



**ZEROGEN COMMERCIAL SCALE
INTEGRATED GASIFICATION COMBINED CYCLE (IGCC)
WITH CARBON CAPTURE AND STORAGE (CCS)
*PROJECT SUPPORTED BY AUSTRALIA AND JAPAN***

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1. ZeroGen Pty Ltd

- ▶ **Who is conducting the ZeroGen Project?**
 - ▶ *ZeroGen Pty Ltd*
 - ▶ *Incorporated in 2006*
- ▶ **Current Structure**
 - ▶ *Owned by the State of Queensland*
 - ▶ *Other private shareholdings being negotiated at present*
- ▶ **Personnel**
 - ▶ *Chair of Board – Dr Keith Hilless AM*
 - ▶ *Chief Executive Officer – Dr Anthony Tarr*
 - ▶ *Project Director – Dr Chris Greig*
- ▶ **Funders**
 - ▶ *Queensland Government*
 - ▶ *Australian Coal Association Low Emissions Technologies (ACALET)*
 - ▶ *Mitsubishi Corporation (MC)/ Mitsubishi Heavy Industries (MHI)*

2. What is the ZeroGen Project?

▶ The Project will:

- ▶ *Design, construct, demonstrate and operate the world's first industrial scale 530MW integrated gasification combined cycle (IGCC) with carbon capture and storage (CCS) technology*
- ▶ *Initially capture 65% of CO₂ emissions, moving towards 90% during the demonstration phase of the Project*
- ▶ *Prove the effectiveness, safety and permanence of CO₂ geosequestration*
- ▶ *Validate the engineering, economic and environmental viability of advanced, coal based, low emission technologies so that similar plants, at industrial scale will be bankable technically*
- ▶ *Standardise technologies and protocols for CO₂ measuring, monitoring and verification*

3. Objectives

- ▶ Accelerate the development and deployment of IGCC and CCS technologies in Australia and globally
- ▶ Assist in providing Australia with a low carbon future while continuing to provide dependable, competitive energy in an active carbon market
- ▶ Ensure the continued mining, export and use of Australian black coal

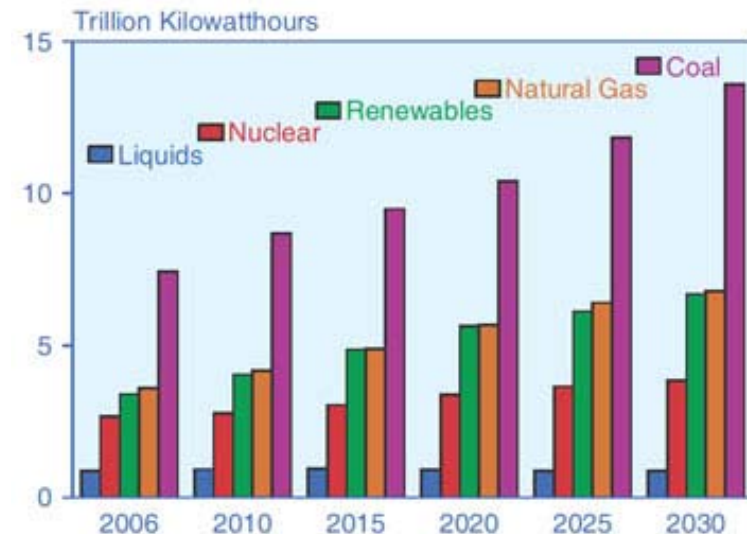


ZeroGen 11 – test injection site

4. The Need

- ▶ Fossil fuels will continue to play a major role in delivering global energy supply for decades ahead
- ▶ Energy Information Administration's 2009 International Energy Outlook predicts world electricity generation to grow by 77% between 2006 and 2030
- ▶ Confirmed coal continues to be the dominant fuel source for electricity globally

