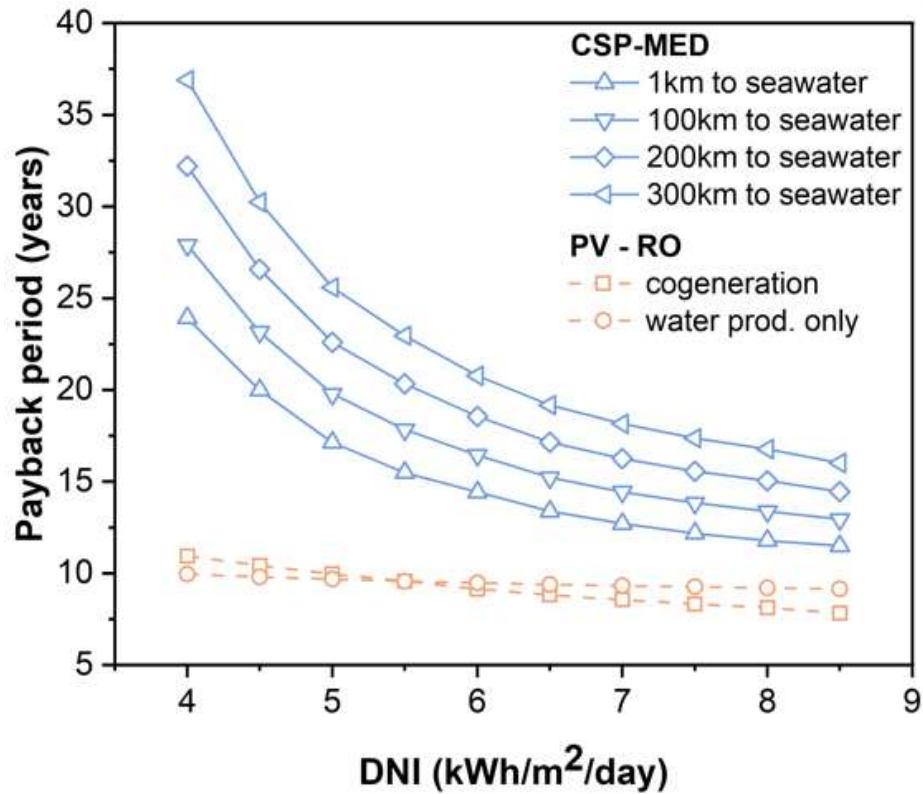
CSP-MED



PV-RO



# Key Message



- A Barassi Line does **NOT** exist for CSP-MED and PV-RO in Australia.
- CSP-MED's electricity and water are made on-site for in-land mining towns.
- The potential of 24/7 operation of CSP can provide the edge against PV-battery.

**Both** could be installed hand-in-hand to be part of the electricity and water mix going forward.