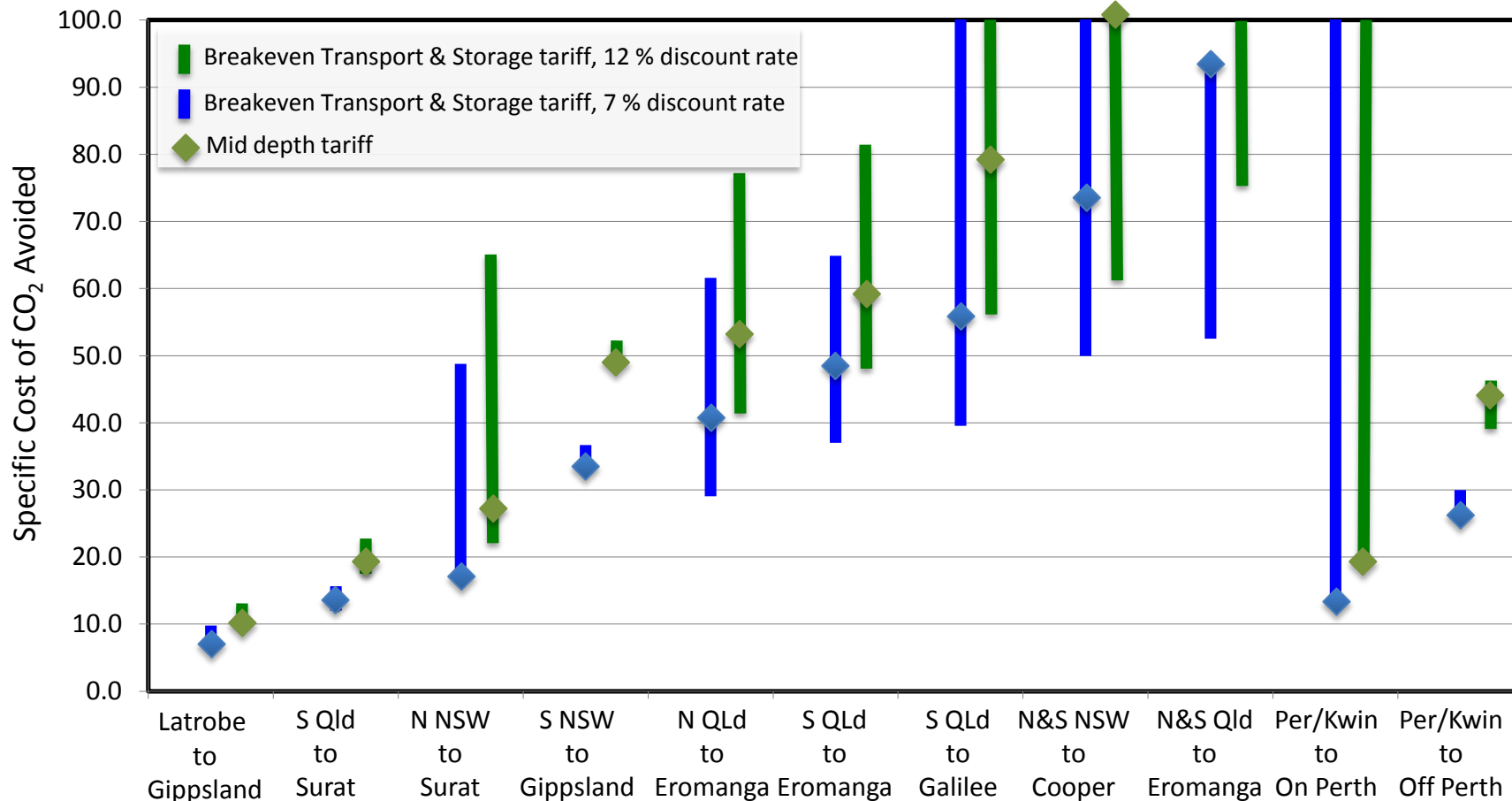




Break-even transport & storage tariff for hub/sink combinations

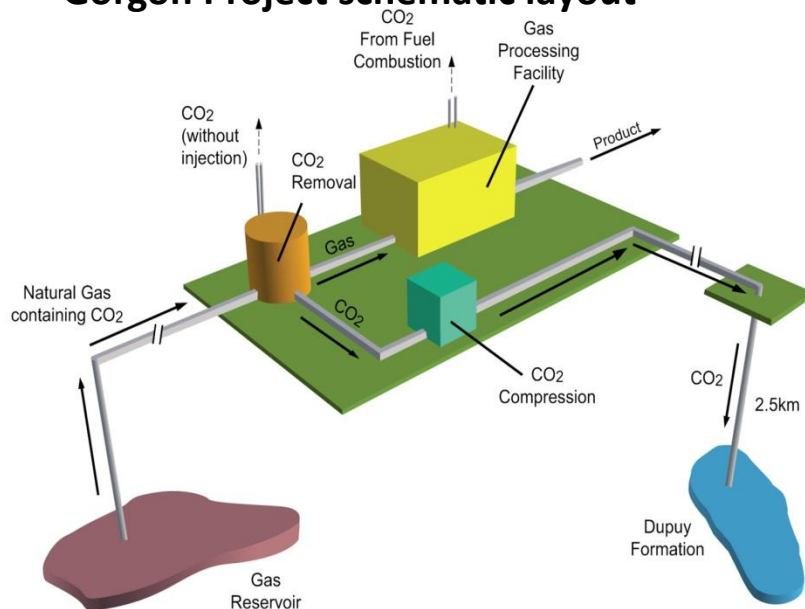




Demonstration projects are important for building investor confidence

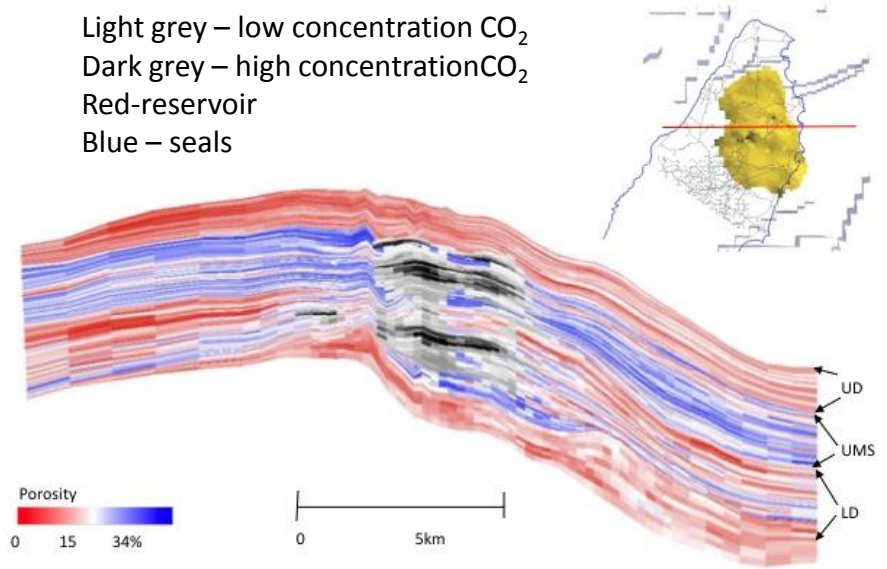
- Gorgon will be the world's largest CCS project (3.5 Mtpa)
- Several demonstration storage sites could be ready by 2018

Gorgon Project schematic layout



Reservoir Simulation Modeling – Plume 500 years

Light grey – low concentration CO₂
Dark grey – high concentration CO₂
Red – reservoir
Blue – seals



Figures courtesy Chevron



Progress on Renewables



Bio-energy



Solar PV



Wind



Solar Thermal



Wave



Geothermal



Renewables

- **Wind**
 - Well established. Intermittency a serious issue.
- **Solar PV**
 - Requires subsidy. Solar Flagships is an opportunity for large projects.
- **Solar Thermal**
 - Maturing but Australian costs unknown until Solar Flagships projects built.
- **Wave**
 - Technology under development & likely to be 5 – 10 yrs before large project.
- **Bio-energy**
 - Acquiring biomass resource (forestry, municipal, agricultural) costly.
Opportunity is energy crops (landcare & regional benefits)
- **Geothermal**
 - Expensive exploration required to define resource. Has baseload potential.