Figure 51. World Electricity Generation by Fuel, 2006-2030

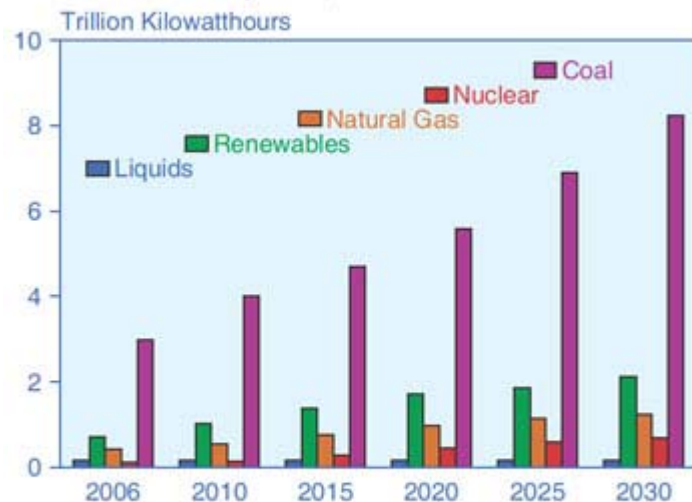


Sources: 2006: Derived from Energy Information Administration (EIA), *International Energy Annual 2006* (June-December 2008), web site www.eia.doe.gov/iea. Projections: EIA, *World Energy Projections Plus* (2009).

5. The Need

- ▶ Non-OECD or developing economies, China and India included, to account for 58% of world power use by 2030
- ▶ China has already overtaken USA as largest emitter of CO₂
- ▶ International Panel on Climate Change, world leaders meeting at G8, International Energy Agency, all confirm CCS as a critical technology to help stabilise and then reduce atmospheric greenhouse gases

Figure 58. Net Electricity Generation in Non-OECD Asia by Fuel, 2006-2030



Sources: 2006: Derived from Energy Information Administration (EIA), *International Energy Annual 2006* (June-December 2008), web site www.eia.doe.gov/iea. Projections: EIA, *World Energy Projections Plus* (2009).

“Now is the time for CCS. If we do not develop several large scale integrated CCS demonstration projects within the next decade, we won’t be able to deploy the technology in time to prevent CO₂ levels from exceeding allowable limits.”

- *Executive Director of the IEA, Nobuo Tanaka*



6. IGCC Plant

ZeroGen is on track to be first of those projects, ensuring early the deployment of this crucial technology

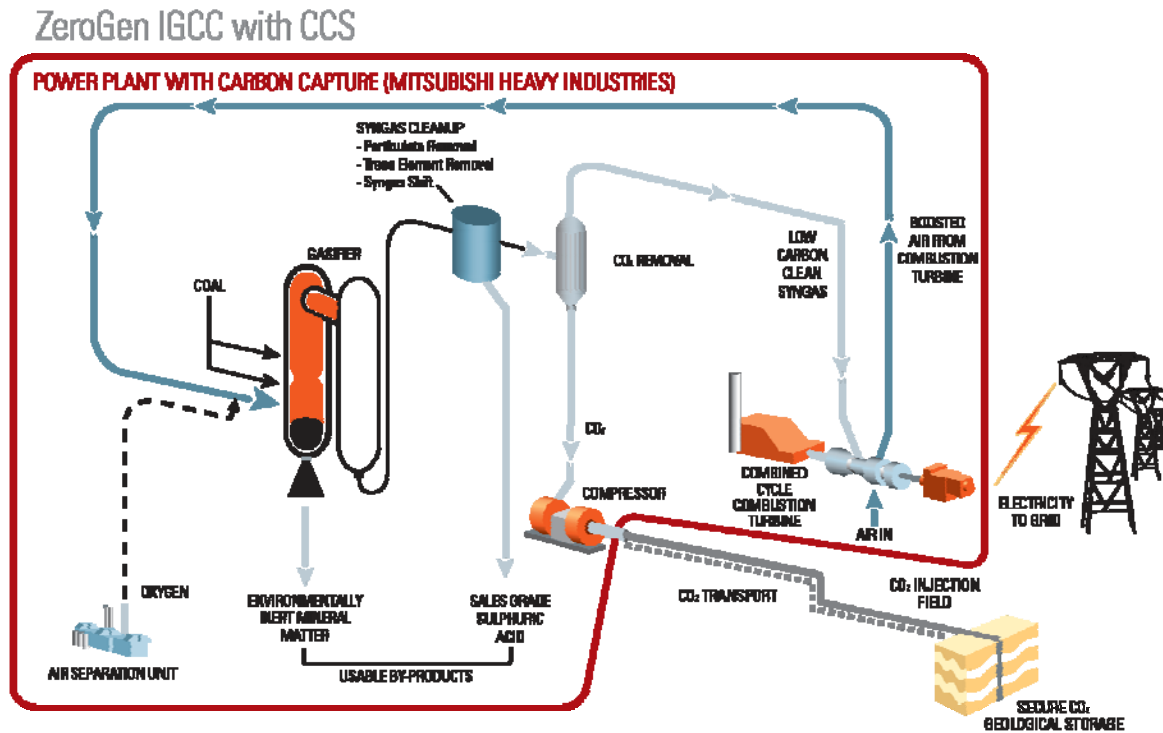
- ▶ 530MW (gross) IGCC plant
- ▶ CO₂ capture 65% initially, 90% later
- ▶ CO₂ captured
 - ▶ *2,000,000 tonnes per year (at 65%)*
 - ▶ *3,000,000 tonnes per year (at 90%)*
- ▶ Cost - \$3.2 billion



