



RENEWABLE ENERGY OPTIONS FOR AUSTRALIAN INDUSTRIAL GAS USERS

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Prepared by IT Power for the
Australian Renewable Energy Agency





ARENA commissioned study

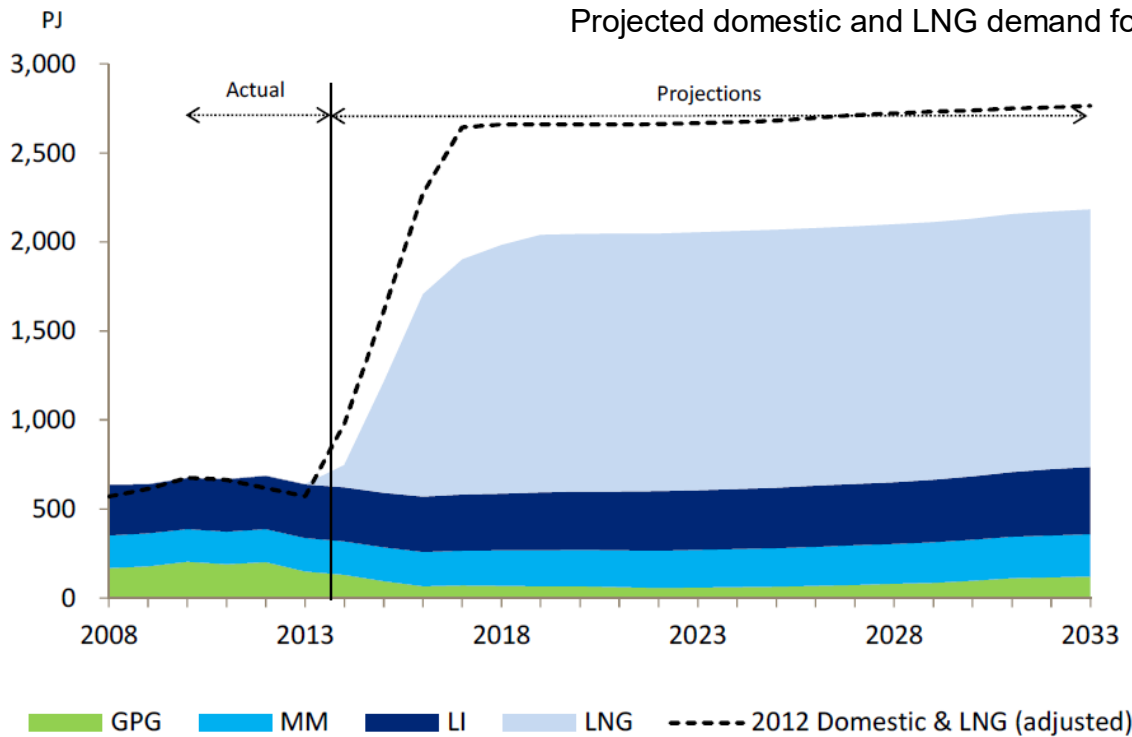
ARENA

- ★ Options for direct (partial or full) substitution of renewables for gas within the boundaries of an existing industrial operation
- ★ IT Power, with Pitt&Sherry, UTS Institute for Sustainable futures and 2B advertising and design
- ★ Outcomes
 - ★ Background technical report
 - ★ Summary report for industrial gas users and stakeholders
 - ★ Spreadsheet for screening analysis of economics
 - ★ Workshops
- ★ <http://arena.gov.au/resources/renewable-energy-options-for-australian-industrial-gas-users/>





New LNG plants will increase demand

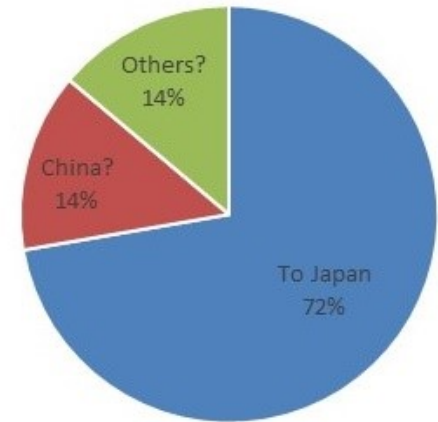


Source: AEMO 2013, Gas Statement of Opportunities

NB: AEMO's 2013 projections do include Arrow Energy

GPG refers to Gas Powered Generation, MM refers to Mass Market (residential and commercial)_LI refers to Large Industrial

