KUALA LUMPUR 2012 WORLD GAS CONFERENCE

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"Gas: Sustaining Future Global Growth"

# Fuel Cell Technology in Australia – An Opportunity for Natural Gas

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# Introduction

- Question:  Is now the time for Fuel Cells?

# Outline of Presentation

- The BlueGen Fuel Cell?
- What are the opportunities for BlueGen?
- What are the challenges?
- Economics of BlueGen
- Conclusions

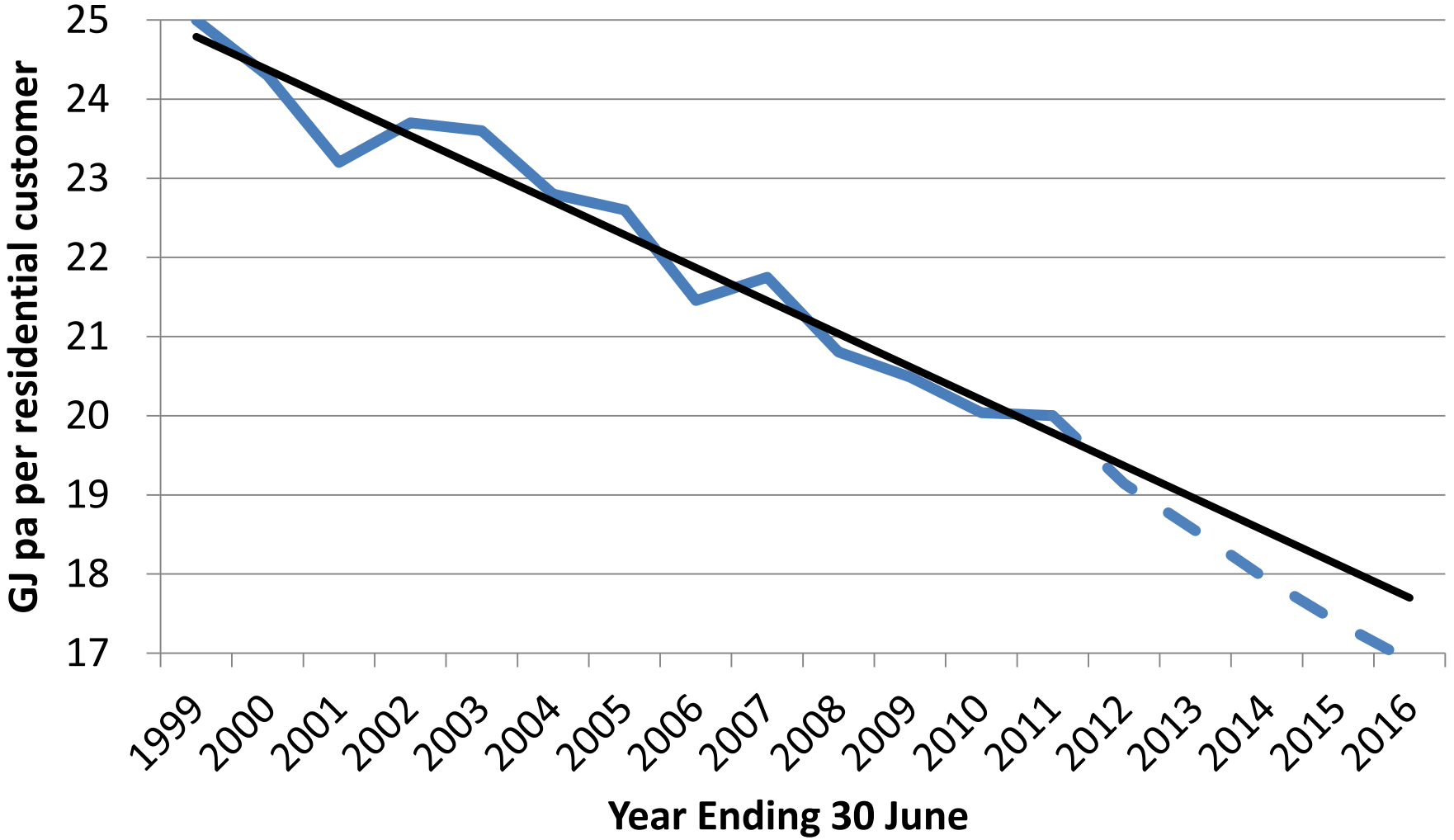
# What is BlueGen?