250MW plant at Nakoso constructed by MHI



7. IGCC with Capture Partner



► Desired delivery model

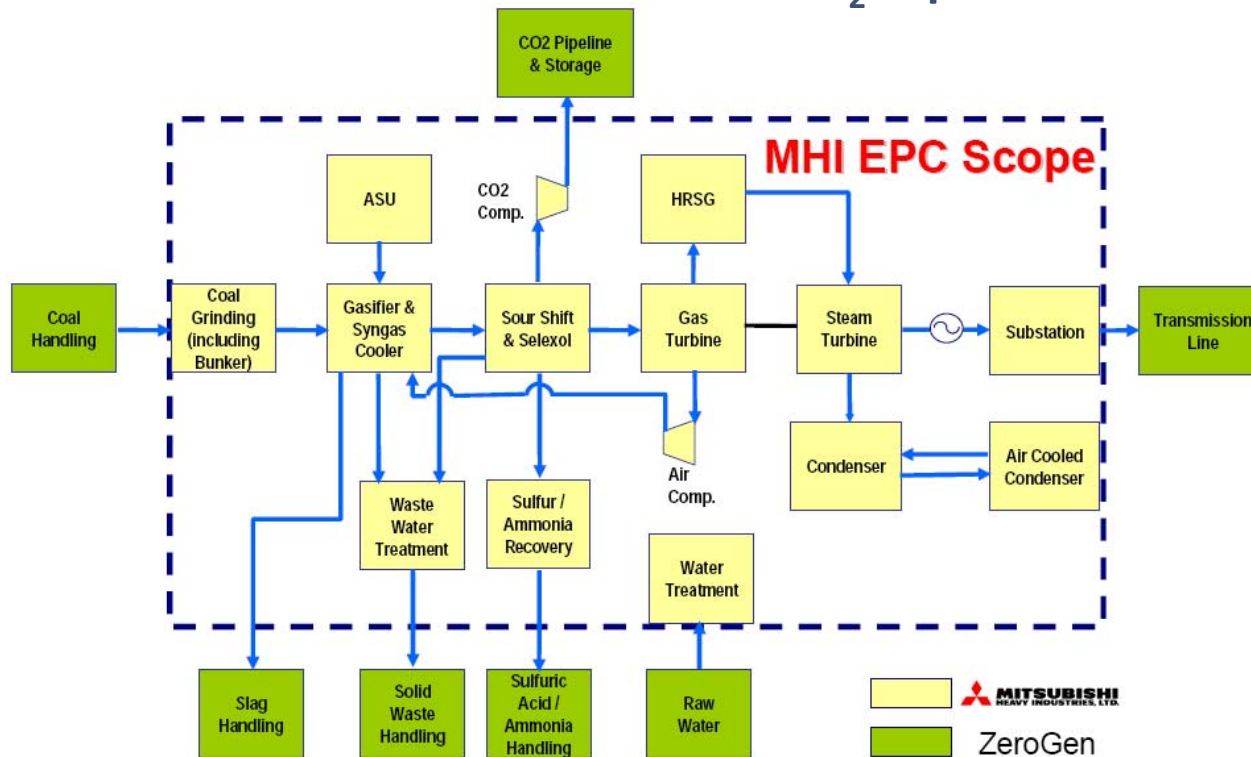
- *single point responsibility*
- *assumption of integration risk*
- *make good obligations*
- *significant elements committed to lump sum pricing*

