



From Rhetoric to Reality: Commercialising Clean Coal

Presentation to the

COMMITTEE FOR ECONOMIC DEVELOPMENT OF AUSTRALIA

Lunchtime Forum on “Commercialising Sustainability”

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From Rhetoric to Reality: Commercialising Clean Coal



Presentation Overview

- Overview of the ZeroGen Clean Coal Power Project
- Into a carbon-constrained future: the need to commercialise clean coal
- Commercialising clean coal: opportunities and challenges



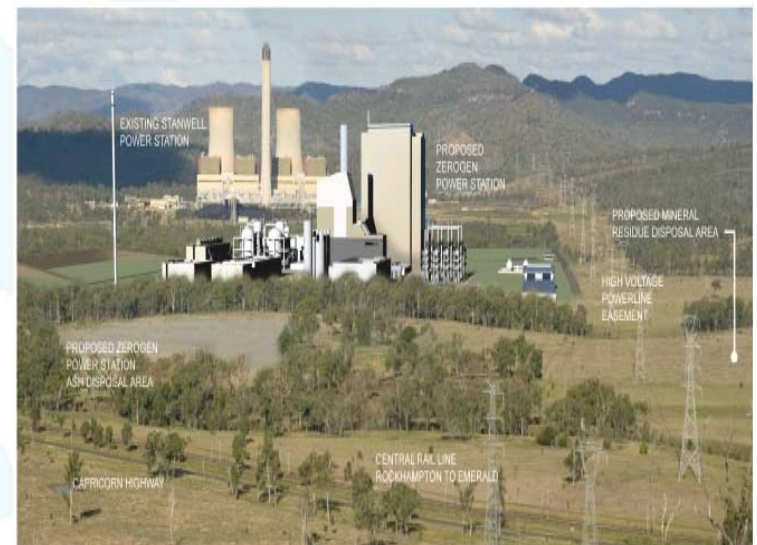
Overview of the ZeroGen Clean Coal Power Project



Project Overview



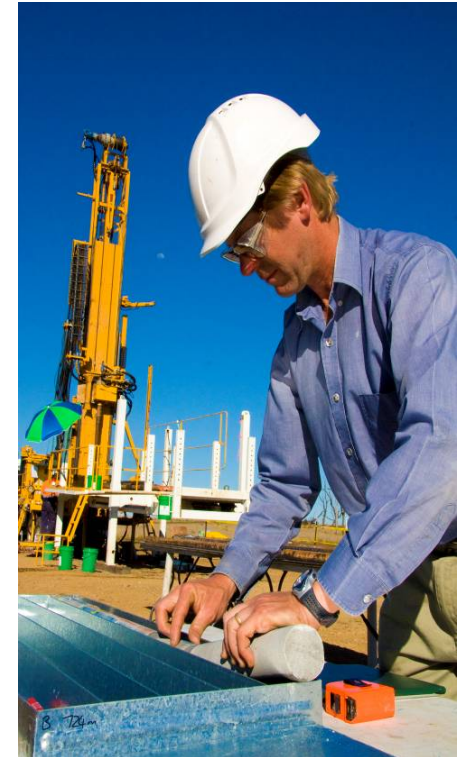
- Investigating the integration of coal-based gasification (IGCC) with carbon capture and storage (CCS) to produce low emission baseload power
 - Identified by coal industry as priority technologies for development
 - ZeroGen leading IGCC with CCS project worldwide
- Proposed IGCC plant to be located adjacent to Stanwell Power Station near Rockhampton
- Demonstrate technologies with potential to capture up to 75% of CO₂ emissions from demonstration plant; up to 90% from large-scale plants