- Fuel Cell manufactured by Ceramic Fuel Cells
  - Solid Oxide Fuel Cell using Natural Gas as the fuel
  - About the size of a washing machine
  - Generates 0.5 to 1.5 KW of electricity (up to 13000 KwH per annum) and uses 80GJ of gas p.a.
  - Operates at high temperature with potential to heat 200 litres of hot water per day

# Opportunities for BlueGen

- Energy Efficient:
  - 60% compared to combined cycle gas turbine of 55%
  - The heat produced in a fuel cell stack can often be used rather than wasted, increasing efficiency of unit up to 85%
  - Produces electricity where it is needed avoiding line losses.
- Reduced carbon footprint compared to conventional sources.
- Deferment of upstream electricity infrastructure expenditure.
- Improves utilisation of gas networks.

# The Gas Network Problem




Decline in average consumption increases the price of gas to consumers.

# Challenges for BlueGen

- High capital cost (>2.5 times conventional generation), and shorter asset life (10 - 15 years vs >40 years CCGT).

- BlueGen is currently in the “demonstration and early commercial sales” phase.

- In Australia, Government / Regulatory policy does not provide any additional incentives for fuel cells (eg – feed in tariff, rebates, incentives etc).

- Technology best suited for constant output stationary power applications (ie - not standby applications) due to high operating temperatures.

# Economics of BlueGen

| Cost per unit (AUS$) | IRR (%) | Pay back period (years) |
|---|---|---|
| 40,000 | -2.4 | na |
| 30,000 | 0.5 | 15 |
| 20,000 | 5.0 | 11 |
| 15,000 | 9.0 | 10 |
| 12,500 | 12.0 | 9 |
| 10,000 | 15.0 | 8 |

Source: Ceramic Fuel Cells (assuming 10c/kWh feed in tariff).

# Conclusion

Is now the time for BlueGen?

- Probably not

- But in 5 years, we may see widespread adoption of BlueGen Fuel Cells
  - Could be earlier in countries that institute favourable policies that encourage Fuel Cells

- Need to continue to develop the technology now:
  - to exploit the window of opportunity that will become available in the future.