8. The Mitsubishi “Engineer Procure Construct (EPC) Wrap”

- ▶ Mitsubishi Heavy Industries agreed to provide an “EPC Wrap” with Make-Good obligations in respect of the key IGCC+C plant performance specifications

Covers 3rd party technologies such as CO Shift & Acid Gas Removal

Such provisions are very unusual in first-of-kind projects and unique in the world of coal fired IGCC with CO₂ capture

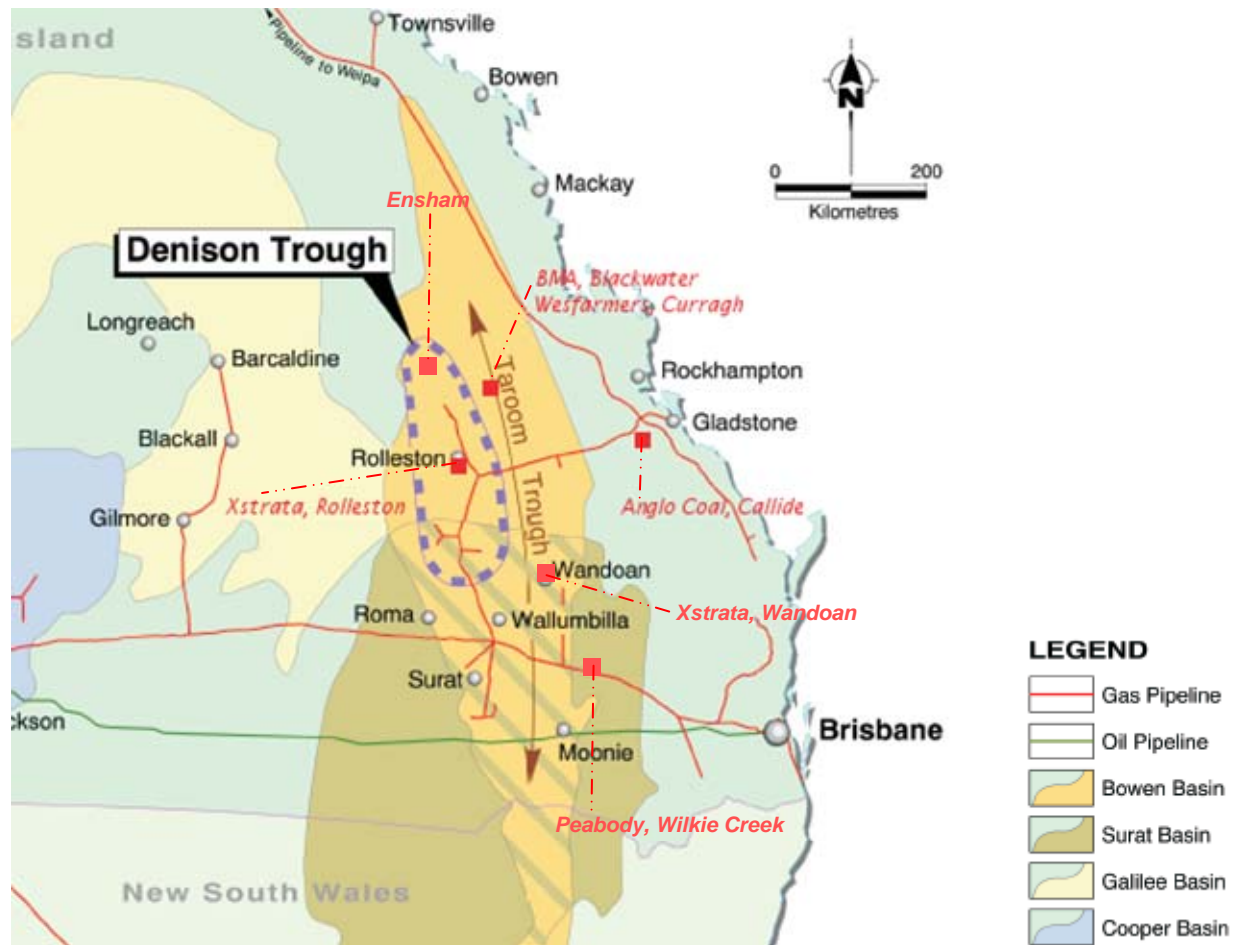


9. Plant Location

- ▶ Plant location will be chosen to optimise factors such as coal supply, transmission, CO₂ transport and storage
- ▶ Currently shortlisted to 3 mine-mouth options plus 1 independent site
- ▶ Selection to be finalised in Q1 2010, with single preferred case to carry forward to Feasibility Study