Artist's impression of proposed ZeroGen plant

Project Overview *cont*

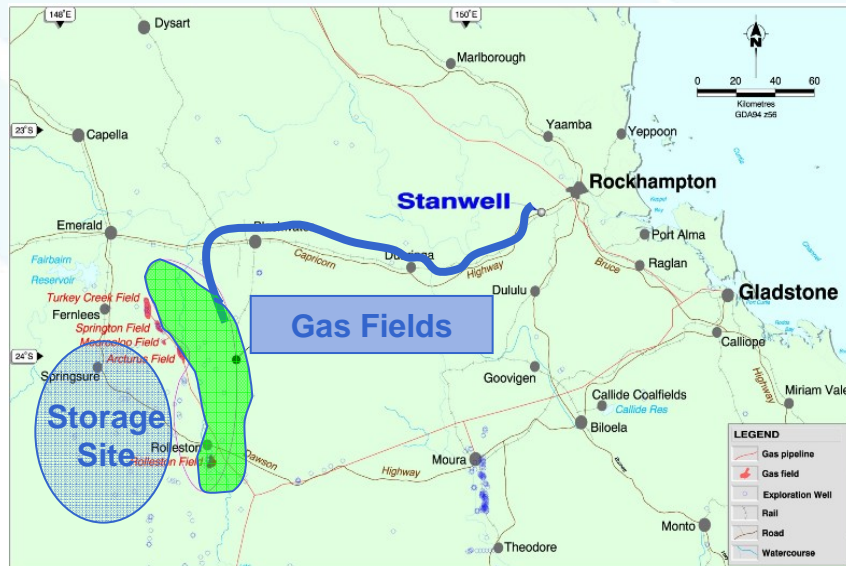
- Accelerating the deployment of clean coal technologies (CCTs) through minimising risks and maximising learnings to facilitate rapid uptake of technology
- Creating specialist knowledge and skills in CCTs
- Project structure:
 - Currently owned by Queensland Government
 - Shell, global leader in geosequestration, providing technical support and finalising 10% equity investment in project
- Building momentum through strategic partnerships and alliances on international, national and local levels
 - Working closely with Australian coal industry; reviewing how project can best meet needs of coal and electricity generation industries



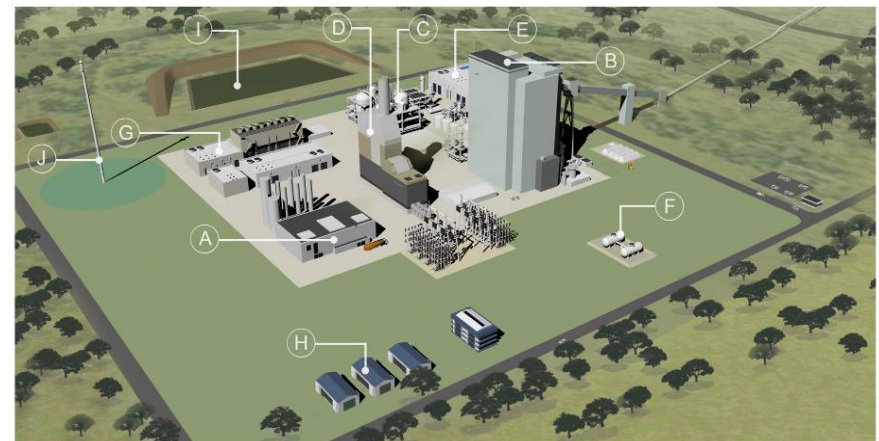
Well-site geologist on-site in second stage of drilling program

Progress

- ✓ FEASIBILITY STUDY UNDERWAY
- ✓ CO₂ SITE IDENTIFIED FOR INVESTIGATION
- ✓ EIS COMMENCED
- ✓ CO₂ TRANSPORT STUDY
- ✓ DRILLING PROGRAM – PHASE 2
- ✓ EXTENSIVE COMMUNITY CONSULTATION
- ✓ FRONT-END ENGINEERING
- ✓ INVESTMENT MEMORANDUM



Northern Denison Trough - Proposed Storage Site



ZEROGEN - ARTIST'S IMPRESSION - PROPOSED ZEROGEN POWER STATION SITE - (LOOKING EAST)

LEGEND					
A	AIR SEPARATION UNIT	D	GAS TURBINE POWER BLOCK	G	WATER TREATMENT AND COOLING TOWERS
B	GASIFICATION BLOCK	E	CARBON DIOXIDE COMPRESSION	H	OFFICES AND WORKSHOPS
C	SYNGAS CLEANUP UNITS	F	DIESEL TANKS (GASIFIER STARTUP FUEL)	I	RAINWATER RUNOFF COLLECTION
				J	FLARE

Into a carbon-constrained future: the need to commercialise clean coal



Commercialising Sustainability



- The need to address climate change whilst facilitating continued economic growth is one of the key challenges facing world today