Australian 2012-13 LNG exports



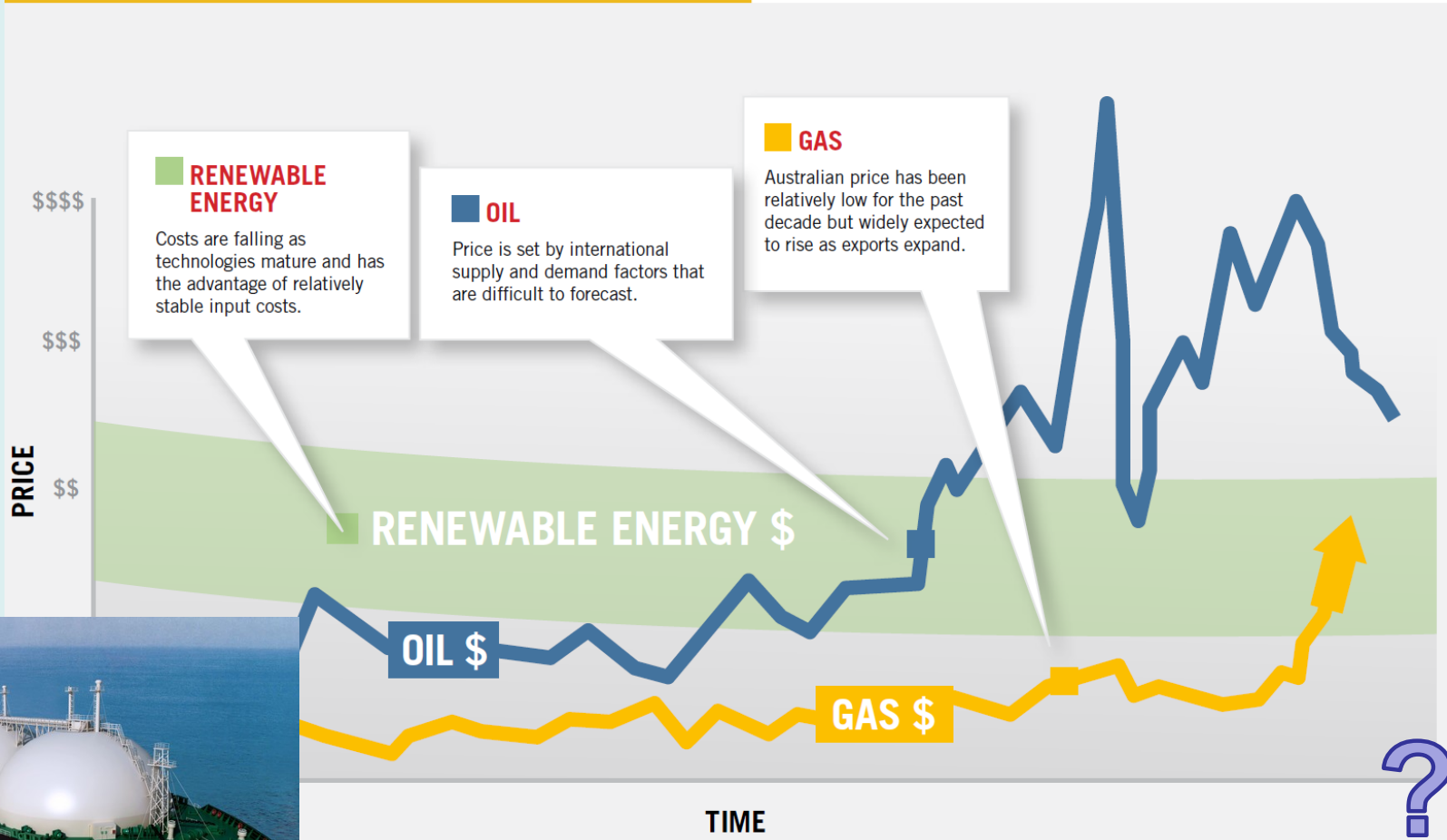
In 2012-13, gas to Japan was 15.7m t for \$10.3b