Renewable technology attributes

	Maturity	Intermittency	Typical capacity factor (%)	Life (years)
Bio-energy	Maturing	Nil	90	20
Geothermal	Mature	Nil	90	30
Hydro	Mature	Seasonally	50	40
Wind	Mature	Hourly, Daily, Seasonally	35	20
Solar PV	Maturing	Hourly, Daily, Seasonally	30	25
Wave	Immature	Hourly, Daily, Seasonally	60	25
Tidal	Immature	Hourly	25	40

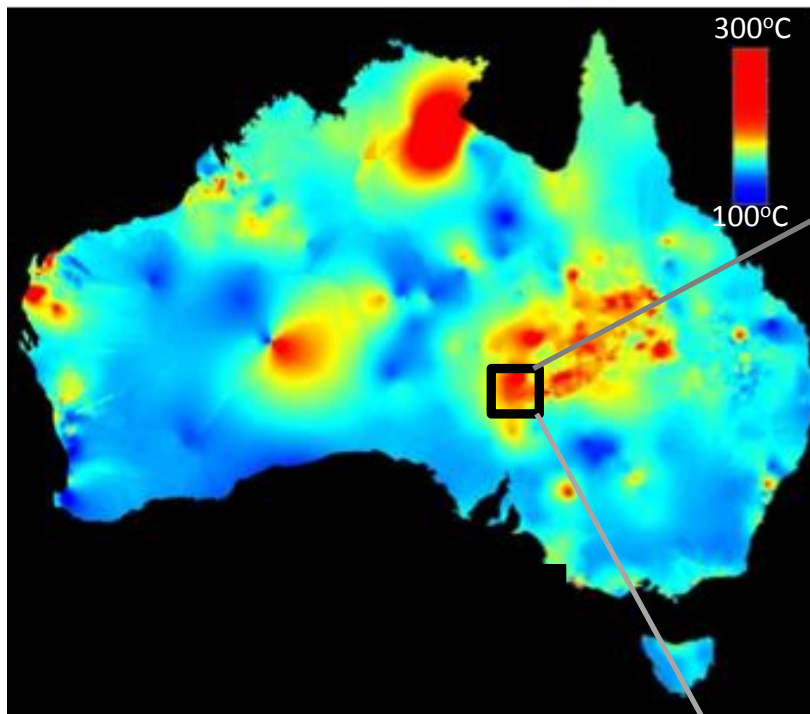


Geothermal

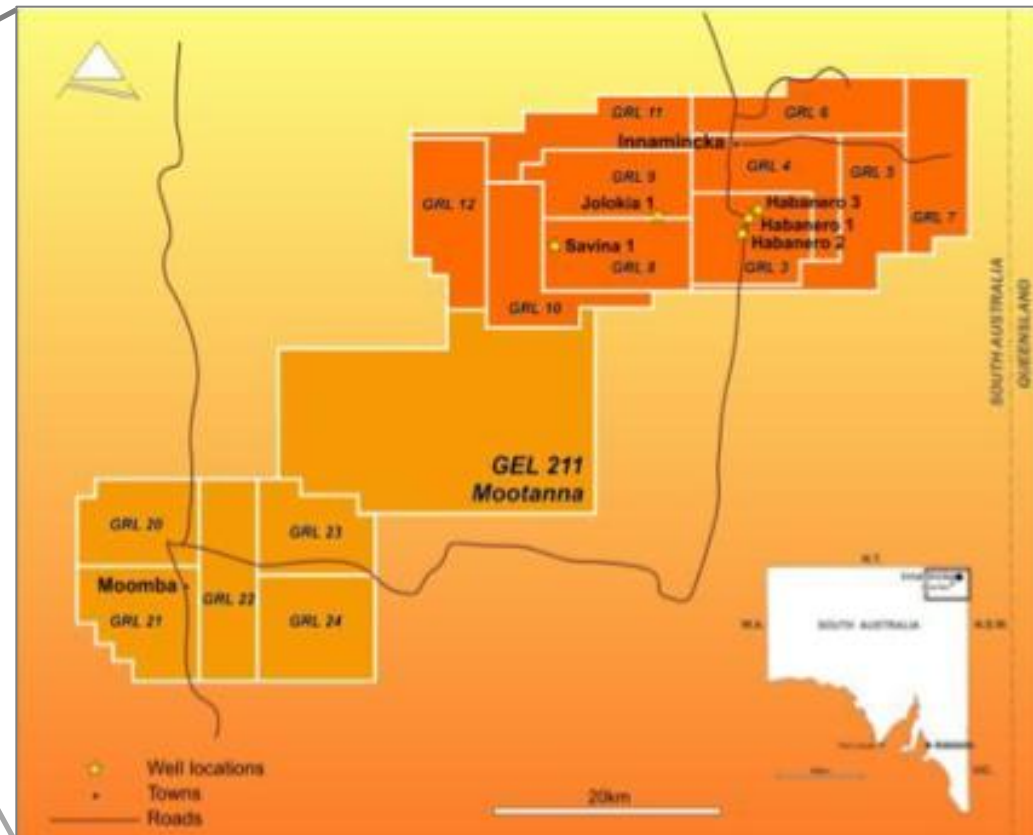




