

# Scaling up Geo CCS



Steve Gale  
Hatch

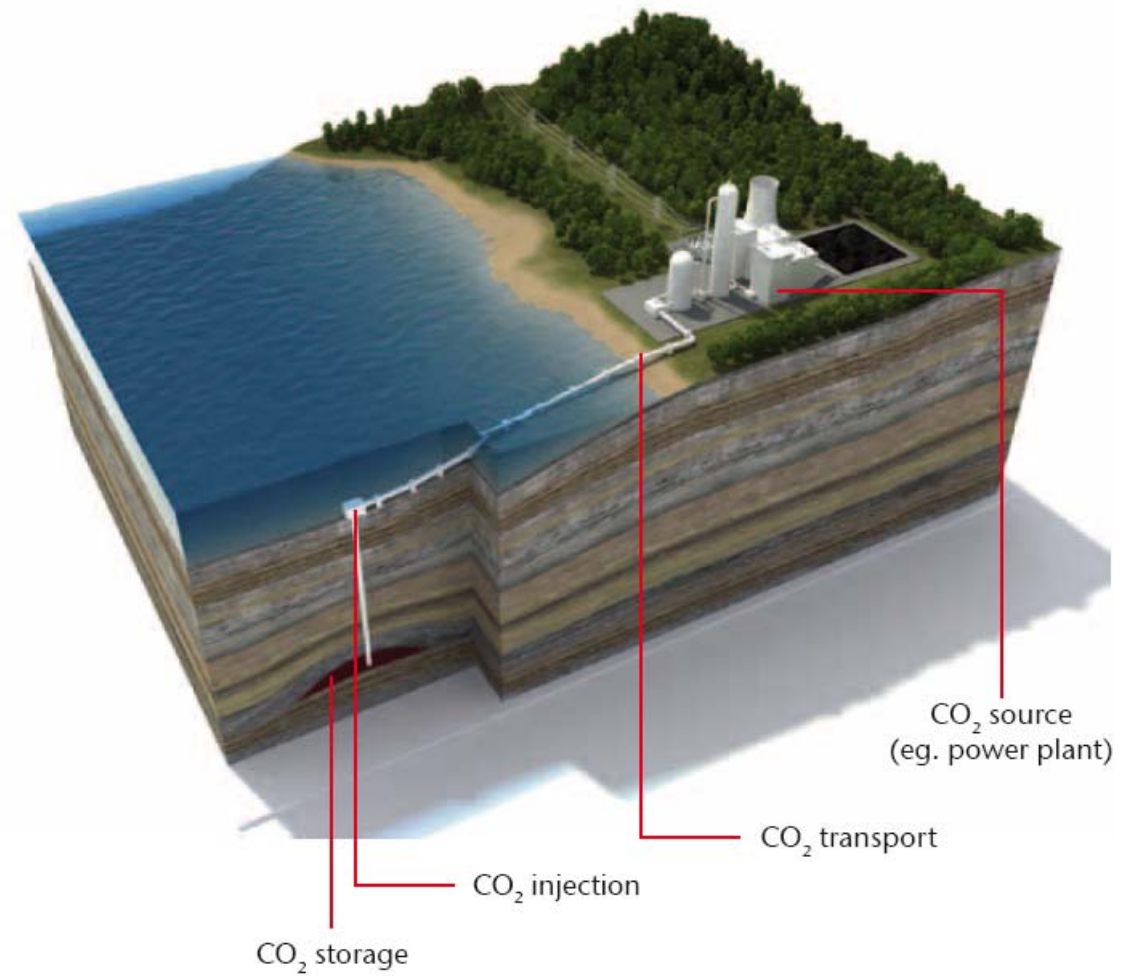


## Australia's absence of climate answers

# Hatch

- We are an engineering organisation operating across Oil & Gas, Energy, Mining, Minerals, Metals and Infrastructure.
- We have about \$40bn worth of projects being implemented by 8000 technical staff.
- Our projects are currently capturing and injecting more than 3MT of CO<sub>2</sub> per annum into depleted oil fields.

