



30 September 2021

Companies Announcement Office  
ASX Limited  
Exchange Centre  
Level 4, 20 Bridge Street  
Sydney, NSW 2000

Dear Sir/Madam

**PROFESSOR PETER COOK TO PRESENT AT THE ANZ CARBON CAPTURE, UTILIZATION AND STORAGE FORUM ON THURSDAY 30TH SEPTEMBER**

Please find attached Professor Peter Cook's presentation at the ANZ Carbon Capture, Utilization and Storage Forum on Thursday 30th September.

Authorised for release by

David Breeze  
Executive Director



ADVENT ENERGY LIMITED

# **The Advent Energy Sea Blue Well: Assessing a CCS Prospect Offshore Sydney Basin**

September 30 2021

Professor Peter Cook,  
CCS Adviser to Advent Energy

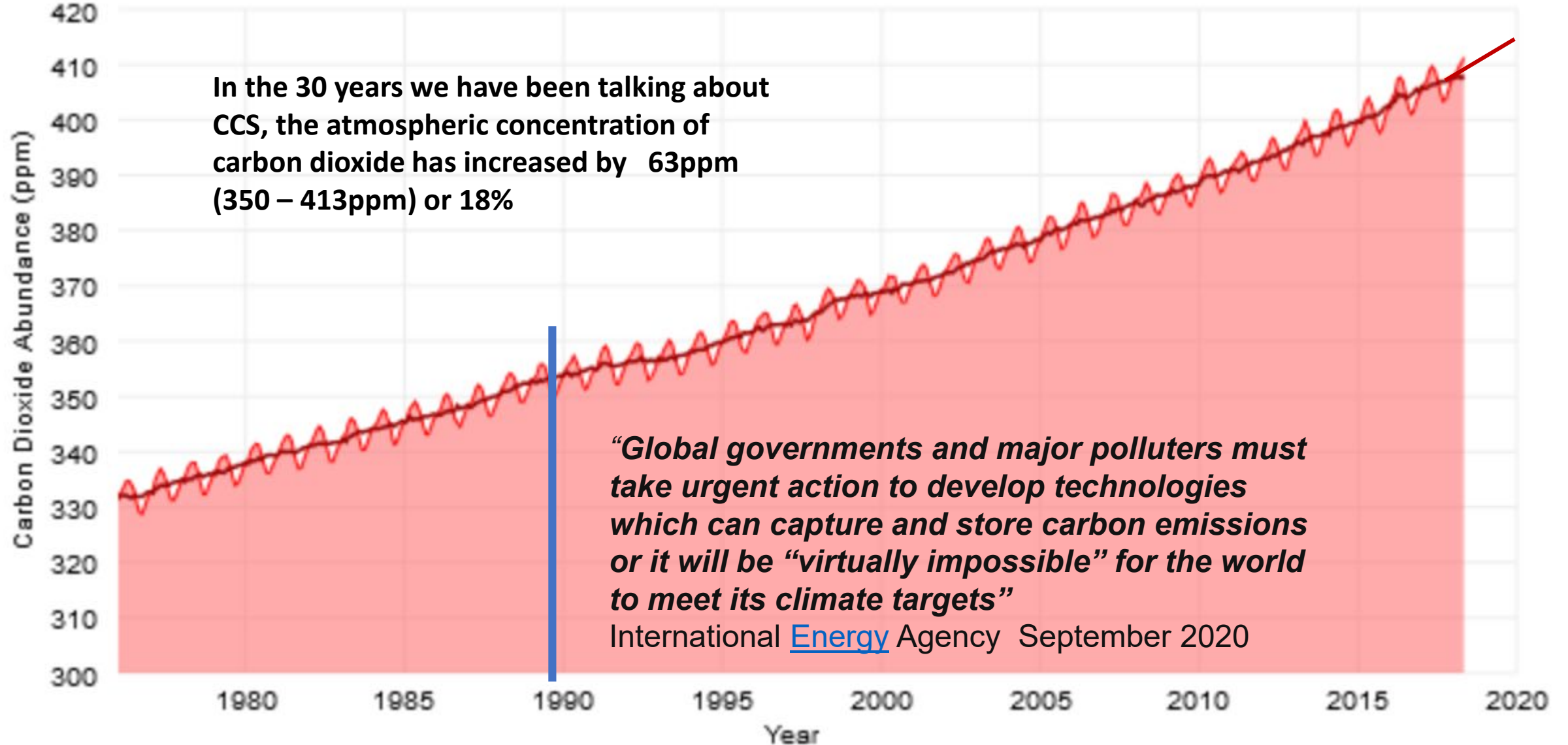




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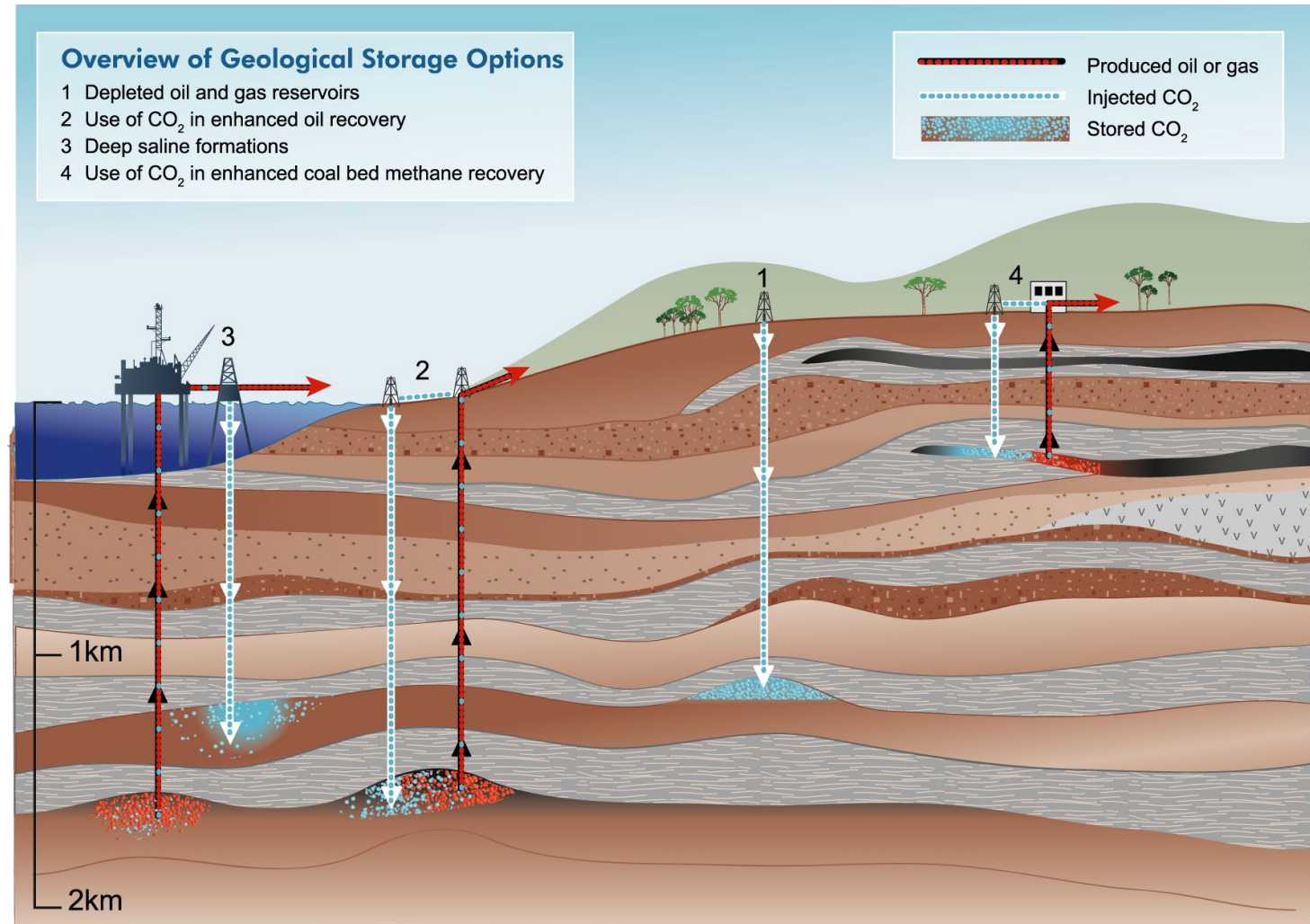
**Using the Sea Blue -1 gas exploration well to cost-effectively appraise the carbon storage potential of the offshore Sydney Basin**