- ★ General expectation that wholesale gas prices will rise to “export netback” levels



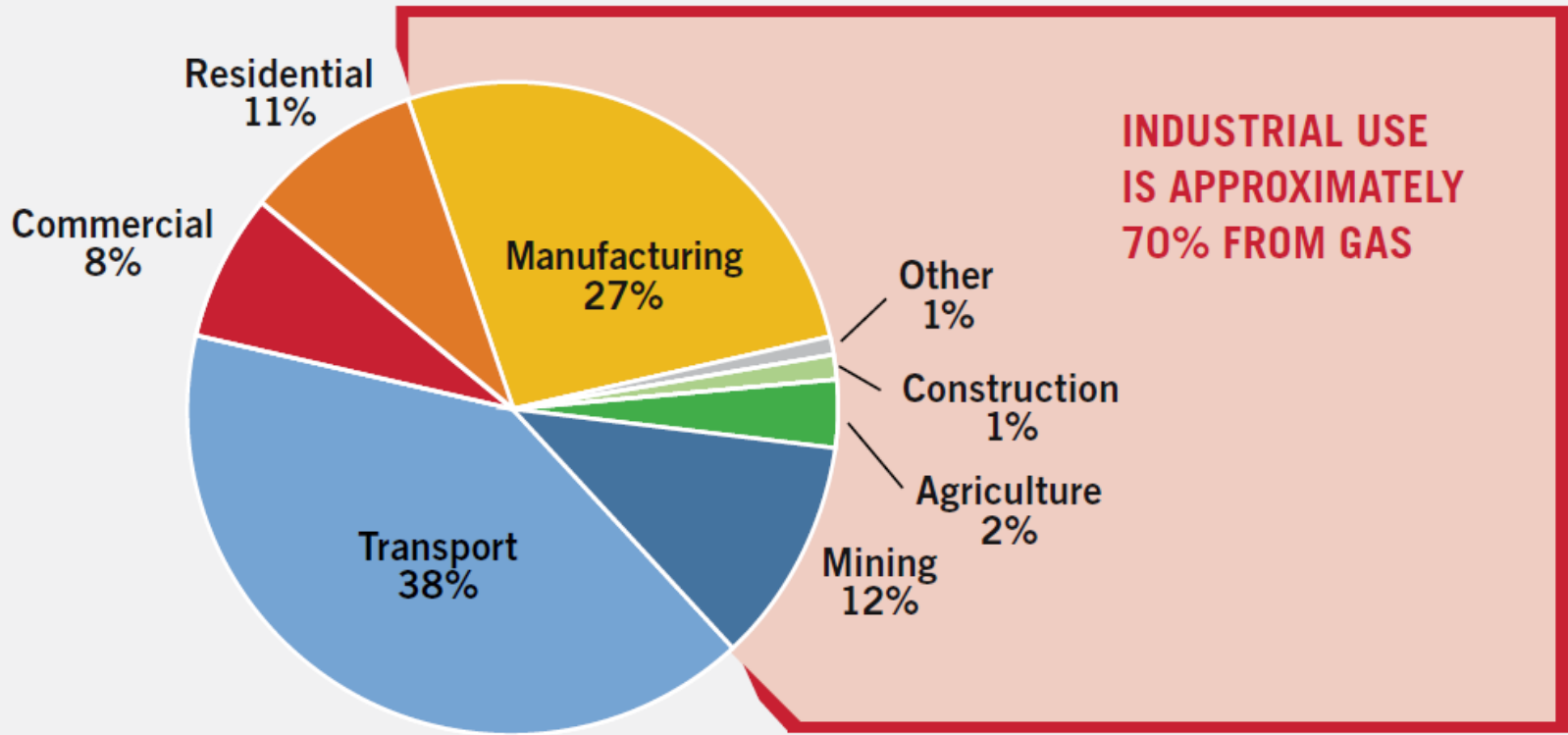
Renewables reduce exposure to fuel price uncertainty