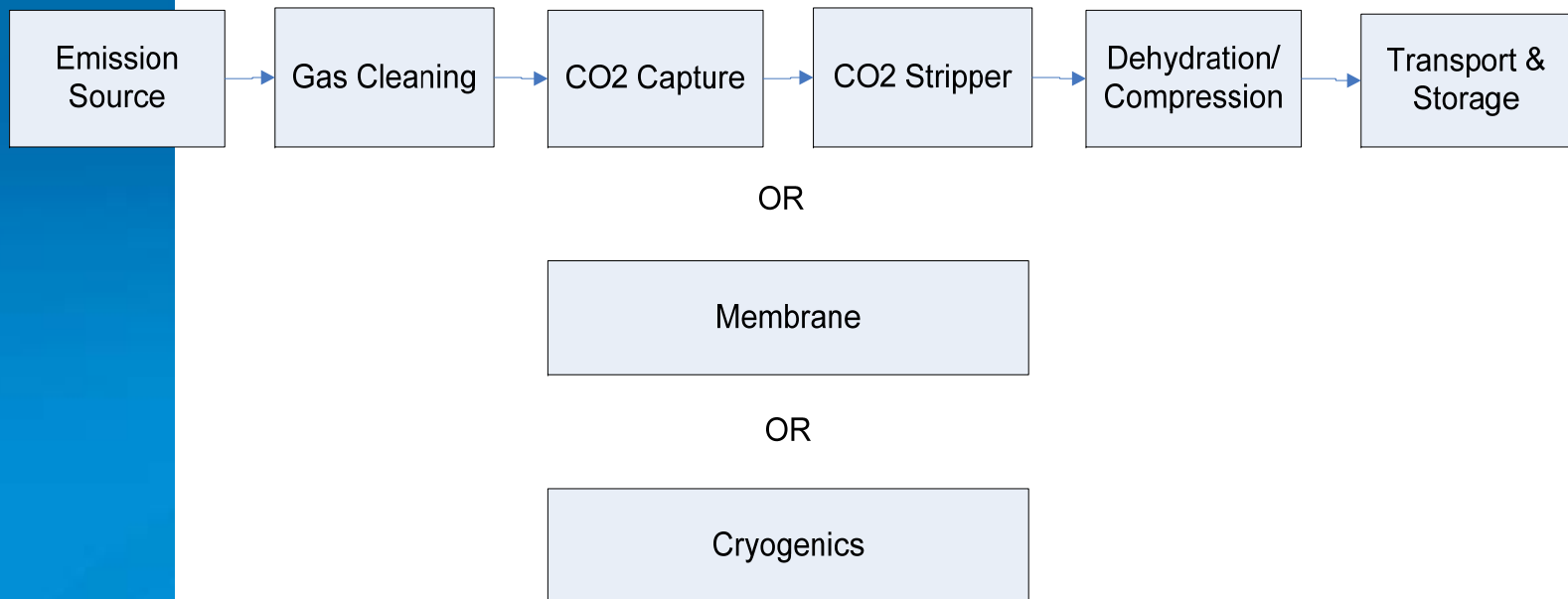
# CCS Principles



IEA: Technology Roadmap



# Simplified CCS Block Flow



# Constructed Projects

## EnCana - Weyburn CO<sub>2</sub> Flood (1995 – 2000)

- Reciprocating CO<sub>2</sub> compressors (2 x 6,000 HP)
- 55 km of dense phase CO<sub>2</sub> distribution pipelines
- CO<sub>2</sub> receiving terminal (6,000 t/day capacity)
- Production flow lines and pipelines
- Production and injection satellites
- Oil production battery upgrades

## EnCana - Weyburn Expansion (2005 – 2007)

- Centrifugal CO<sub>2</sub> compressor (17,500 HP)
- CO<sub>2</sub> dehydration facilities (2 x 5,000 t/day trains)



# Constructed Projects (cont'd)

## Apache - Midale CO<sub>2</sub> Miscible Flood (2005 - 2006)

- Reciprocating CO<sub>2</sub> compressors (2 x 1,400 HP)
- Dense phase CO<sub>2</sub> pumps (2 x 125HP)
- 25 km dense phase CO<sub>2</sub> supply pipeline
- 17 km of dense phase CO<sub>2</sub> distribution pipelines
- CO<sub>2</sub> receiving terminal (1,750 t/day capacity)
- Production flow lines and pipelines
- Production and injection satellites
- Oil production battery upgrades

## Shell - Midale CO<sub>2</sub> Miscible Flood Pilot Plant (1991)

- Included recycle compression and dehydration, Liquid CO<sub>2</sub> storage and pumping, injection and production pipelines and production satellites.

# Some Pre-Construction Studies

## **Vermilion - Chaunoy CO<sub>2</sub> EOR Project (2009)**

- Conceptual study for a 150 t/day pilot project and a 1,100 t/day commercial project.

## **E-Tundra - Sinclair CO<sub>2</sub> Capture Project (2009)**

- Conceptual study for capture and pipelining of CO<sub>2</sub> from 2 sources to an EOR project.

## **Enhance/Fairborne - Clive CO<sub>2</sub> EOR Project (2008)**

- Conceptual study for a 1,600 t/day commercial project.

## **ARC Resources – Redwater Vertical Flood (2008)**

- Conceptual study for a 9,000 t/day commercial project

## **Enhance - Fenn Big Valley EOR Project (2007)**

- Conceptual study for a 3,250 t/day commercial project

## **Co-op Refinery CO<sub>2</sub> Capture Project (2004)**

- FEED study for the capture and compression of 1,350 t/day of CO<sub>2</sub> from the hydrogen plant.

## **Numac – Elswick CO<sub>2</sub> EOR Project (1999)**

- FEED study for a miscible flood EOR project.