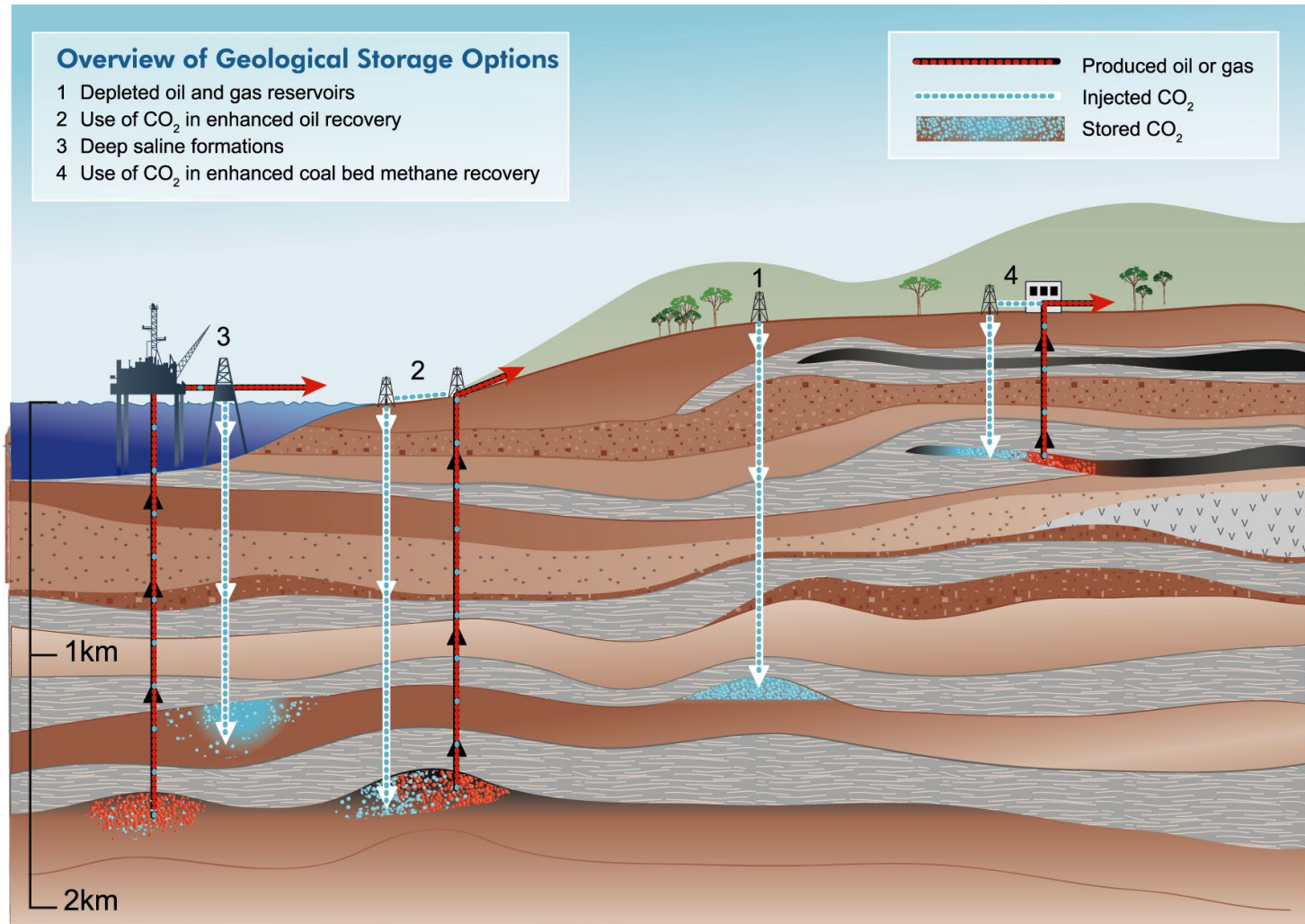




Our  
knowledge of  
CCS has  
increased  
massively

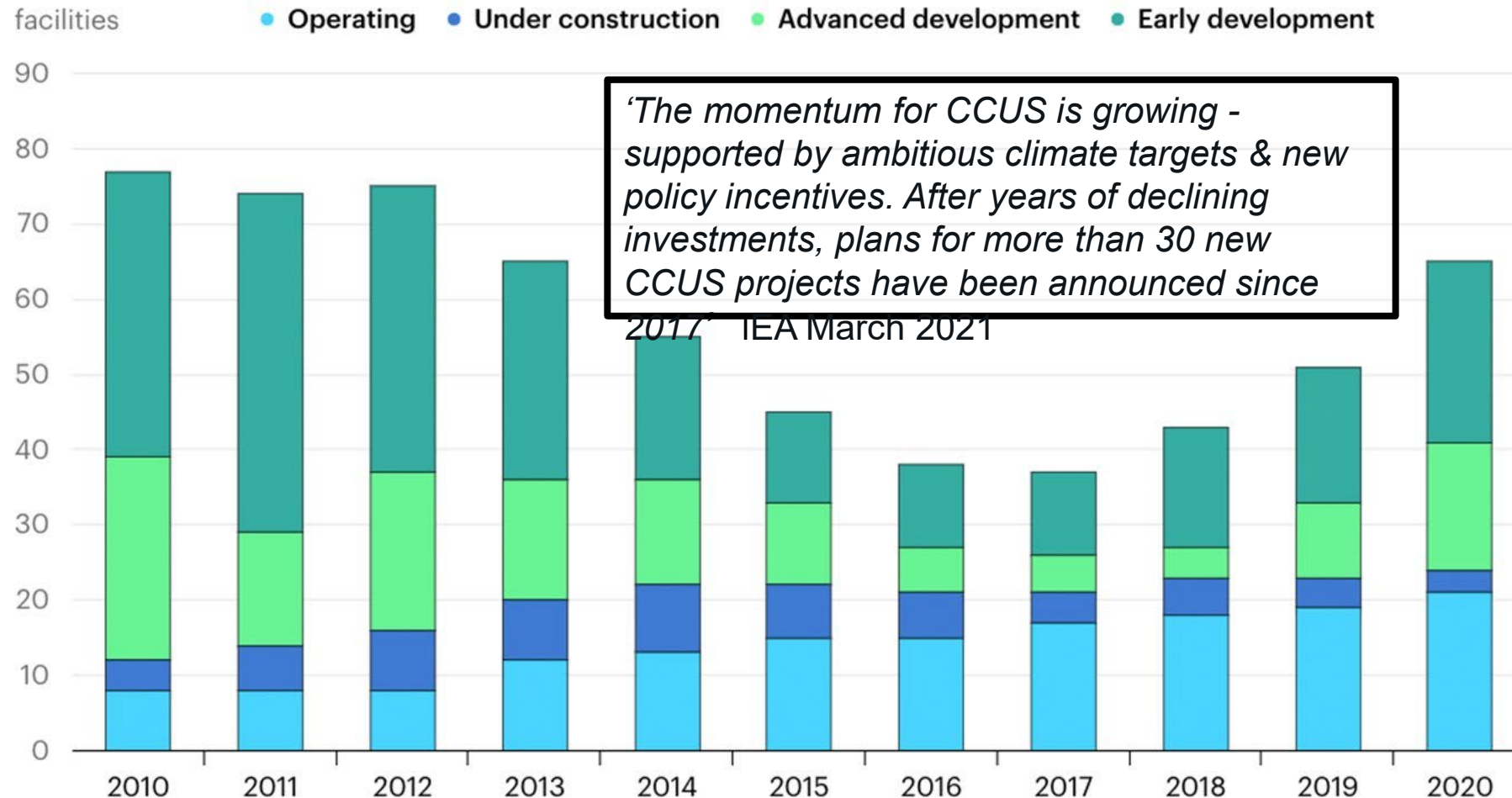


CCS is  
happening  
but too  
slowly



## World large-scale CCUS facilities operating and in development, 2010-2020

CCUS in Clean Energy Transitions: ETP Special Report



Note: Includes the Petra Nova coal-fired power plant, which temporarily suspended CO2 capture operations in May 2020 in response to low oil prices.