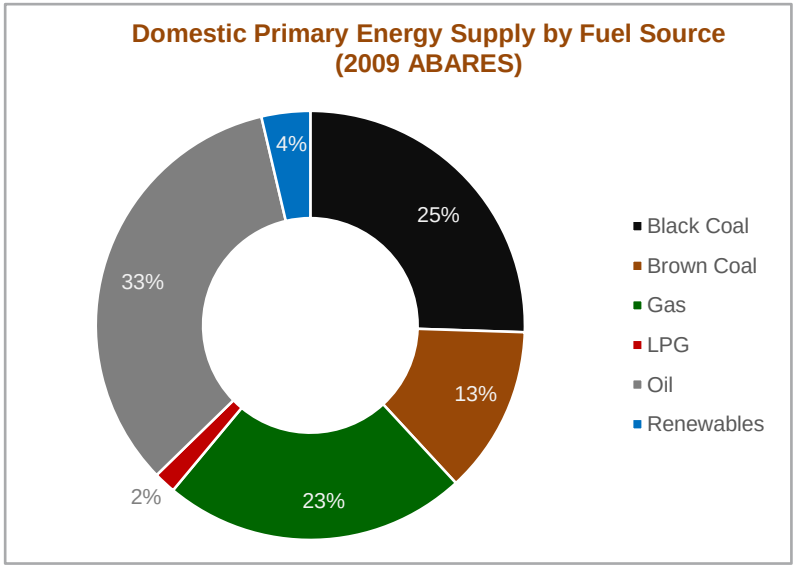
# Back Up Slides

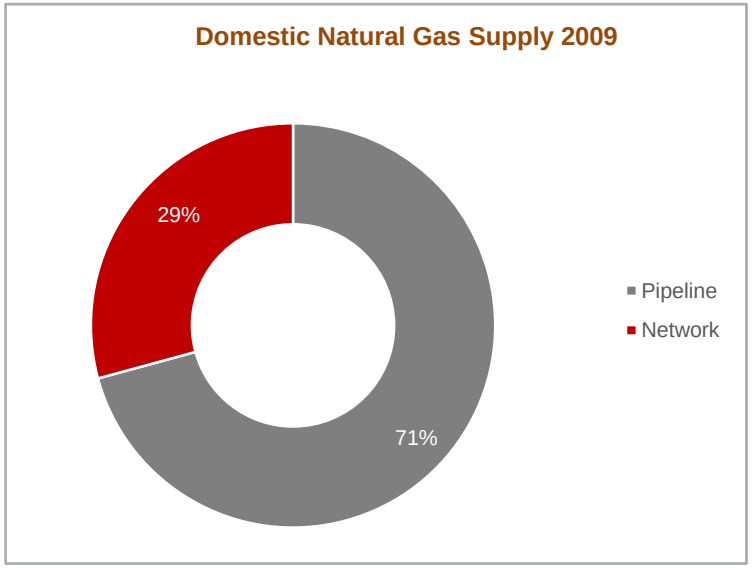
# The Role of Gas Networks

- Solid Oxide fuel cells are most likely to be supplied with natural gas through gas networks.
  - receive gas from high pressure transmission pipelines and distribute to residential, commercial and small industrial customers via a network of low pressure pipelines.
- Key Statistics of the Australian Gas Network Sector:
  - Approximately 85,000 km of gas networks
  - More than 4 million customers served
  - Delivering approximately 400 PJ of gas annually or approximately 30 per cent of total domestic gas supply.

# The Australian Natural Gas Distribution Sector

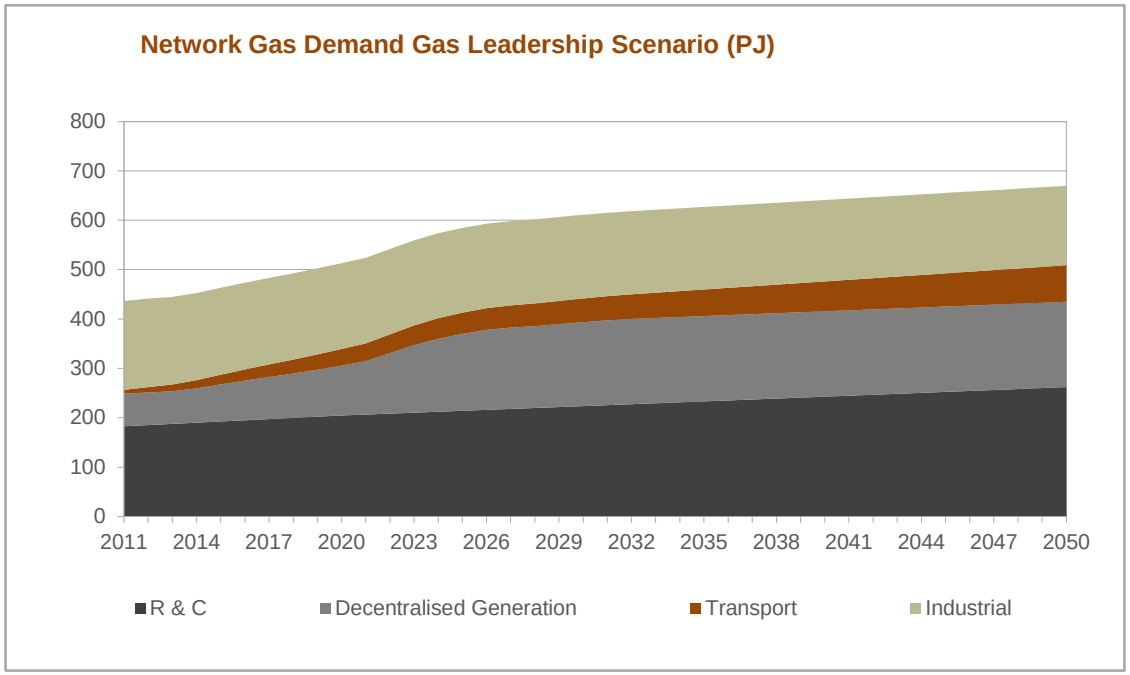
- Natural Gas play a significant role in meeting Australia's energy needs in terms of electricity generation, industrial processes, and residential and commercial appliance use.



# The Opportunity for Gas Networks

- The Australian Energy Networks Association has modeled a number of scenarios for the gas network and identified a Gas Leadership Scenario.




- Increase in Distributed Generation - an opportunity for Fuel Cells.
- Reduces cost of transporting natural gas.