# CCS- Impacts, PC Boiler 1000MWe Net

Item	Capital Cost
Power Plant (1325MWt)	US\$3.6bn
CO2 Capture/Stripping	US\$1.05bn
CO2 Compression	US\$0.05bn
Pipeline	US\$0.1bn
Subsurface	US\$0.3bn
	<b>US\$5.1bn</b>

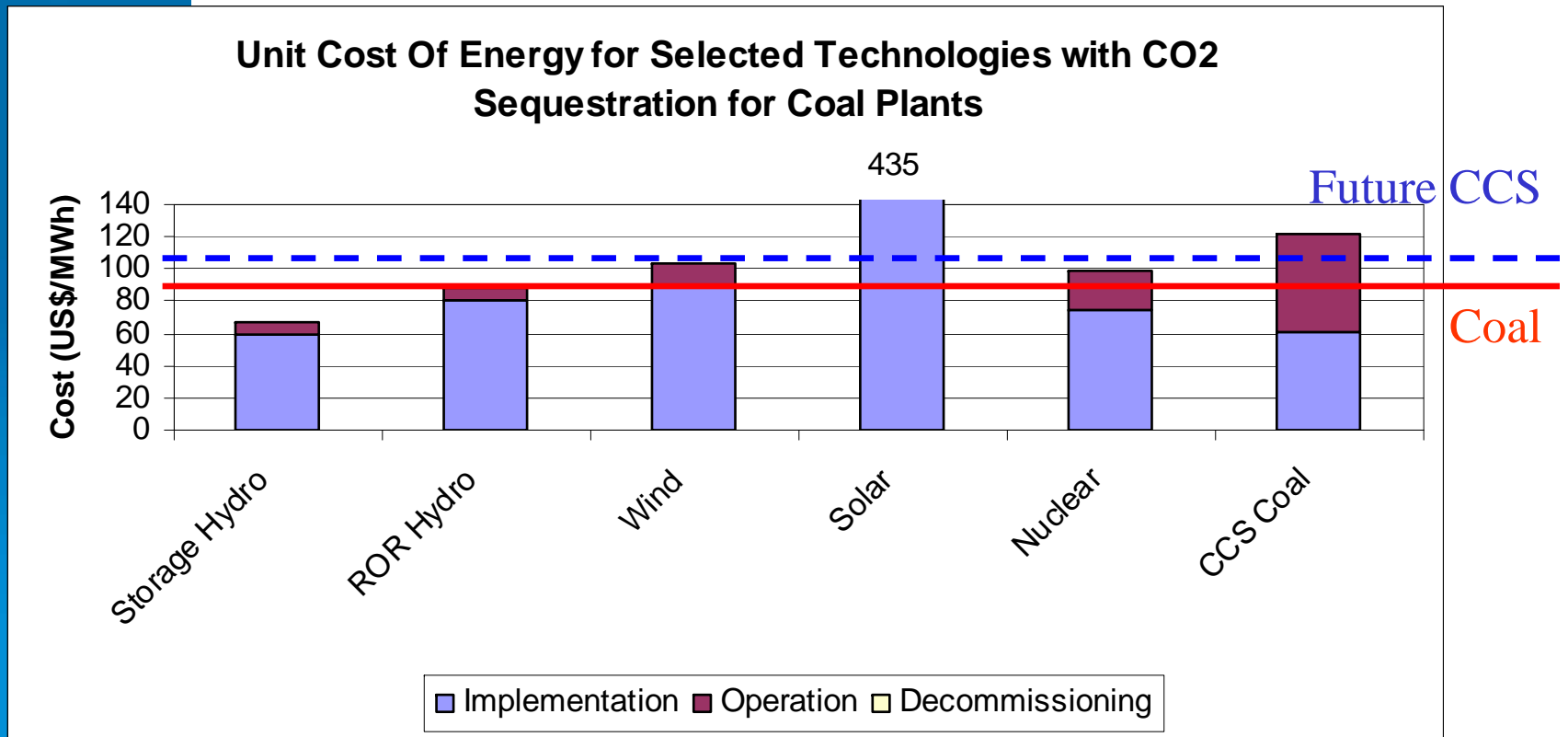
# CCS- Impacts, PC Boiler 1000MWe Net

	With CCS	Without CCS
Gross	1325 MWe	1075 MWe
Capital	US\$5.1bn	US\$2.9bn
LCOE	US\$126/MWh	US\$88/MWh

# Future Costs

- Carbon Capture capital cost likely to reduce significantly with development.
- Carbon Capture efficiency likely to improve significantly reducing parasitic load and power plant capital.
- No Change expected in transport or subsurface.

# Comparison of Costs



**Conclusion: CCS Very likely to be adopted as widespread low marginal cost option that defends investments & maintains capacity**



---

Steve Gale

Ph +61 2 4231 7229

Email [Sgale@hatch.com.au](mailto:Sgale@hatch.com.au)

All material copyright Hatch 2010