# UK CCS

*Drax has started the planning process to build its first two bioenergy with carbon capture and storage (BECCS) units in 2024. The technology, which is claimed to be carbon negative, is predicted to capture and store up to eight million tonnes of carbon dioxide a year. MMD Economics 2020*

*All decarbonisation technologies considered are likely to be important – the most irreplaceable technology is likely to be CCUS, given its crucial role in abating process emissions. DEEP DECARBONISATION PATHWAYS FOR UK INDUSTRY A report for the UK Climate Change Committee Dec 2020*

*“We must develop and scale up new options for industrial decarbonisation such as carbon capture and storage (CCS), low-carbon hydrogen and engineered emissions removals”. Policies for the Sixth Carbon Budget and Net Zero Committee on Climate Change December 2020*

*The Acorn CCS project is being developed following the Accelerating CCS Technologies (ACT) Acorn study conducted by the project consortium. The carbon dioxide will be transported to a storage site in the North Sea from the terminal for permanent sequestration in saline formation. The storage site covers an area of 971km<sup>2</sup> and is located approximately 80km from the gas terminal. NS Energy*

- Capturing Carbon at Drax: Delivering
- Jobs, Clean growth and Levelling up the Humber



Report prepared for Drax

December 2020

**mmd**economics  
energy economics engineers





## US CCS

**“HOUSTON, Texas – Eleven companies have expressed interest in supporting the large-scale deployment of carbon capture and storage (CCS) technology in Houston. Calpine, Chevron, Dow, ExxonMobil, INEOS, Linde, LyondellBasell, Marathon Petroleum, NRG Energy, Phillips 66 and Valero have agreed to begin discussing plans that could lead to capturing and safely storing up to 50 million metric tons of CO<sub>2</sub> per year by 2030 and about 100 million metric tons by 2040. The companies plan to help address industrial CO<sub>2</sub> emissions in one of the largest concentrated sources in the United States. Collectively, the 11 companies are considering using CCS technology at facilities that generate electricity and manufacture products that society uses every day, such as plastics, motor fuels and packaging.”**

Exxon press release 16 September 2021



## **NORWAY CCS IS NOT JUST SLEIPNER.....**

**"Fortum will process the waste to provide electricity and heat to Oslo and nearby towns, he said. With the city's target of 95% reduction of greenhouse gas emissions by 2030 in focus, the Klemestrud facility in Oslo has successfully developed a carbon capture and storage process which recaptures the CO<sub>2</sub> emissions.**

**"This is part of the Longship project developed by the Norwegian government which will see recaptured CO<sub>2</sub> being stored in underground reservoirs."**







Municipal waste and timber 'waste' are favoured as biomass sources because they are not competing with food crops

*"Oil and gas major Chevron has partnered with Microsoft to construct a bioenergy with carbon capture and sequestration (BECCS) project*

*Other partners involved in the scheme, which is designed to produce 'carbon-negative' power in the Californian city of Mendota, are oilfield services firm Schlumberger New Energy and the developer Clean Energy Systems".*

BIOENERGY WITH CCS AND DIRECT AIR CAPTURE OF CARBON DIOXIDE ALSO WITH CCS ARE SEEN BY MANY AS KEY NEGATIVE EMISSION TECHNOLOGIES



DACCS plant in Switzerland



## AUSTRALIA CCS

Carbon capture and storage technologies are one of five priority areas for investment under the Government's [Technology Investment Roadmap](#).

### **Minister for Energy and Emissions Reduction**

**Angus Taylor** said *"Carbon capture technologies would be critical to achieving net zero emissions from power generation, natural gas and hydrogen production as well as process emissions from heavy industries like cement and fertiliser production"*.

- *"Australia has the potential to be a world leader in geosequestration. We have the right geology and storage basins"* Minister Taylor said.

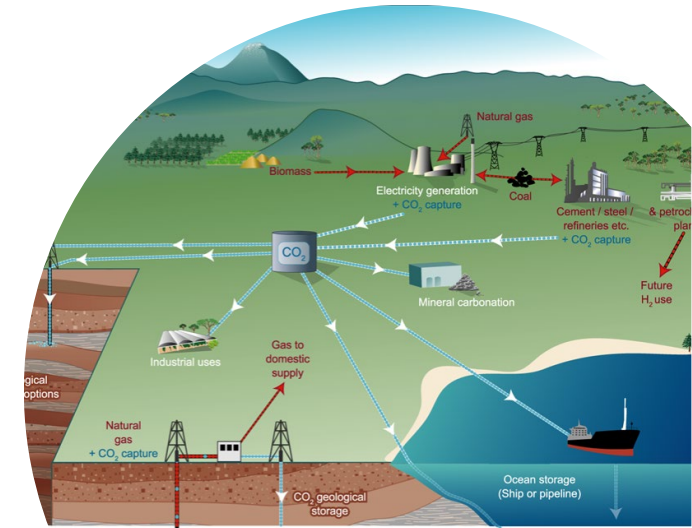
1 March 2021



- **Low Emissions Technology Statement September 2020.**

The Statement outlines five priority technologies and economic stretch goals to make new technologies as cost-effective as existing technologies.

- **Hydrogen production under \$2 per kilogram.**
- Long duration energy storage (6-8 hours or more) dispatched at less than \$100 per MWh
- **Low carbon materials – low emissions steel production under \$900 per tonne, low emissions aluminium under \$2,700 per tonne.**
- **CCS – CO<sub>2</sub> compression, hub transport, and storage under \$20 per tonne of CO<sub>2</sub>.**
- Soil carbon measurement under \$3 per hectare/ year





**Josh Frydenberg** 24 September 2021

**Address to the Australian Industry Group, Melbourne**

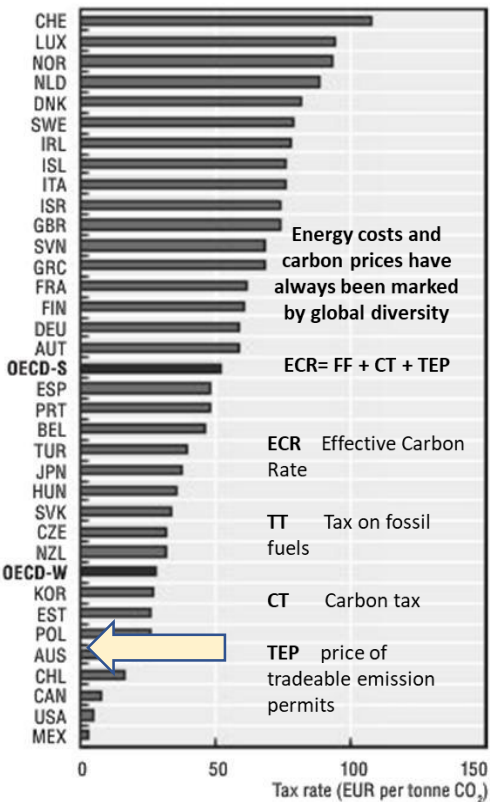
**Capital markets and the transition to a low emissions future**

*‘The global transition is likely to lead to increased demand for clean energy and associated critical minerals exports, and the creation of new markets **such as clean hydrogen and carbon capture and storage.**’*

**Treasurer Josh Frydenberg says** *“global markets are already pricing in net zero targets by 2050 and Australia cannot be left behind”* **ALEX ELLINGHAUSEN**

**Treasurer Josh Frydenberg has backed** the case to cut greenhouse gas emissions to net zero by 2050 in a warning that *“Australia must not be left behind in a mammoth economic shift that will impose sweeping costs on countries that do not act on climate change”*

Average effective tax rates on CO<sub>2</sub> from energy



# A PRICE ON CARBON



*“The spot price of Australian Carbon Credit Units (ACCUs) recently passed \$20 per tonne for the first time since the abolition of the Gillard government’s carbon price in 2014. And, according to leading carbon market analyst firm Reputex, it could more than double in value, reaching as high as \$50 per tonne by the end of the decade”* July 2021

## Some quotes.....

- **The carbon commodity market is ultimately a political construct**
- **Net zero emissions is a key driver of the long term price of carbon**
- **An EU levy could impose a carbon price of A\$65-140 on Australian exports**
- **The CO<sub>2</sub> offset price to enable Australia to meet a net zero emission target would be in the order of \$30- 100 a tonne of CO<sub>2</sub>**
- **Australia needs to commit to a 2030 emission reduction target of 50-74% to limit global warming to 1.5-2.0 degrees C**