10. Queensland Central / Southern Potential Plant Sites & Storage Areas for CO₂

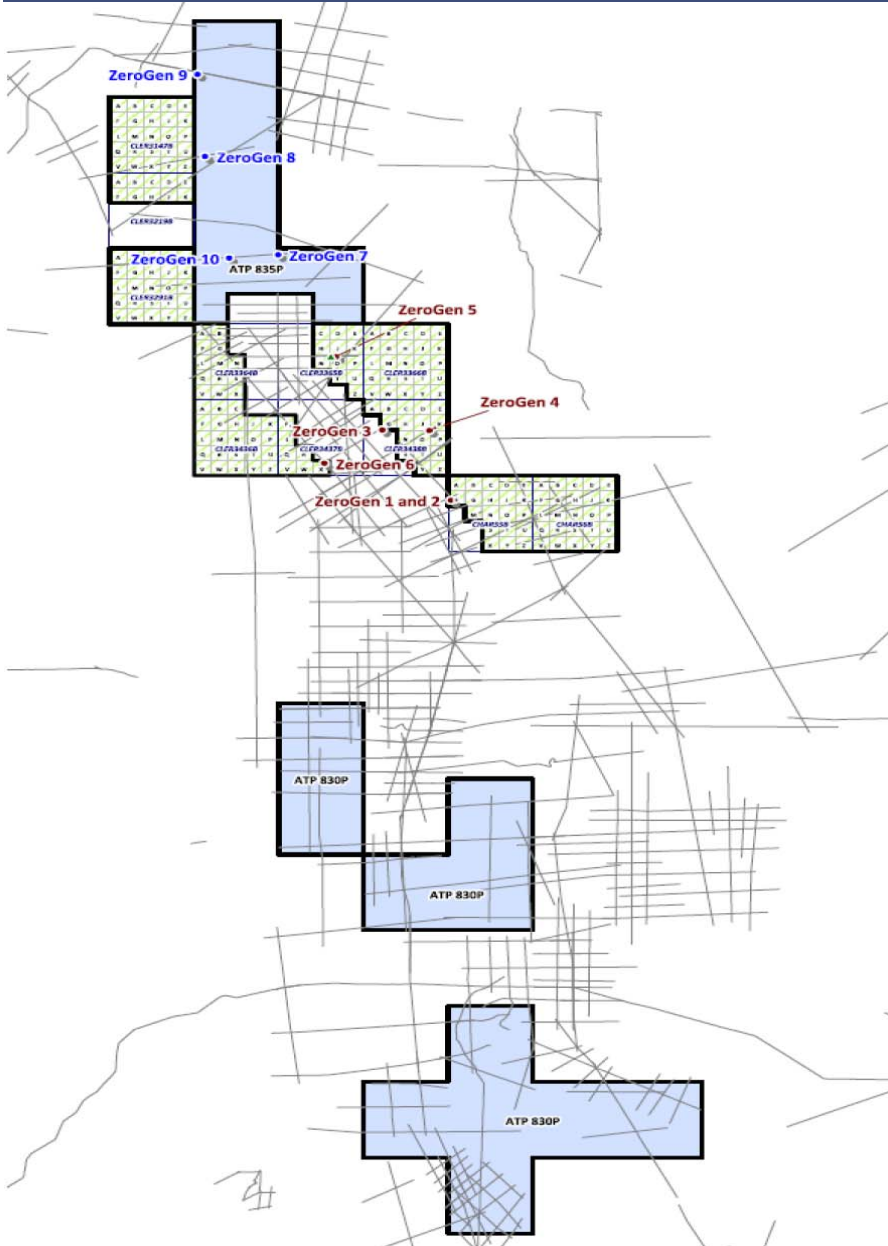


11. CO₂ Storage

- ▶ Cost of CO₂ transport and storage part of Project - \$800 million
- ▶ Critical risk issue is to identify, prove and develop CO₂ storage capacity for 30 years at a total cost (capital and operating) for less than \$50 per tonne
- ▶ Focus at present on Denison Trough with a storage potential for at least 100 million tonnes
- ▶ Concurrently ZeroGen will collaborate with Commonwealth and State authorities (such as the Carbon Geostorage Initiative Qld) to investigate alternative storage sites
- ▶ Queensland *Greenhouse Gas Storage Act 2009* in force, ZeroGen received tenements under transition provisions



12. GHG Exploration Tenements



- ▶ Tenements are essential to progress any exploration program
- ▶ Under the new *Greenhouse Gas Storage Act*, ZeroGen acquired Greenhouse Gas Exploration Permits
- ▶ ZeroGen is the only organisation at present to hold these permits under Queensland legislation
- ▶ Total area of tenements
 - ▶ **1,225.5km²**

13. Drilling Program

- ▶ Twelve wells drilled in Northern Denison Trough by end 2009
- ▶ Confirmed potential to safely store injected CO₂ long term
- ▶ 6,000m of core extracted and analysed
- ▶ Considerable know-how and expertise in:
 - ▶ *Managing CO₂ exploration program*
 - ▶ *Optimising well field design*
 - ▶ *Developing tests and methodology to achieve storage confidence*
 - ▶ *Optimising the costs of CO₂ exploration*
 - ▶ *Applying the theory of sub-surface storage to different geologies*



14. ZG11 Injection Well and CO₂ Injection Facilities

ZeroGen will commence the first Supercritical CO₂ injection test in Australia as part of exploration activities in October this year



15. Timetable

- ▶ **Prefeasibility Study Completion**
 - ▶ *June 2010*
- ▶ **Feasibility Study Completion**
 - ▶ *September 2011*
- ▶ **Plant Operational**
 - ▶ *October 2015*



16. Conclusion

- ▶ **Mature project – expert staff, significant preparatory engineering conducted, extensive drilling and exploration, very experienced power plant technology provider**
- ▶ **Strong partnership with Mitsubishi Corporation and Mitsubishi Heavy Industries, Ltd**
- ▶ **Project management, project engineering and geosequestration knowledge sound basis for commercial-scale project**
- ▶ **Strong local, state, national and international support including government and ACA**
- ▶ **Diverse support – World Coal Institute, CFMEU, WWF**





Thank You