Geodynamic's Cooper Basin permits

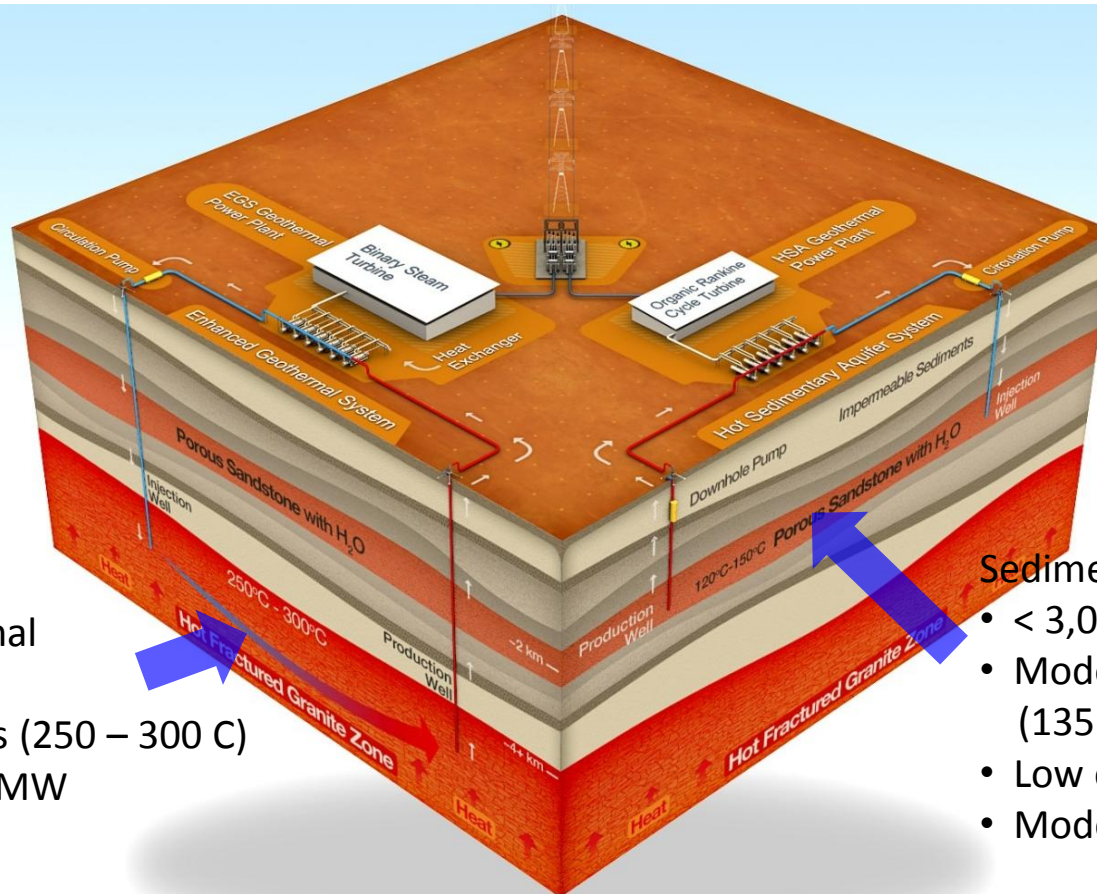


Estimated crustal temperature at 5km depth
(after AUSTHERME05 database of Chopra & Holgate (2005)
Image is Copyright 2007 – Dr Prame Chopra, Earthinsite Pty Ltd