### Well, it's a start

Europe, price per permit to emit one tonne of CO<sub>2</sub>

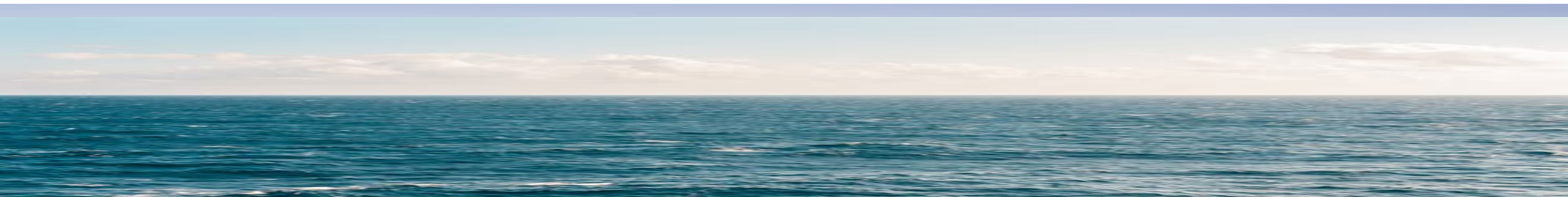






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- Advent Energy proposes to drill a gas exploration well, Sea Blue-1, in the offshore Sydney Basin in 2022
- It will also use the well to evaluate the CCS potential of the basin
- The exploration lease (PEP 11) is located close to the Newcastle-Hunter region
- Sydney-Newcastle- Hunter region is the NSW population-industrial-emission heartland
- If NSW is to meet its target of NET Zero by 2050 and maintain an industrial base, CCS will be a key technology option
- The offshore Sydney Basin has storage potential but has never been definitely evaluated due to lack of well data
- Sea Blue- 1 will provide the opportunity to cost-effectively assess CO2 storage potential.
- Confirmation of offshore geological storage potential would be a game changer for NSW and its NZE target



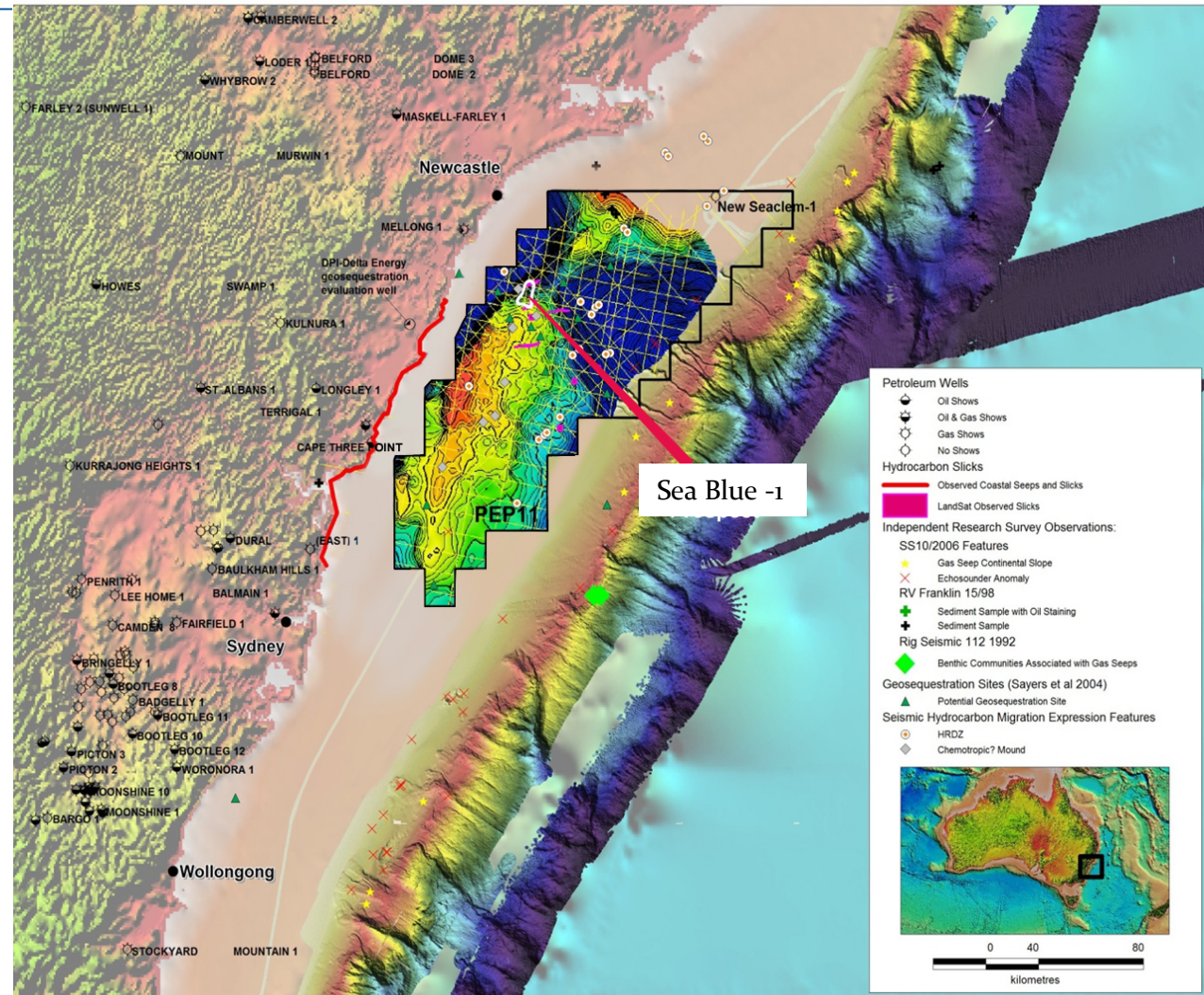




## PEP11-85% Interest

### PEP11– Offshore Sydney Basin:

- The Sydney Basin has excellent potential for discovery of natural gas
- PEP11 covers 4,649 km<sup>2</sup> on the doorstep of Sydney-Newcastle & extensive gas infrastructure (<50km).
- Current application to NOPTA to enable drilling as next step
- Significant interest in the project is driven by the gas market dynamics
- Shortfall forecast in gas supply east coast
- New gas fired power stations for NSW
- firming generation under consideration by power industry.
- All this has provided the impetus to Advent and its partners to propose a gas exploration well, Sea Blue -1.