The future is not the past for energy





Australia's end use energy

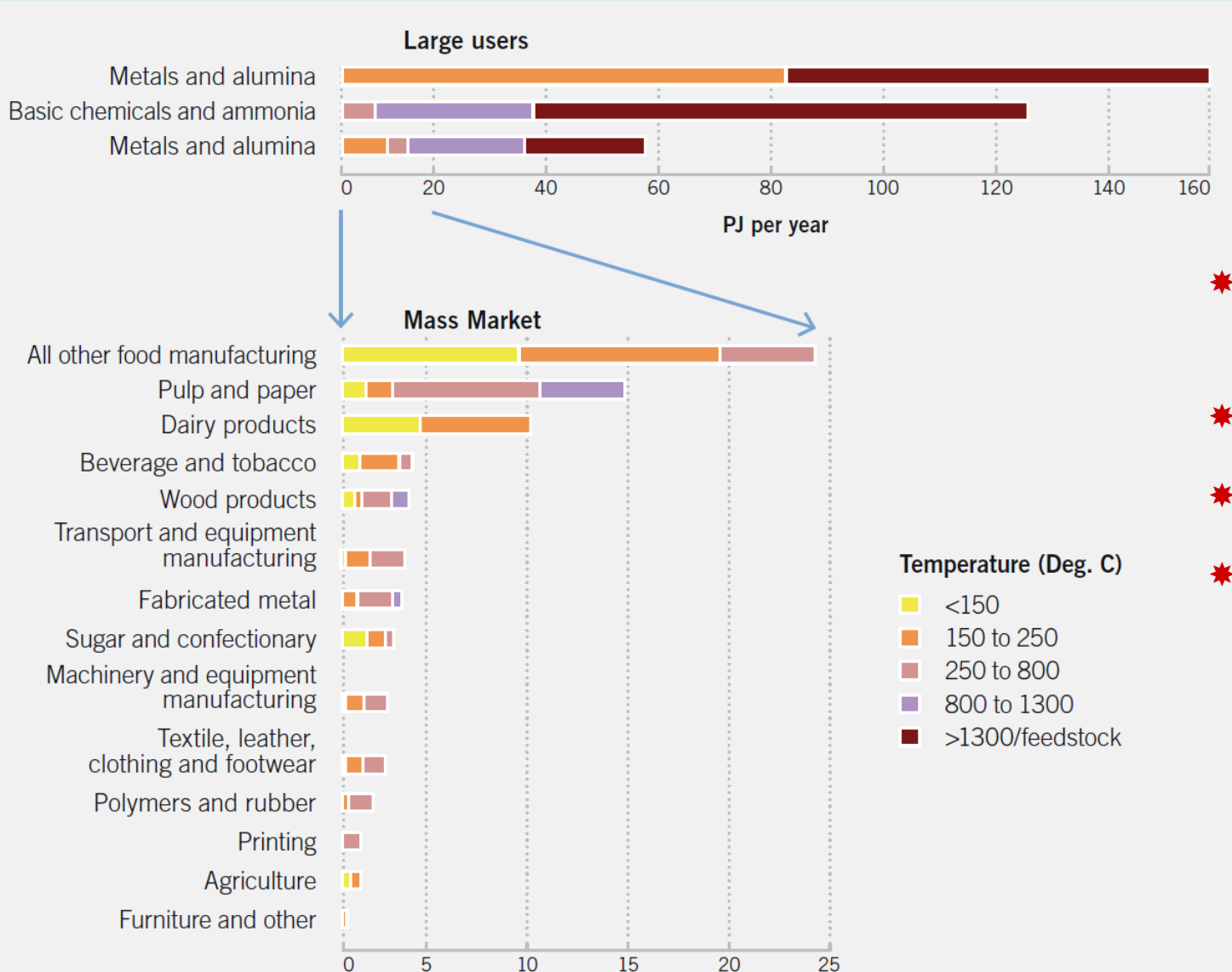


Australian 2012-13 end use energy consumption by sector

Data From Australian Energy Statistics 2014
<http://www.industry.gov.au/industry/Office-of-the-Chief-Economist/Publications/Pages/Australian-energy-statistics.aspx#>



Current industrial use



- * Heating water / steam
- * Drying
- * Ovens
- * Chemical feedstock



Close to cost effective solutions

- ★ Biomass if a low cost suitable biomass resource is available convenient to the location.
 - ★ Combustion boilers
 - ★ Digester gas where the composition of combustion products does not affect the process.
 - ★ Gasifiers where the composition of combustion products does not affect the process
- ★ Solar heating of water or steam at temperatures below approximately 250°C in areas of reasonable solar resources.
- ★ Hot sedimentary aquifers for low temperature process heat where a resource exists nearby to the point of use at modest depth
- ★ Heat pumps (and PV) if electricity costs justify
- ★ *Non renewable resources such as coal, mine waste gas, other waste etc, (each with their own issues.)*



Solar Thermal Examples

AIS aquatic centre, 1,500m² of unglazed collector



10MW_{th} solar thermal trough array for 250°C, at a copper mine in the Atacama Desert Chile.