Cooper Basin has potential for both Enhanced & Sedimentary Geothermal



Enhanced Geothermal

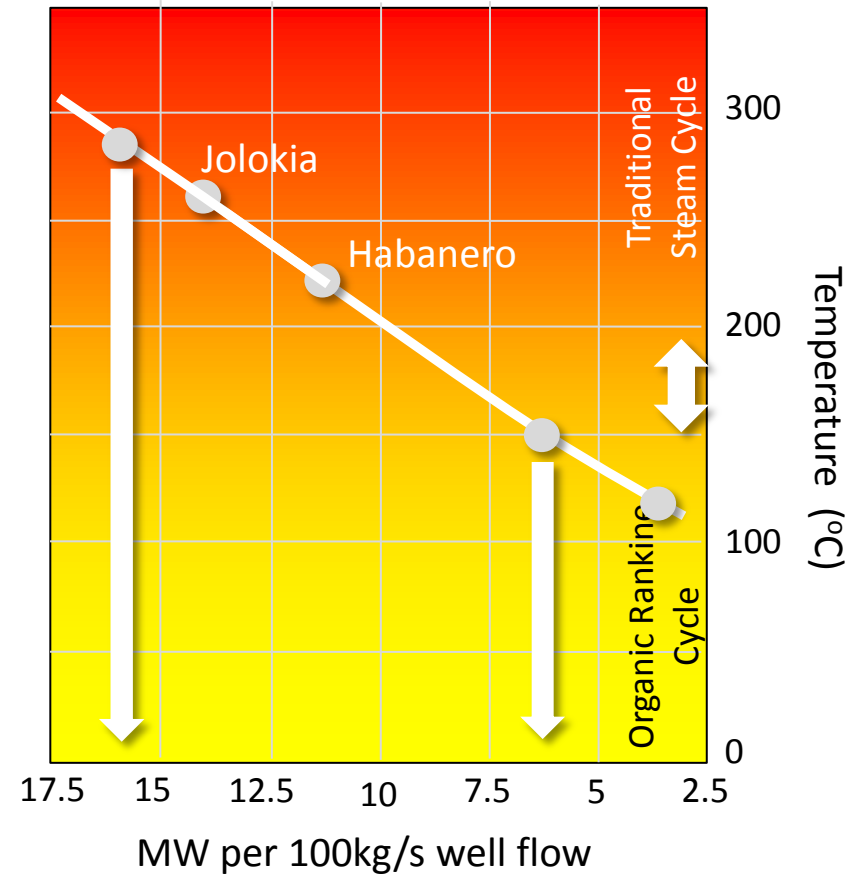
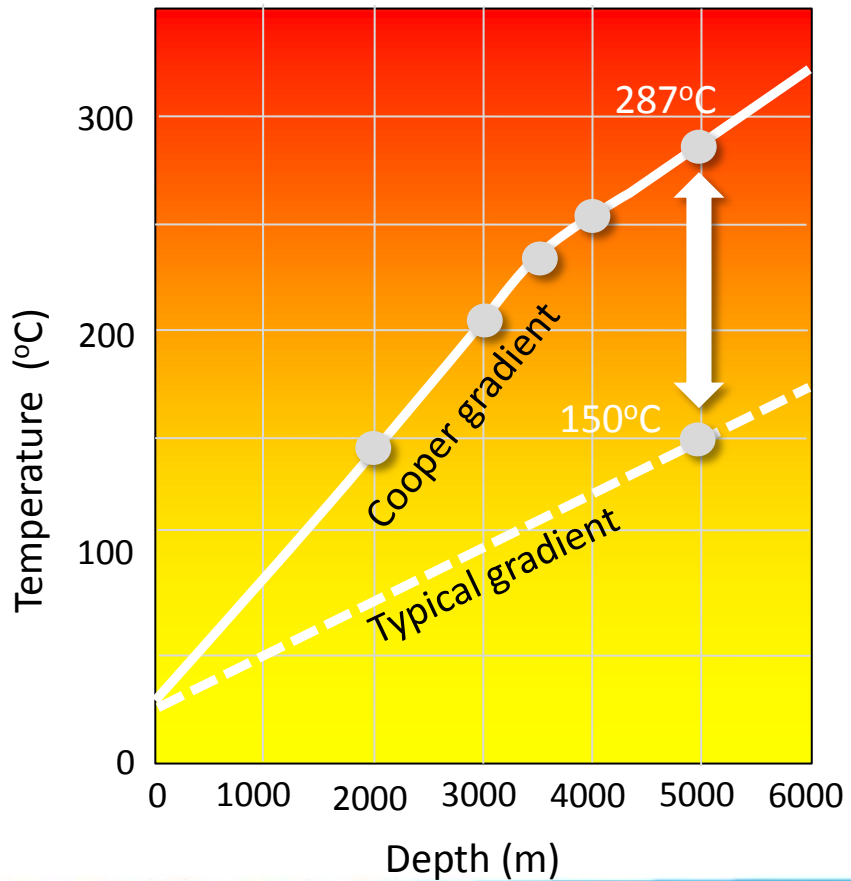
- > 4,000m
- High temperatures (250 – 300 C)
- Large scale '000's MW