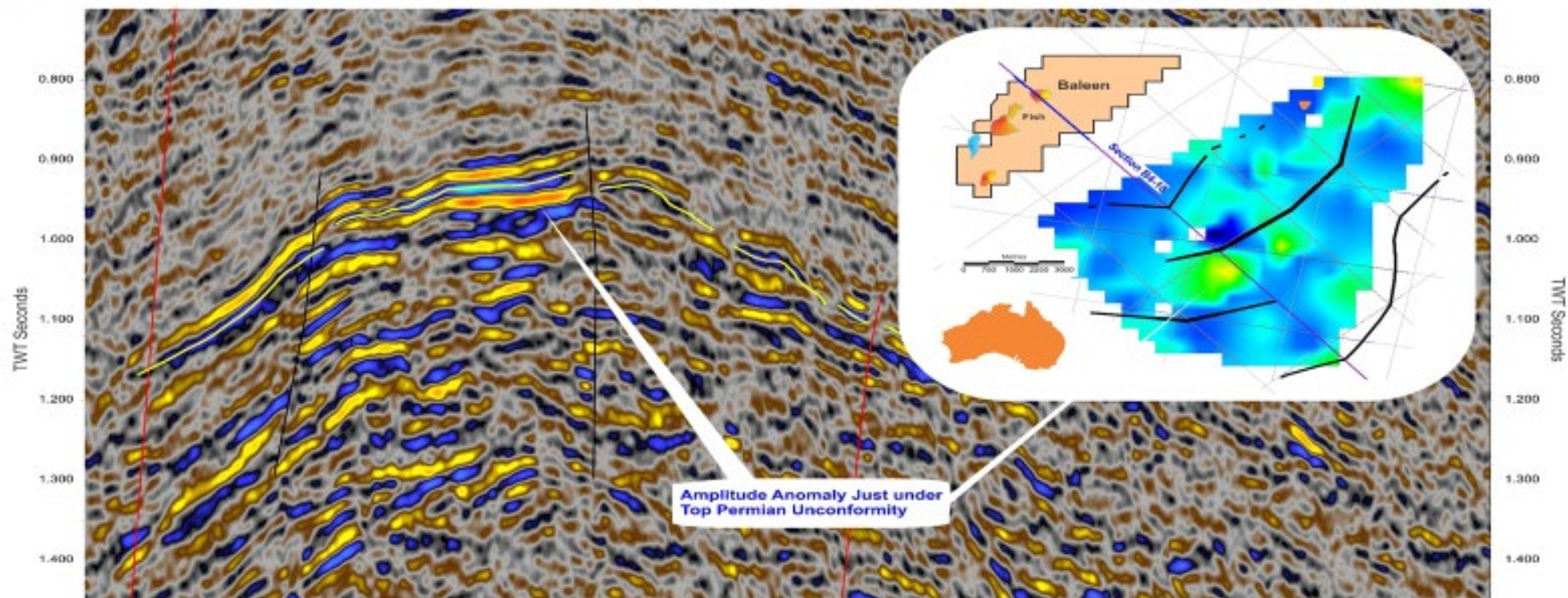






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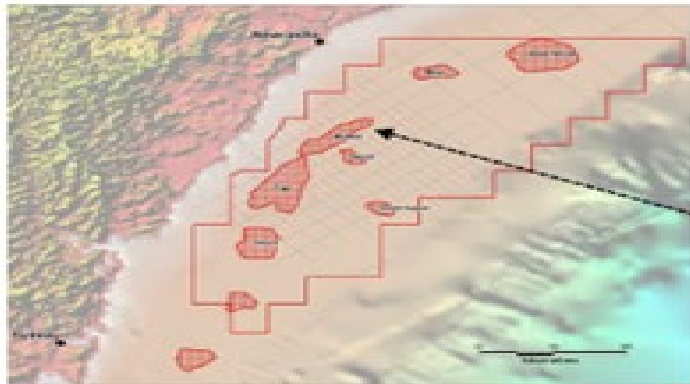
# PEP 11 Baleen Anticline AVO Anomaly



**De risking target - Distinct amplitude (AVO) anomaly, phase change along strike and brightens with offset**

# The Advent Energy gas proposal

## PEP11 Project



PEP11 Prospects & Leads



Sea Blue 1 well at the  
Baleen gas prospect  
Approx. 125m water

*Illustrative graphic only — actual development plan may differ*



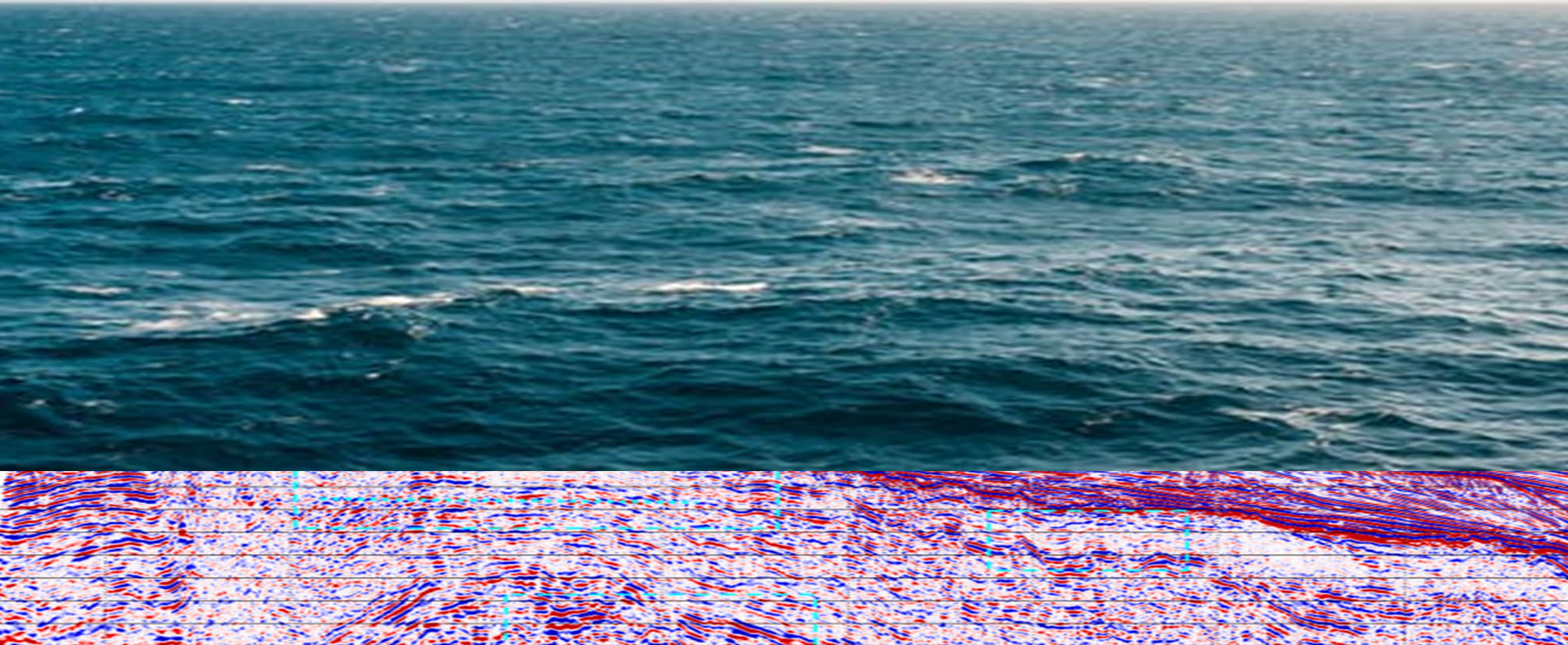
Collongra / Munmorah Power Plant Precinct;  
Prospective Gas Processing Plant Location



Newcastle Port;  
Prospective Gas Processing Plant Location



# The Advent Carbon Storage Project





## NET ZERO PATHWAY: CCS and Natural Gas

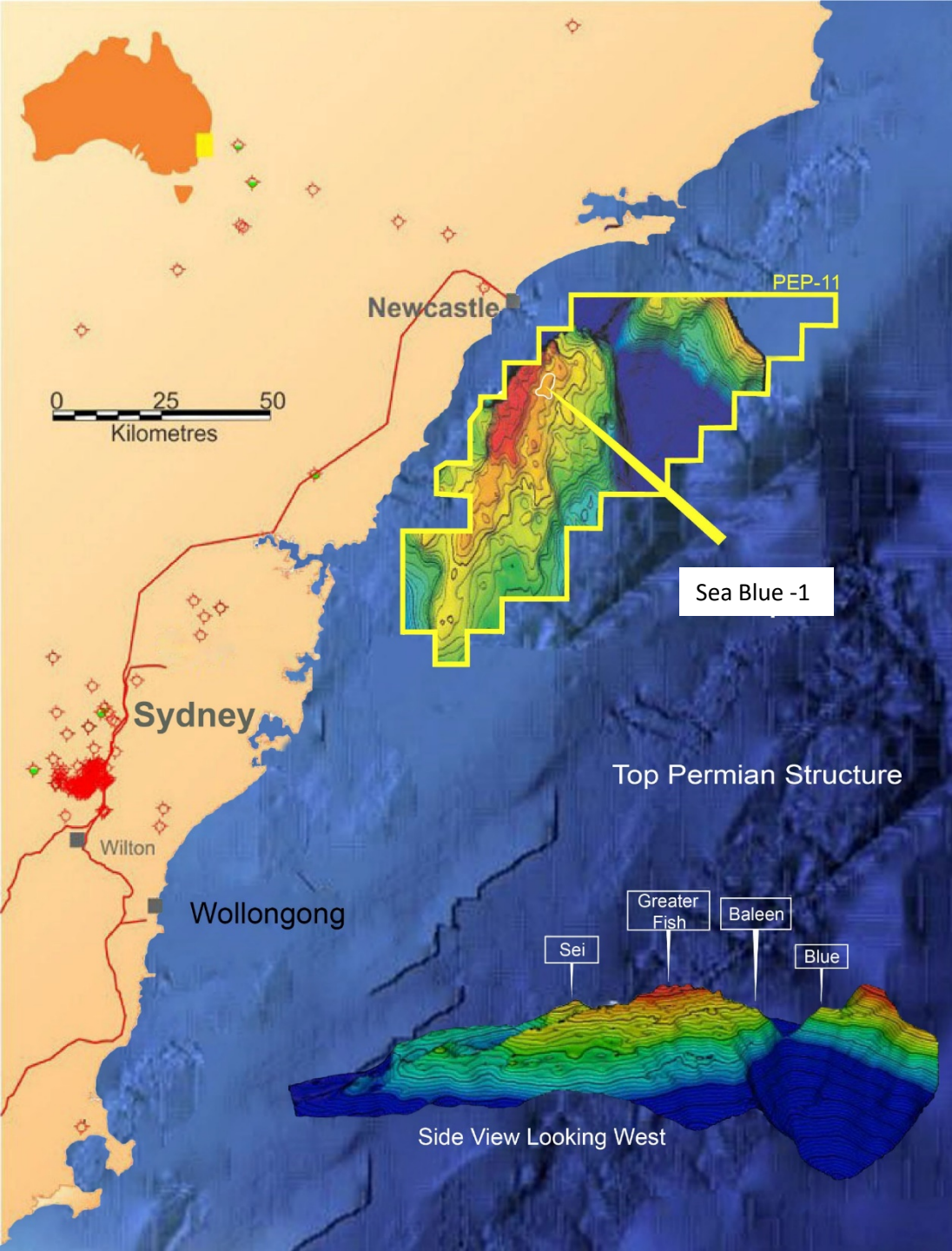
- Many of the same geological and engineering principles apply to carbon dioxide and methane so it is “familiar territory”
- CCS has been applied commercially by the gas industry since 1996 at Sleipner
- Depleted gas reservoirs offer one of the most promising storage targets for long term geological storage of CO<sub>2</sub> as they have a proven seal.
- It is also possible to use CO<sub>2</sub> as a “displacing agent” to help recovery and achieve enhanced gas recovery (EGR).
- In principle, EGR with CO<sub>2</sub> can be applied at various stages during gas production
- Gas is less carbon intensive than coal, but the gas industry recognises it still produces CO<sub>2</sub> which needs to be mitigated
- The future production of ‘blue’ hydrogen from gas will have to incorporate CCS