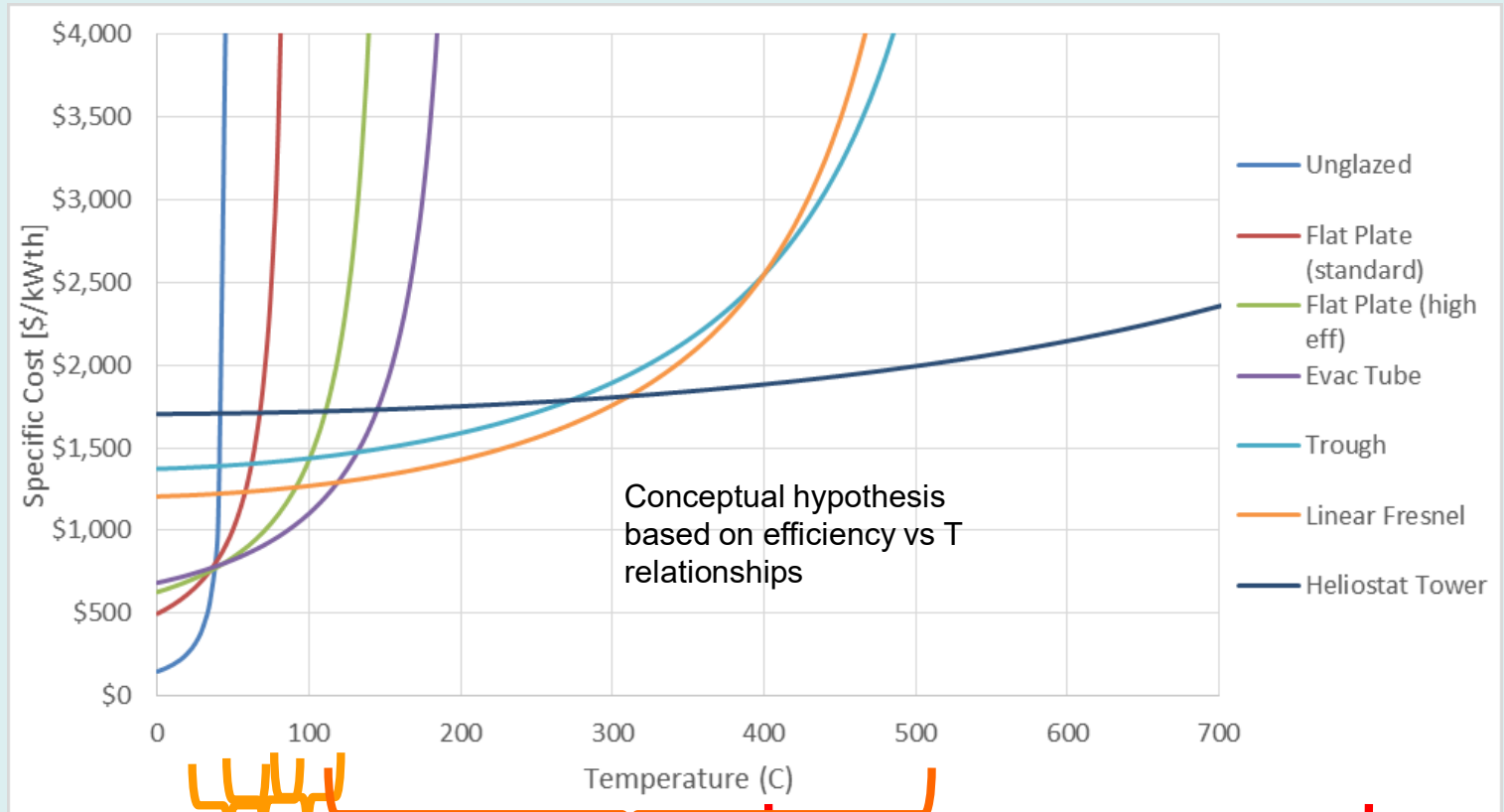


De Bortoli winery Griffith NSW, 100 x 30 tube collectors to deliver 12,000L of water per day, at 95°C