World Business Council for Sustainable Development¹

 - Climate change industry is in order of \$US300 billion worldwide²
 - Clean energy is one of the largest industry segments – growing globally at 20 - 30% per annum
- Energy is critical to continued economic growth; population growth and increasing industrialisation will drive energy demand upwards in Australia by more than 50% by 2020
 - Fossil fuels, including coal, will be a major contributor in meeting these future energy demands
 - This will lead to substantial increase in greenhouse gas (GHG) emissions unless more sustainable technologies, such as CCTs, can be implemented at commercial scale

¹ World Business Council for Sustainable Development, Investing in a Low-Carbon Energy Future in the Developing World, 2007

² Climate Change Business Journal, Jan/Feb 2008

Commercial Significance of Clean Coal



- Coal industry has substantial direct and indirect economic benefits for the Australian economy:
 - \$AU24.5 billion (2005-06)
 - 32,000 jobs
 - Supports energy-intensive industries
- Coal-fired power generation is increasingly being targeted due to GHG emissions
- Assuming GHG restrictions are in place by 2030 (and IGCC with CCS is not commercialised) ACIL Tasman calculates:
 - Reduction in GDP of \$AU3.65 billion per annum
 - Reduction in coal exports of 1.8% by 2030, valued at almost \$AU2 billion
- CCTs will underpin future value of coal-fired power generation into a carbon-constrained future

Commercialising clean coal: opportunities and challenges



Business Strategies for Commercialising Clean Coal



Hunt Energy Drill Rig

1. Do nothing: BAU scenario
2. Wait, watch and follow (so called “fast follower” approach).... but whom do we follow?
3. Support early movers: innovative companies that are committed to developing new products or services to assist in mitigating or adapting to climate change



Commercialising Clean Coal: Opportunities



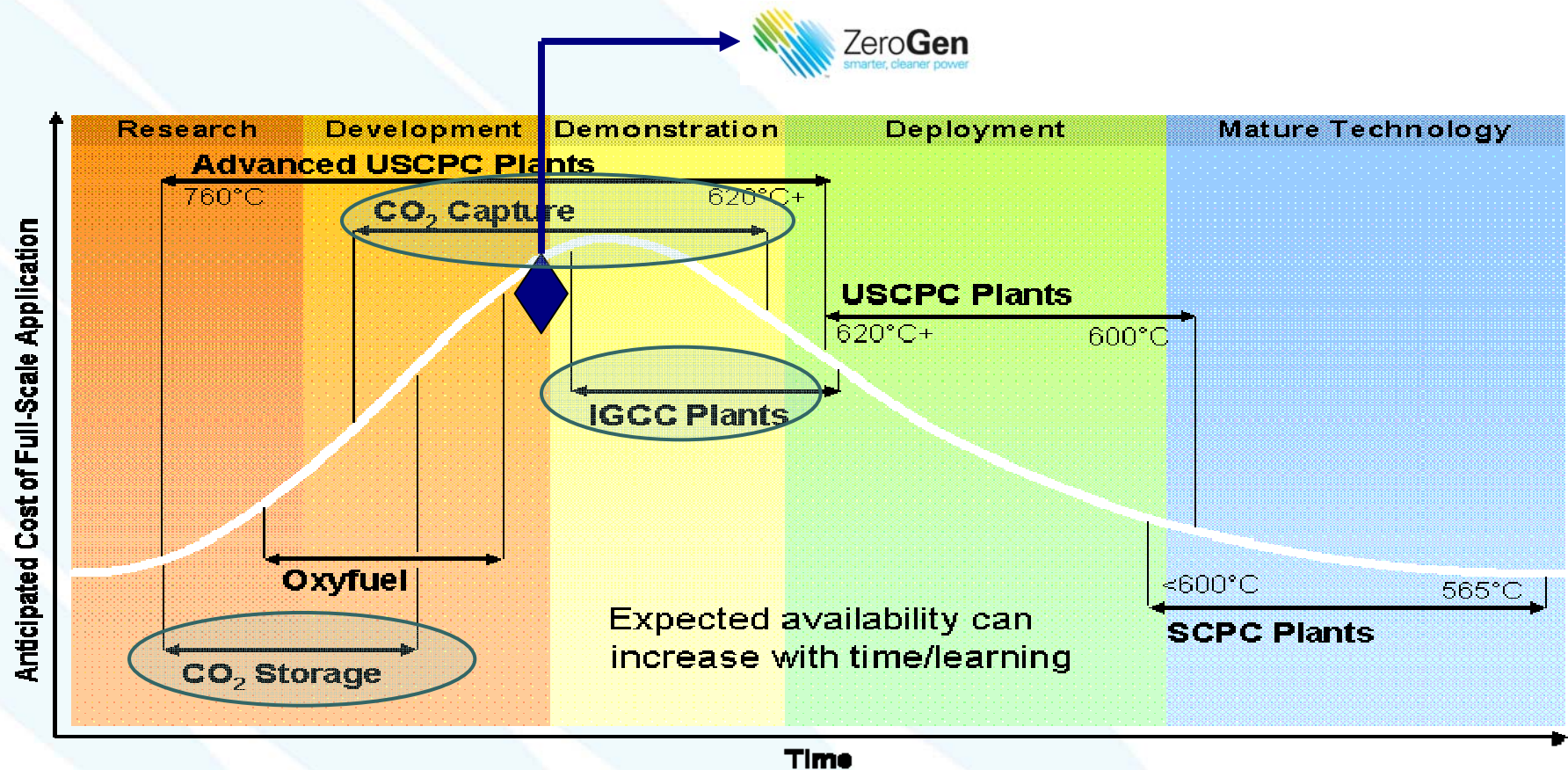
- Baseload electricity demand increase by 50% by 2020 in Australia
 - Significant market opportunity for baseload electricity produced by clean coal
 - In terms of new markets this is just the tip of the iceberg...
- Establish Queensland as global centre of excellence for CCTs eg., “clean coal cluster”
- Link arguably the world’s best coal producing companies with higher value-added service industries - legal, commercial, engineering, marketing etc - in clean coal