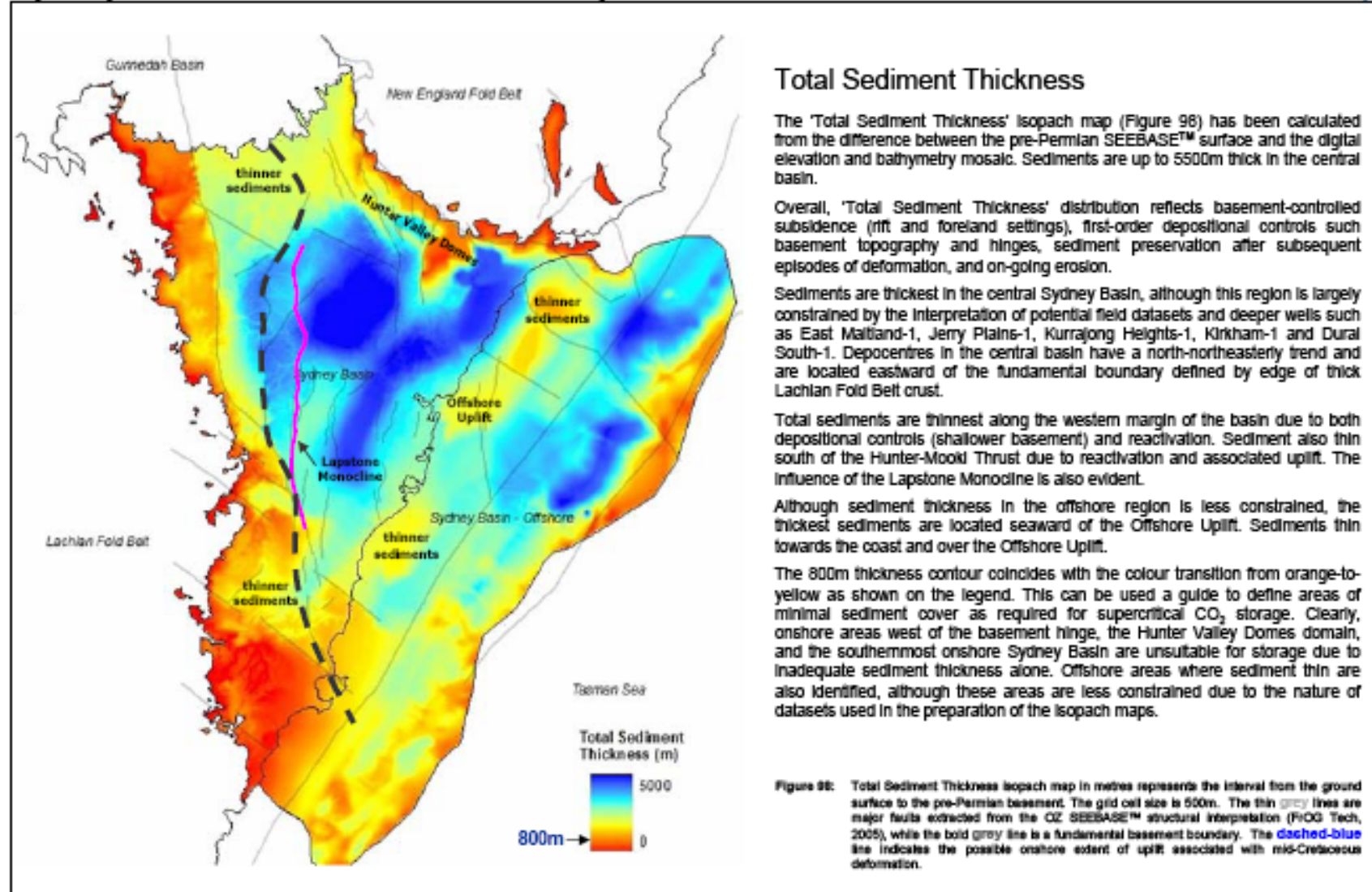


# The proposed CCS Project

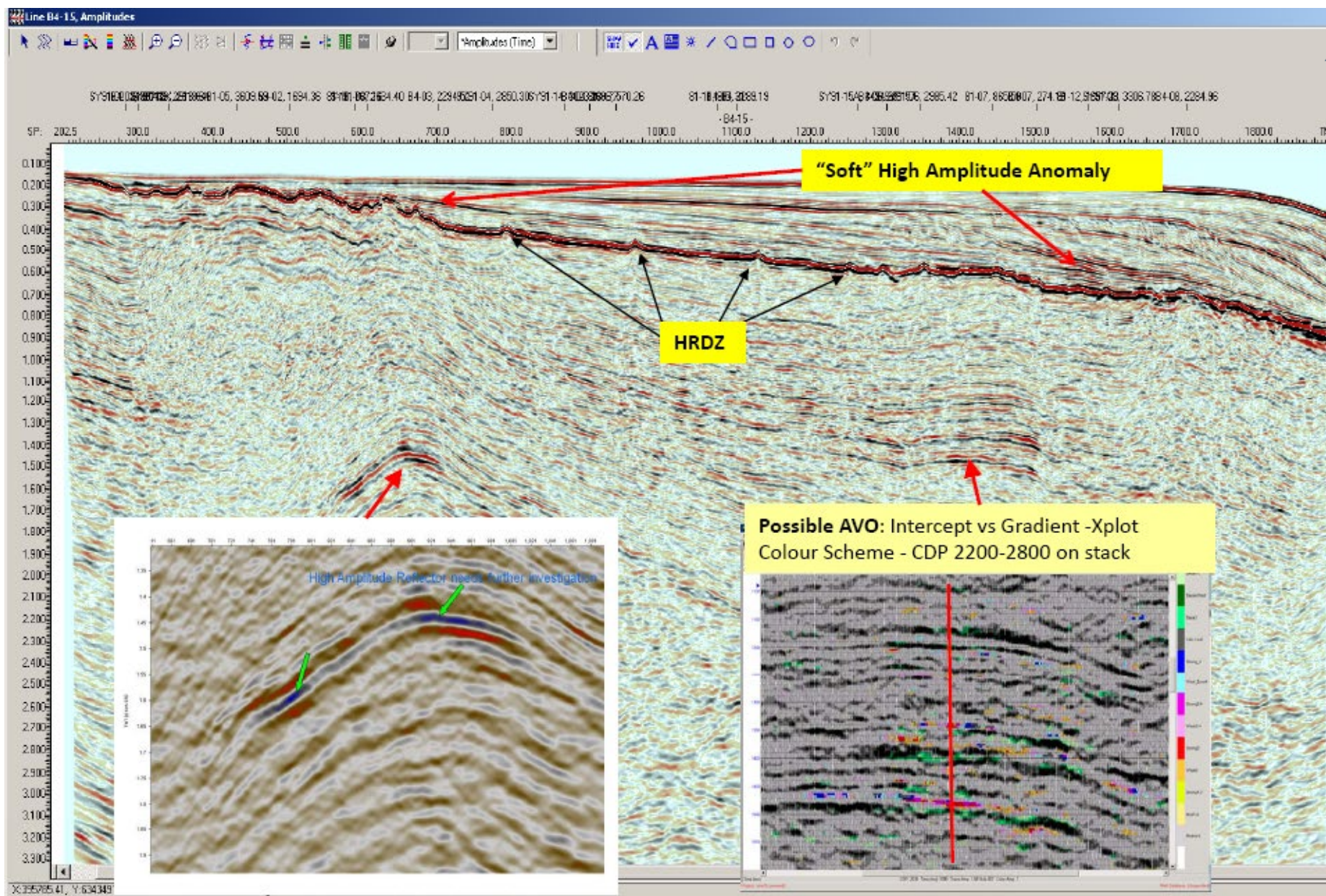
## Factors in decisions regarding storage potential