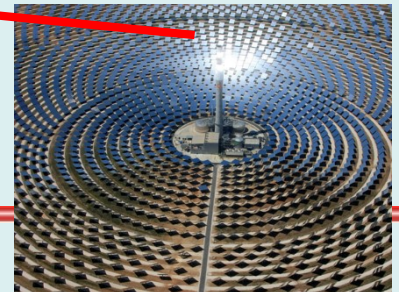




Capital costs for solar

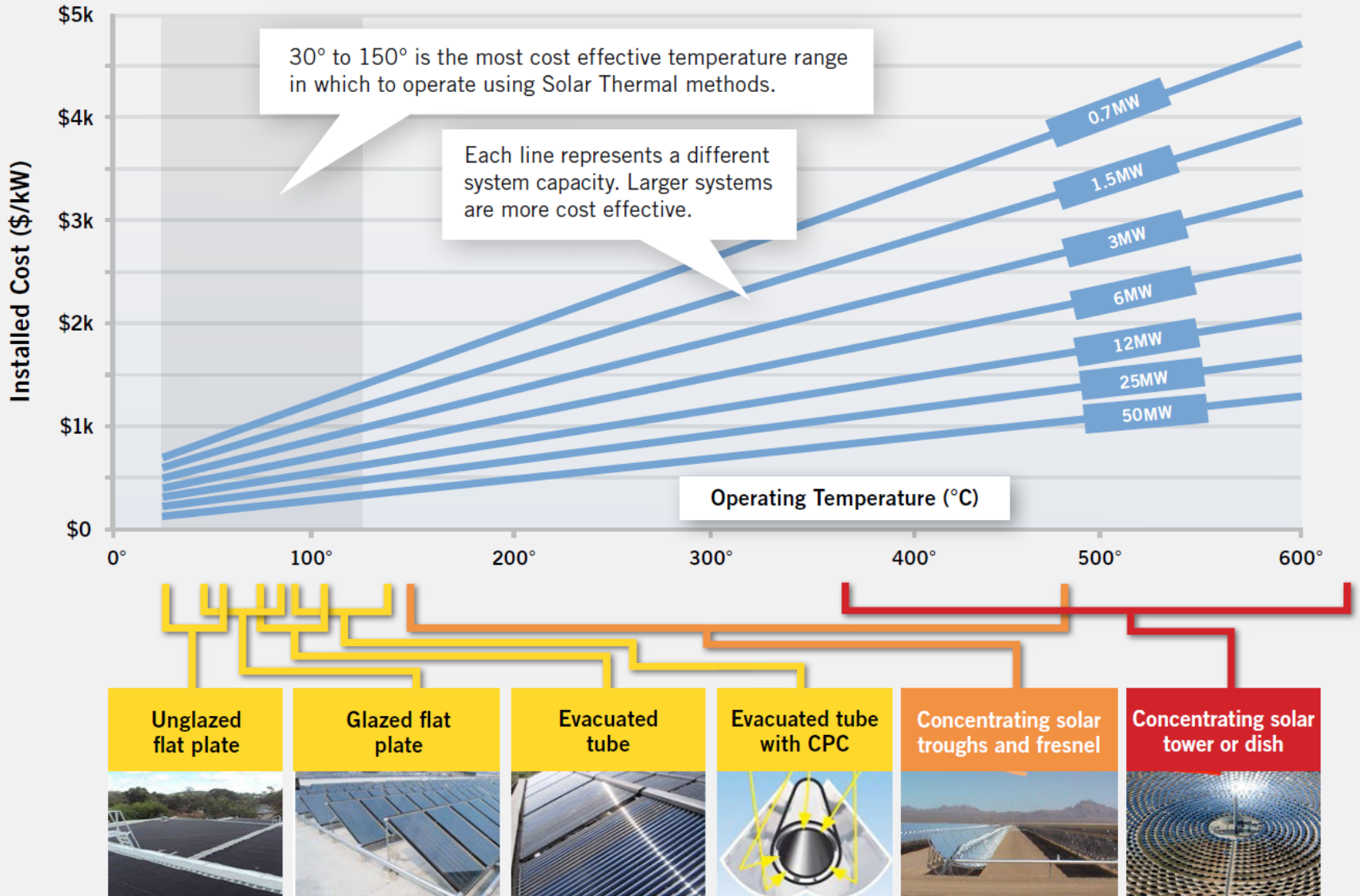


Note: High temperature systems can also be used for