Commercialising Clean Coal: Challenges

- No clean coal technology is commercial without a price for CO₂
 - Power stations have long economic lives - need long-term CO₂ price signal
- Global knowledge and skills shortage in CCTs
- Regulations for CO₂ storage not yet in place
- Stakeholder acceptance: public must be confident technology is safe

Given these challenges, bottom line is:
Early movers will need support

New Technology Deployment Curve: IGCC with CCS



Not All Technologies at the Same Level of Maturity.

Note USC = Ultrasupercritical PC= pulverised fuel (pulverized coal)

Source: EPRI

Conclusion



- ZeroGen is a clean coal power project developing the integration of IGCC with CCS to produce low emission baseload power
- Clean coal must be commercialised to sustain the value of the coal industry into a carbon-constrained future
- Presents significant business opportunities as this technology is deployed worldwide
- ZeroGen project is addressing commercialisation challenges – with our partners in government and industry

“There are risks and costs to a program of action, but they are far less than the long-range risks and costs of comfortable inaction”

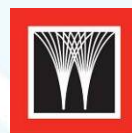
President John F. Kennedy



Thank you



Project Participants



WorleyParsons
resources & energy

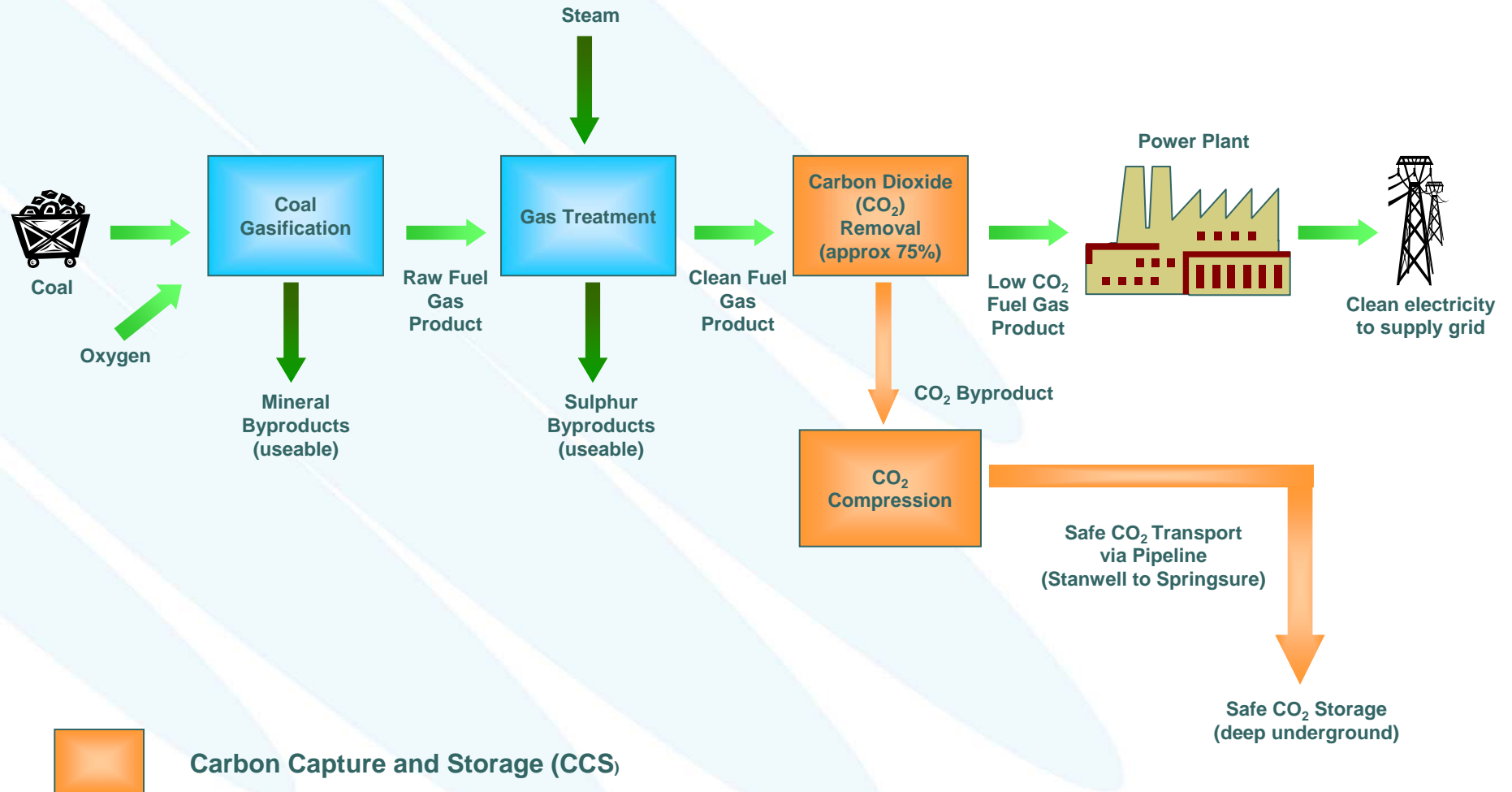


COOPERATIVE RESEARCH CENTRE FOR GREENHOUSE GAS TECHNOLOGIES

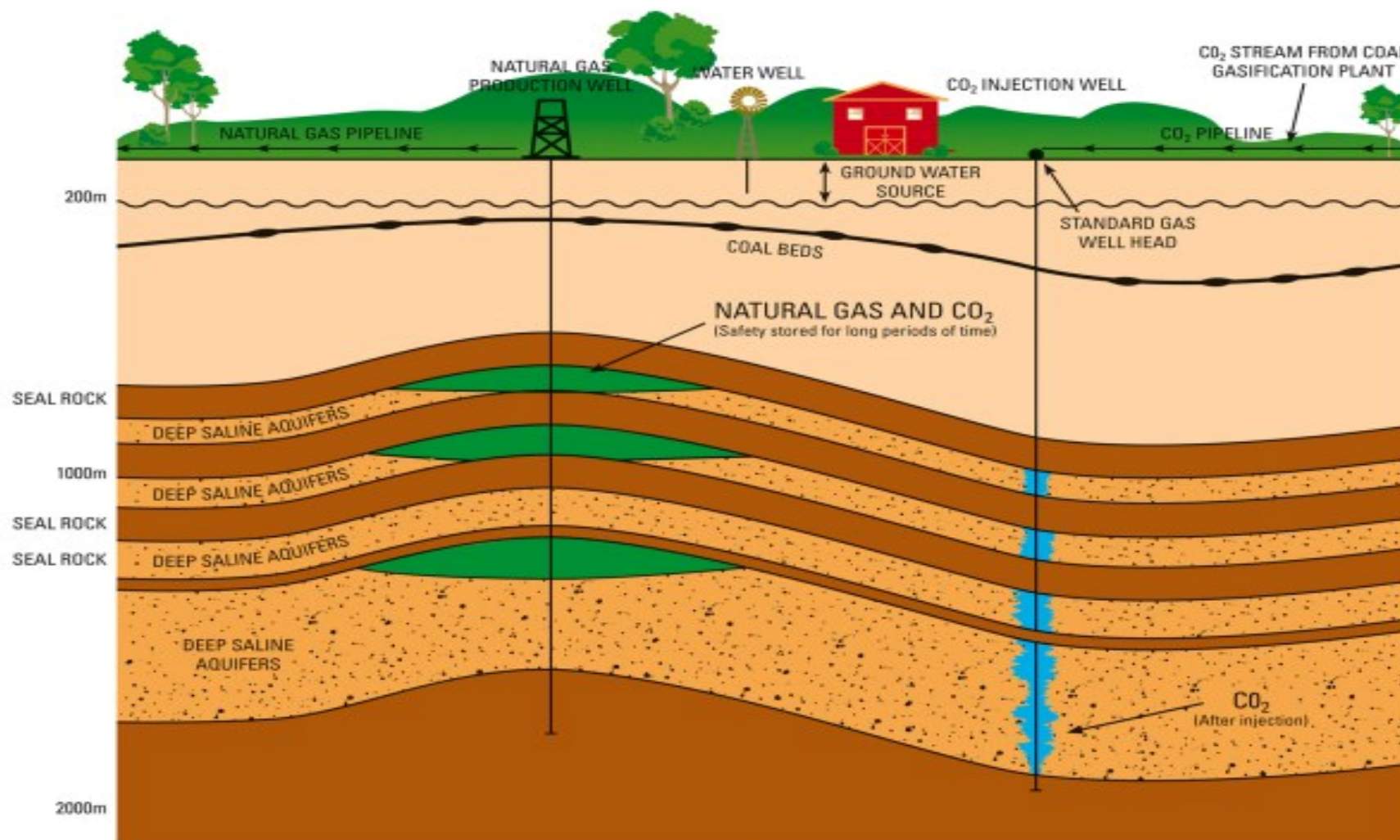
Additional Supporting Slides



ZeroGen Clean Coal Power Project



CO₂ STORAGE IN THE NORTHERN DENISON TROUGH



Low-emission coal test success

Sean Parnell

AUSTRALIA will have a blueprint for a near-zero-emission coal-fired power plant by the end of next year after drill tests proved the central Queensland coal and gas fields could safely store greenhouse gas underground.

Amid a highly charged political debate over the most appropriate policy response to global warming, the ZeroGen team has shrugged off the controversy of being Labor's favoured clean coal project to reveal a series of successful drill tests in the Northern Denison Trough near Rockhampton.

The drill tests were undertaken at depths of between 1000m and 2000m, with water injected into underground caverns to replicate carbon dioxide released from the

production of electricity by burning coal.

An international peer review of the results has now confirmed the tests were successful in determining that the local geology could support the clean coal technology. The ZeroGen team has now mapped out the area for a second round of tests to locate the best saline aquifer for storing large quantities of CO₂ — a process called geosequestration.

The ZeroGen team will also complete a thorough cost and risk analysis and consult with key stakeholders to have a feasibility study completed by the end of next year.

If ZeroGen gets the green light — and does not sell its technology and expertise to other players — the \$1.3 billion project will become a world leader. It plans a

100 megawatt coal-fired demonstration power plant fitted with "carbon capture and storage" technology allowing up to 400,000 tonnes of CO₂ each year to be piped about 200km and stored underground instead of released into the atmosphere.

The ZeroGen plant could be in use by 2013 and potentially modified at a later stage to produce commercial quantities of hydrogen or ammonia.

Although he was not willing to predict whether the ZeroGen plant would be built, Queensland Premier Peter Beattie said yesterday the team was gathering crucial data, knowledge and experience that would help combat global warming.