Sedimentary Geothermal

- < 3,000 m
- Moderate temperatures (135 - 150C)
- Low cost drilling
- Moderate scale '00's MW

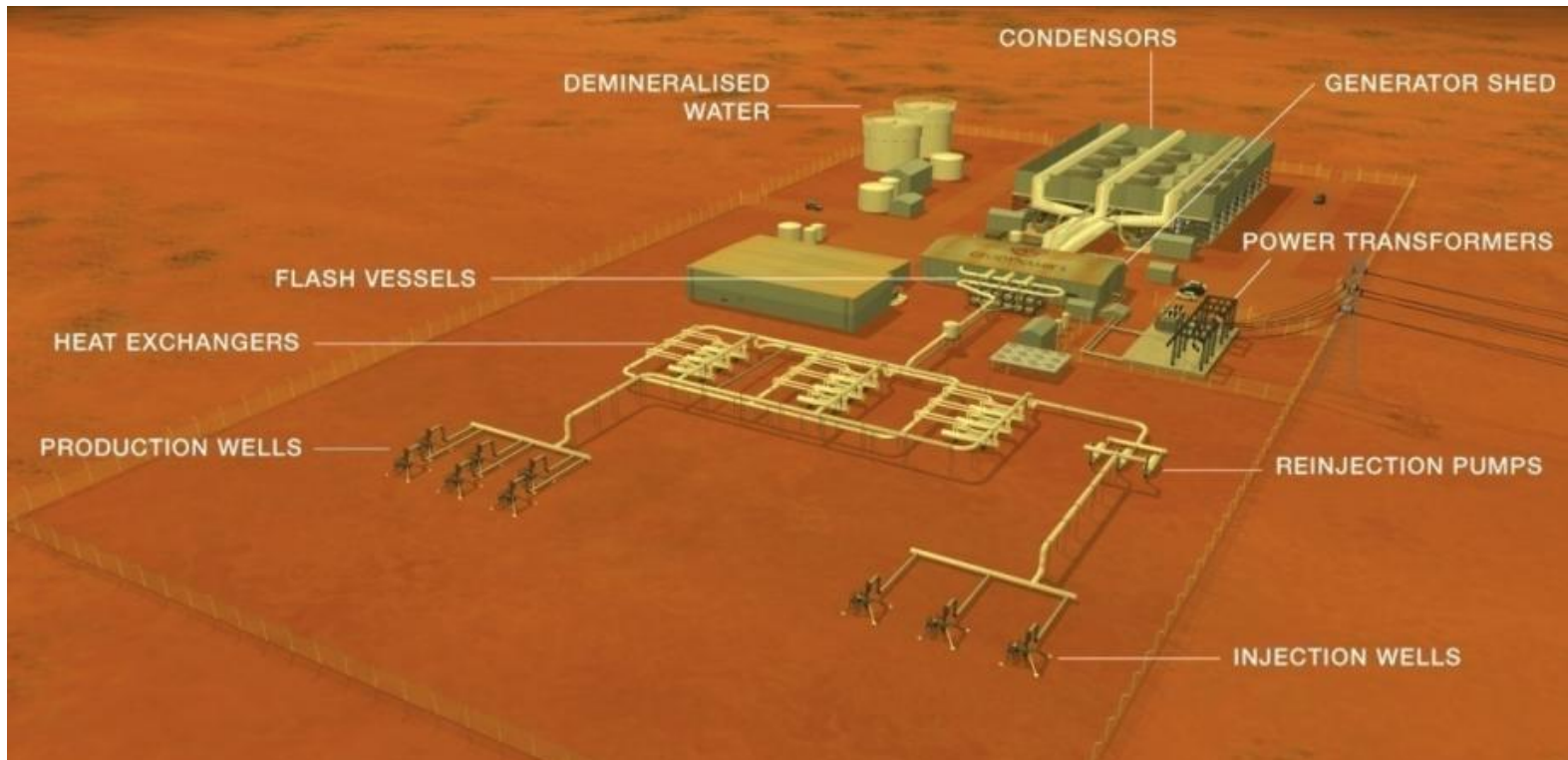


Temperature is King





25 MW Commercial demonstration plant Concept design





Observations

- **Energy sector transformation on a massive scale required**
 - Lead time to implement new technologies is 10+ years
 - CCS, Solar demonstrations rely on government sponsorship to bridge the commercial gap (Flagships)
 - Gas to play a greater role in the future
- **Absence of carbon price**
 - New base load plant difficult to finance in uncertain carbon price world – the generation fleet is ageing
 - No incentive to pursue new technologies – the commercial gap is too wide
- **RET scheme encourages greater investment in renewables**
 - Wind the main beneficiary
- **Increasing public concern for climate change**
 - Market demand for energy auditing, efficient design & construction of houses & offices, low emission vehicles, domestic solar



Implications of new technologies for workforce & skills

- **Many technologies build on existing skills**
 - Supplemented with new skill sets - embed in existing training packages
 - Some areas require totally new qualifications (e.g. energy auditors)
- **Immediate**
 - Energy auditors, domestic Solar installation & maintenance, energy efficient building designers
- **Medium term**
 - Demonstration projects (e.g. CCS, Solar, Geothermal) inform future skills
- **Long term (post 2020)**
 - Workforce for reconstruction of Australia's Energy Sector
 - Geothermal, CCS will require a broad knowledge from subsurface to surface (integration)



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