co-generation, providing low T heat and electricity

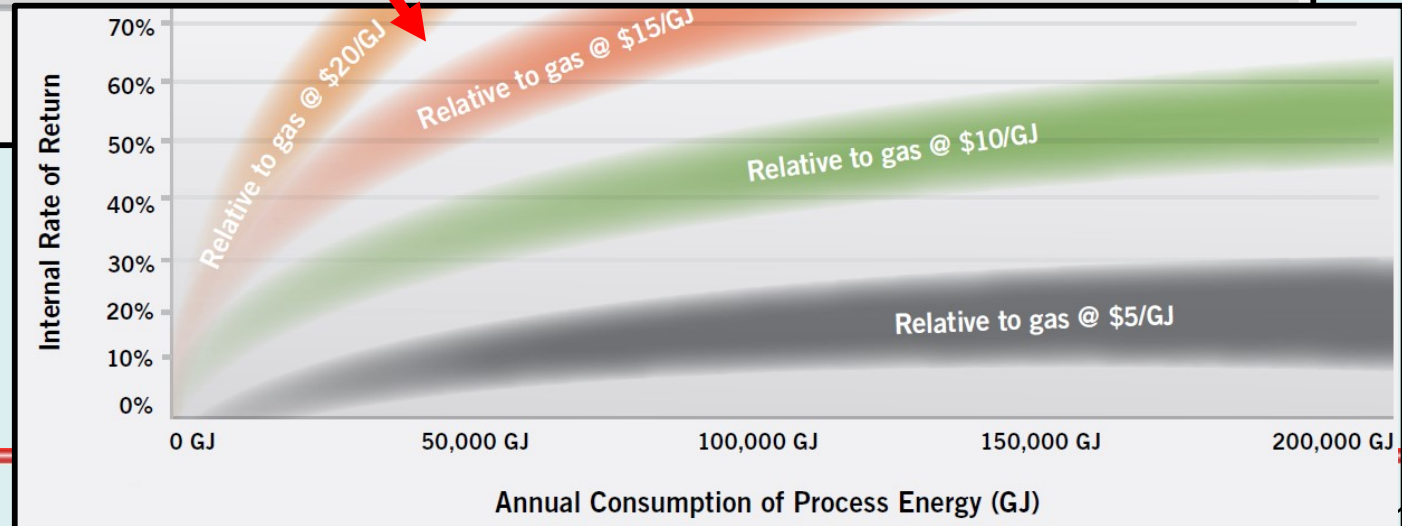
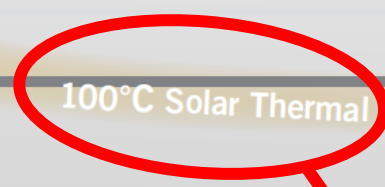
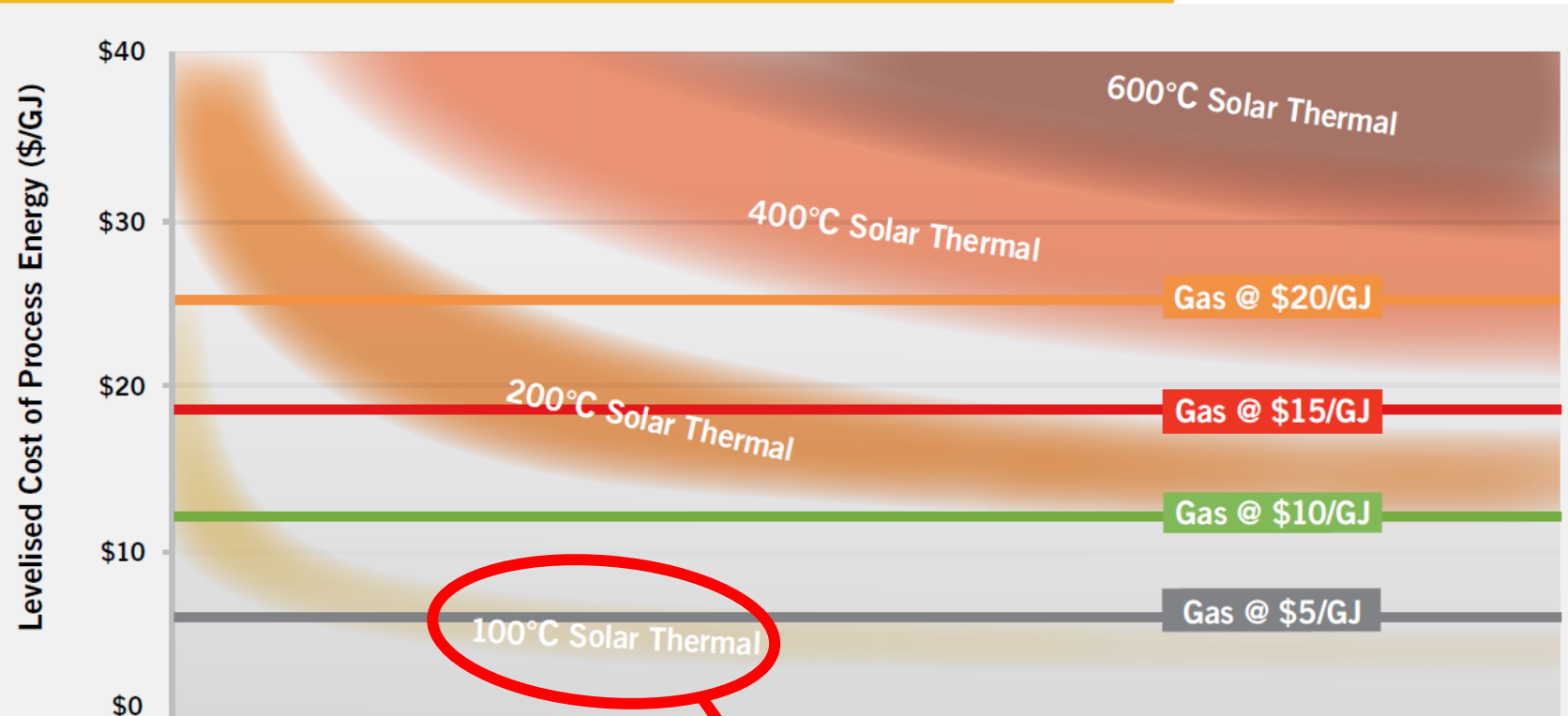