Mr Beattie said ZeroGen still faced competition for up to

(Continued — Page 8)

Low-emission coal test successful

From Page 1

\$900 million in state government and industry funding — the commonwealth may also contribute — and he was determined that Queensland's next power station would use clean coal technology. "In the competitive process they (ZeroGen) have still got to win, but it shows they've obviously got the technology to work," he said. "This sends a signal to the world, we've now got to scale it up."

ZeroGen — owned by the Queensland Government and run by its Starnell power corporation — was until earlier this year aggressively promoted by Mr Beattie. This enthusiasm prompted federal Labor leader Kevin Rudd to visit the Starnell site and promise funds for clean coal research.

ZeroGen's commercial partner Shell Development (Australia) has agreed to be part of the next stage and will work in collaboration with Sunshine Gas and MIRA Petroleum Consultants.

Shell has yet to decide whether to take a 10 per cent equity in the project.

Clean coal technology is considered crucial to addressing global warming, given the continued use of coal-fired power stations, particularly in developing countries. But much depends on whether electricity generated by projects such as ZeroGen would be competitively priced.

While there are a number of clean coal technology projects around the world, including geosequestration tests being undertaken in Victoria's Otway Ranges, ZeroGen is unique in that it is designed to produce power and reduce emissions using a series of technologies in Queensland geological conditions which are, most importantly, similar to that of

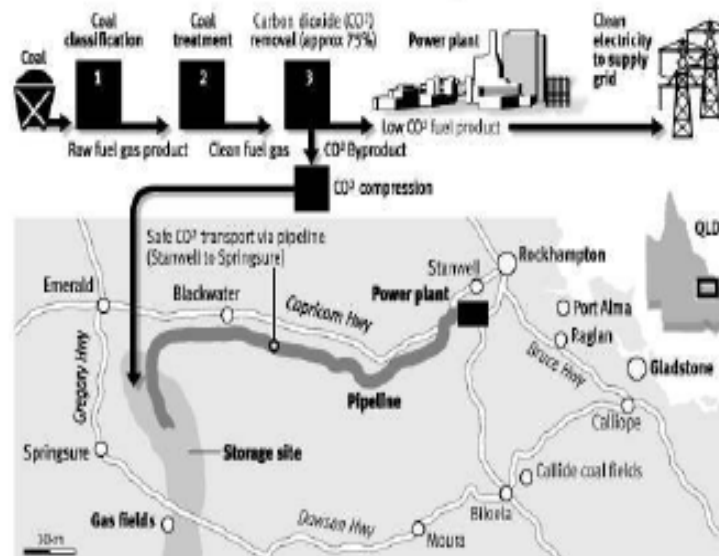
CLEAN ENERGY

What is coal gasification?

- It is a process that combines coal with a mixture of oxygen and steam under pressure to produce a clean synthesis gas (syngas).
- Syngas is a fuel rich in hydrogen that can be used for combustion in

- turbines to generate electricity.
- CO₂ and other gases are separated and captured from the syngas before combustion in the turbines, preventing release to the atmosphere.
- CO₂ emissions are reduced by up to

- 75% compared with traditional black-coal-fired stations.
- Captured CO₂ will be transported via pipeline to be buried in deep saline aquifers in the Northern Denison Trough.



China. Mr Beattie has made no secret of his desire to sell clean coal technology to China in an effort to safeguard Queensland's future as a coal exporter. He has promoted ZeroGen in meetings with Chinese Government officials, while the ZeroGen team has also helped China's GreenGen project and held talks with potential Chinese investors.

Graham Reed, program manager for the Centre for Low Emission Technology, yesterday

said ZeroGen had made "a very significant step in so far as this project and Queensland are concerned".

Peter Cook, chief executive of the Cooperative Research Centre for Greenhouse Gas Technologies, also welcomed the ZeroGen development, describing it as "a first, cautious and totally appropriate step in the process".

The ZeroGen plant's critics, including at one point federal

Industry Minister Ian Macfarlane, argue that it is too small at 100mw and will not be commercially viable. Mr Macfarlane would not comment yesterday on the status of ZeroGen's application for Federal funding.

But ZeroGen remains several years ahead of its comparable rivals, including the US-based FutureGen project, and is starting to be assessed by coal companies, whose financial support is crucial to its success.

Press clipping from
The Australian
30 August 2007, p1