Costs for solar thermal: Capital only, depends on temperature & size



Dividing annualised cost by annual energy consumption to compare the levelised cost of process energy from new solar thermal and existing gas



Assumptions:
 7.5% on 60% debt, 10% on equity, 15 year depreciation, 20yrs life...



Considerations of gas users

- ★ Wide concern on future gas prices
- ★ A strong interest but limited knowledge on renewable alternatives
- ★ Concerns to business continuity paramount – technically risk averse
 - ★ Business continuity
 - ★ Market position
 - ★ Contractual (supply) risk
 - ★ Future fuel prices
 - ★ Technology risk
- ★ Frequently limited access to capital
- ★ Short payback time / High IRR expectations
- ★ Sliding block tariff structure / take or pay clauses
- ★ Solutions need to be “plug in” with gas systems retained



Conclusions

- ★ Gas price increases & uncertainty are creating a challenge to users
- ★ Solar thermal technology providers could target the gas replacement market
 - ★ Opportunities for 3rd party energy service supply business models
 - ★ Strong potential for expanding commercial efforts with small solar concentrators
 - ★ Greater commercial take up of low temperature solar collectors should improve supply chains and drive prices down.
 - ★ Co-generation solutions allow best use of high temperature systems
- ★ For higher temperature / feedstock applications solar thermal has a smaller “cost gap to fossil” than CSP
- ★ There is scope for policy initiatives involving grants for pilots, low interest financing for close to commercial solutions and changes to measures like the RET