- **Geology**
- **Data availability and prior knowledge**
- **Regulatory regime and lease conditions**
- **Location: distance from major emission sources**
- **Scale of the CO2 emissions**
- **Logistics of the site: existing infrastructure**
- **Environmental impact**
- **Resource impacts and synergies eg gas; present and future**
- **Community acceptance**
- **Politics of climate change**
- **Cost**

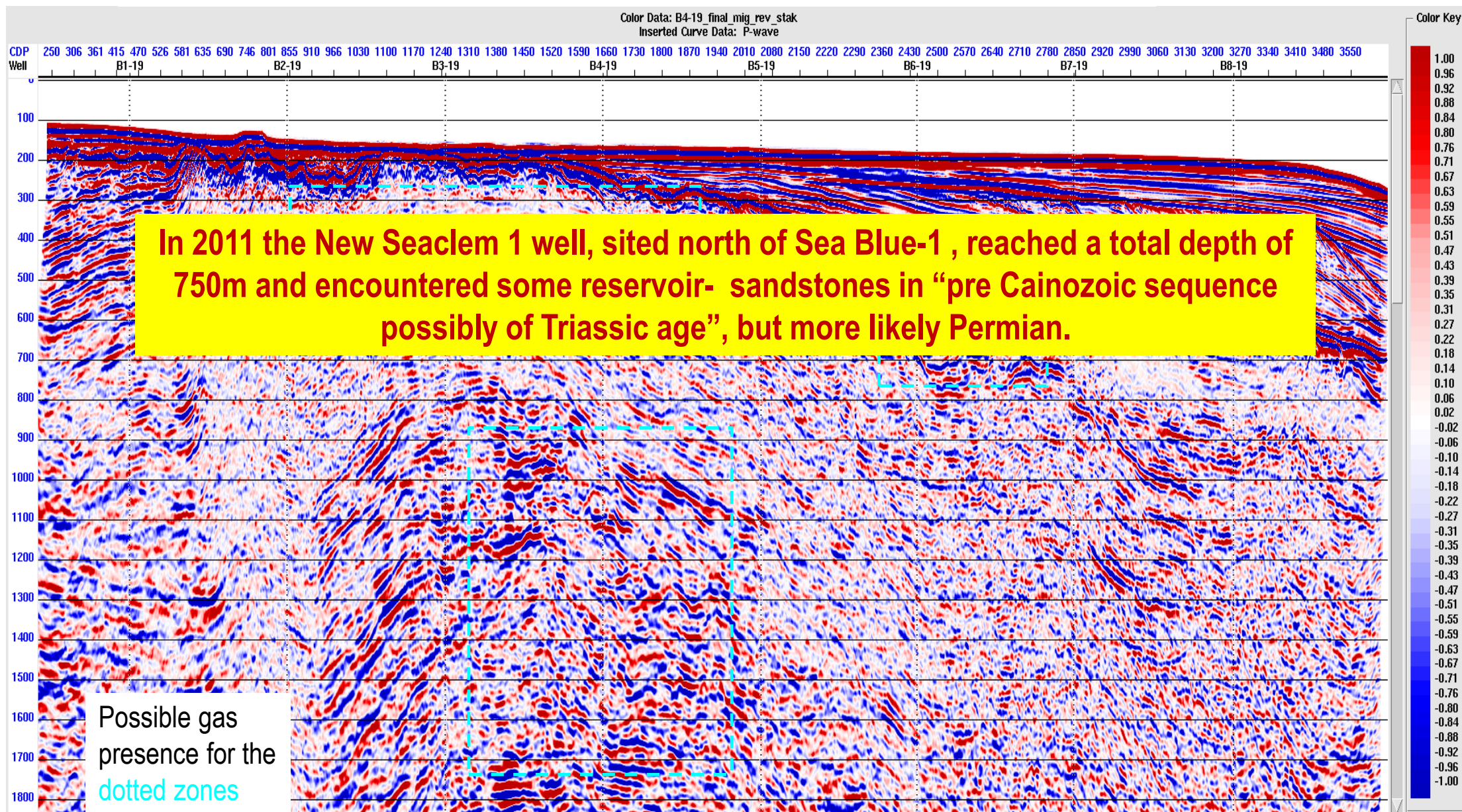




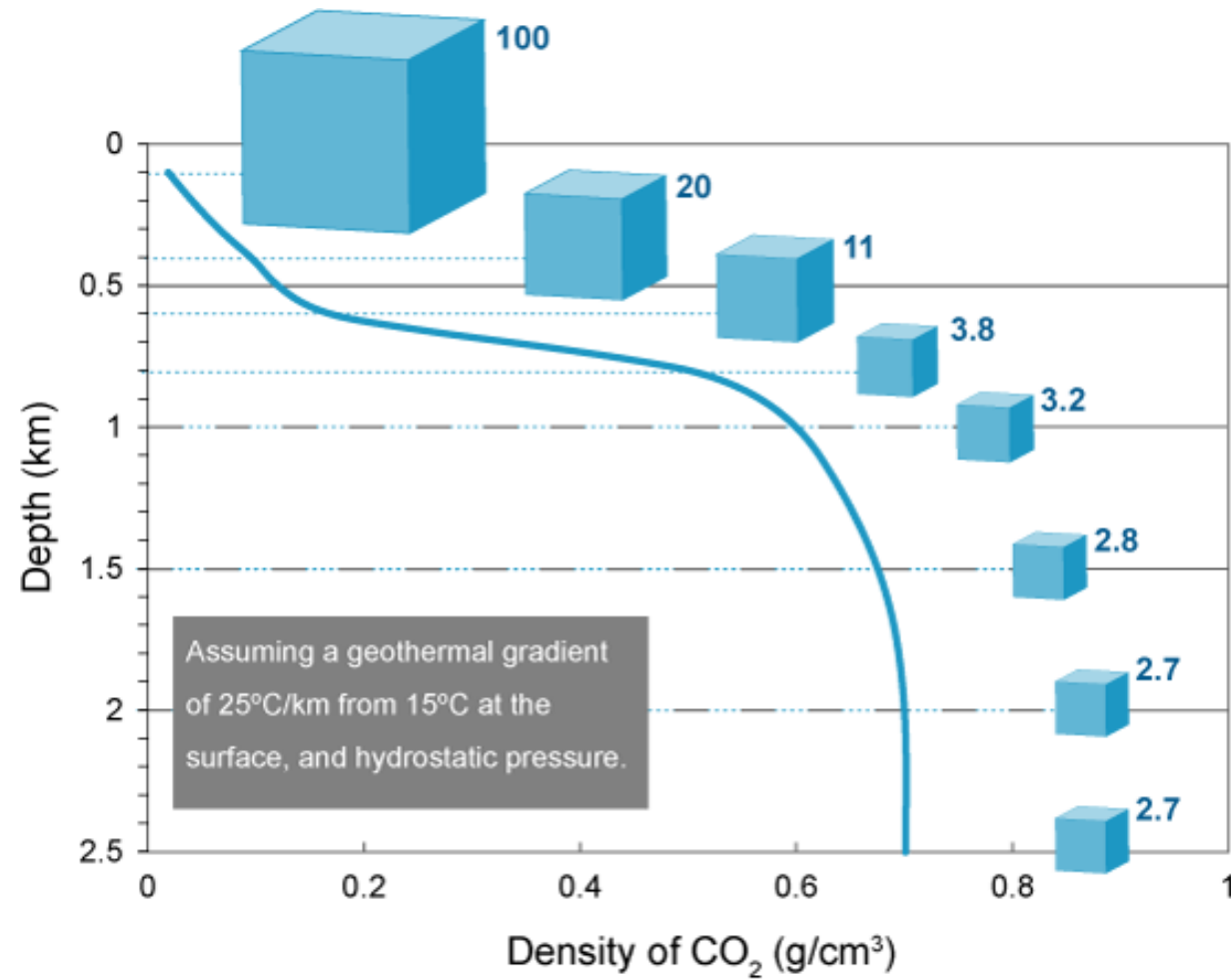






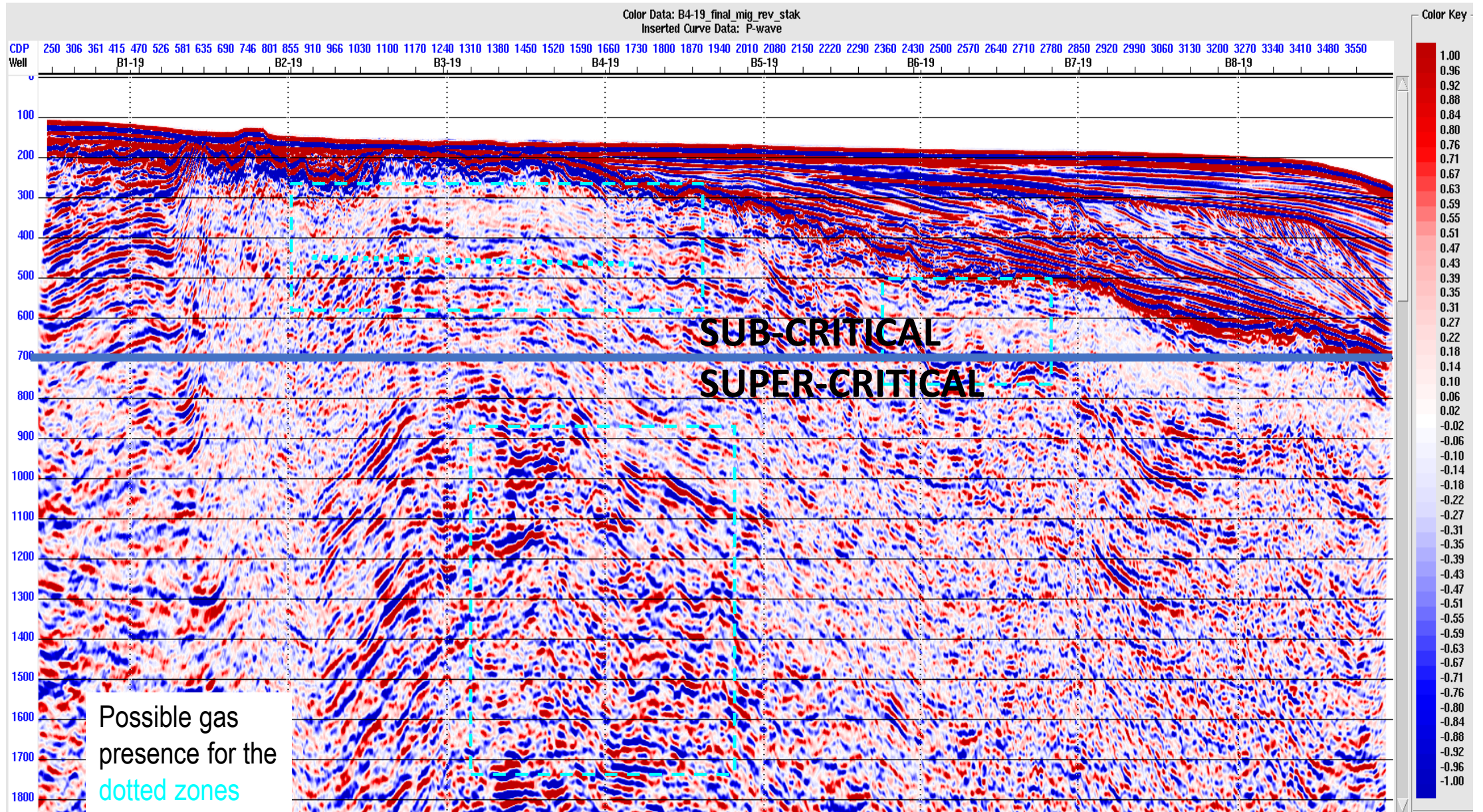


Variation of CO<sub>2</sub> density with depth, assuming hydrostatic pressure and a geothermal gradient of 25°C/km from 15°C at the surface

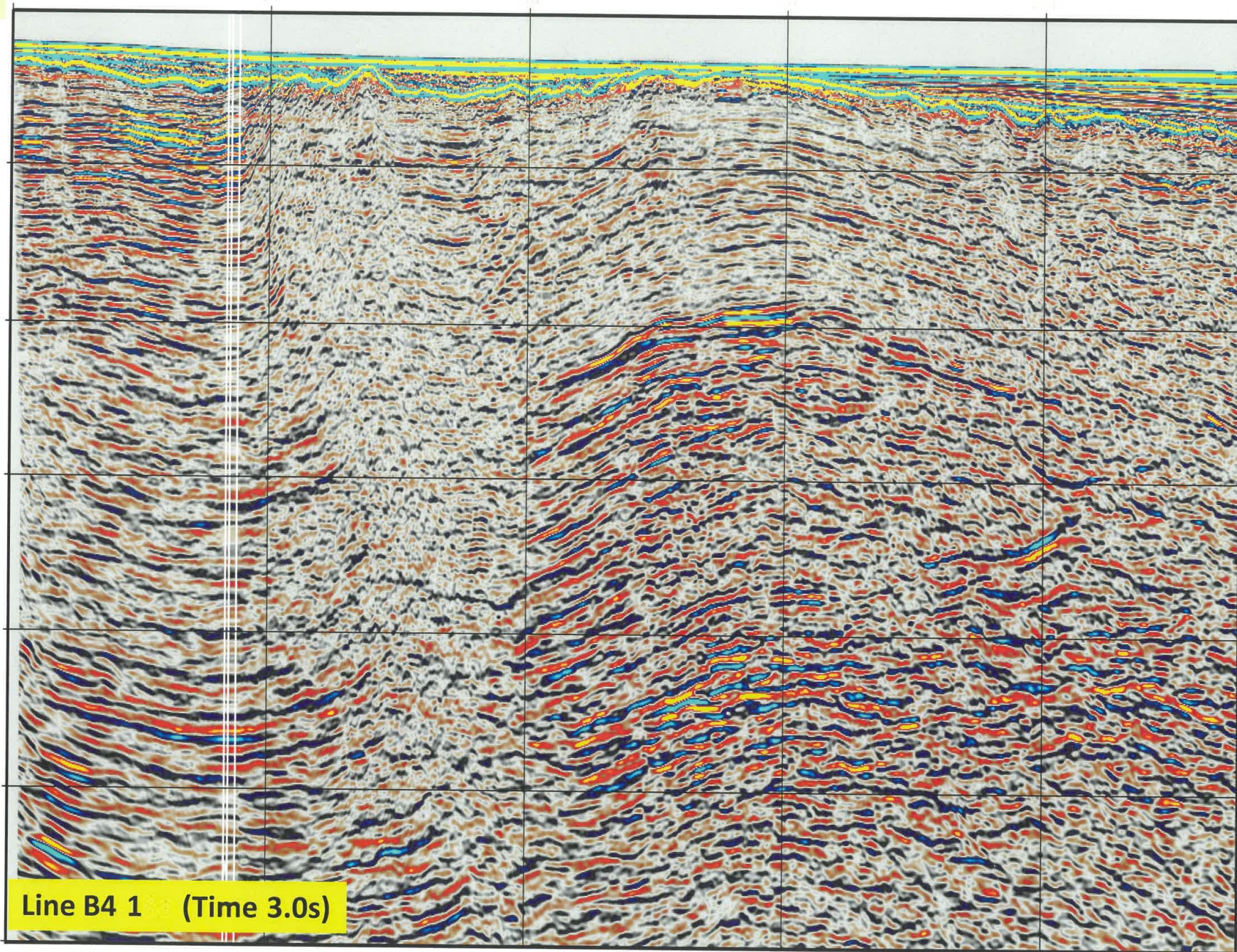




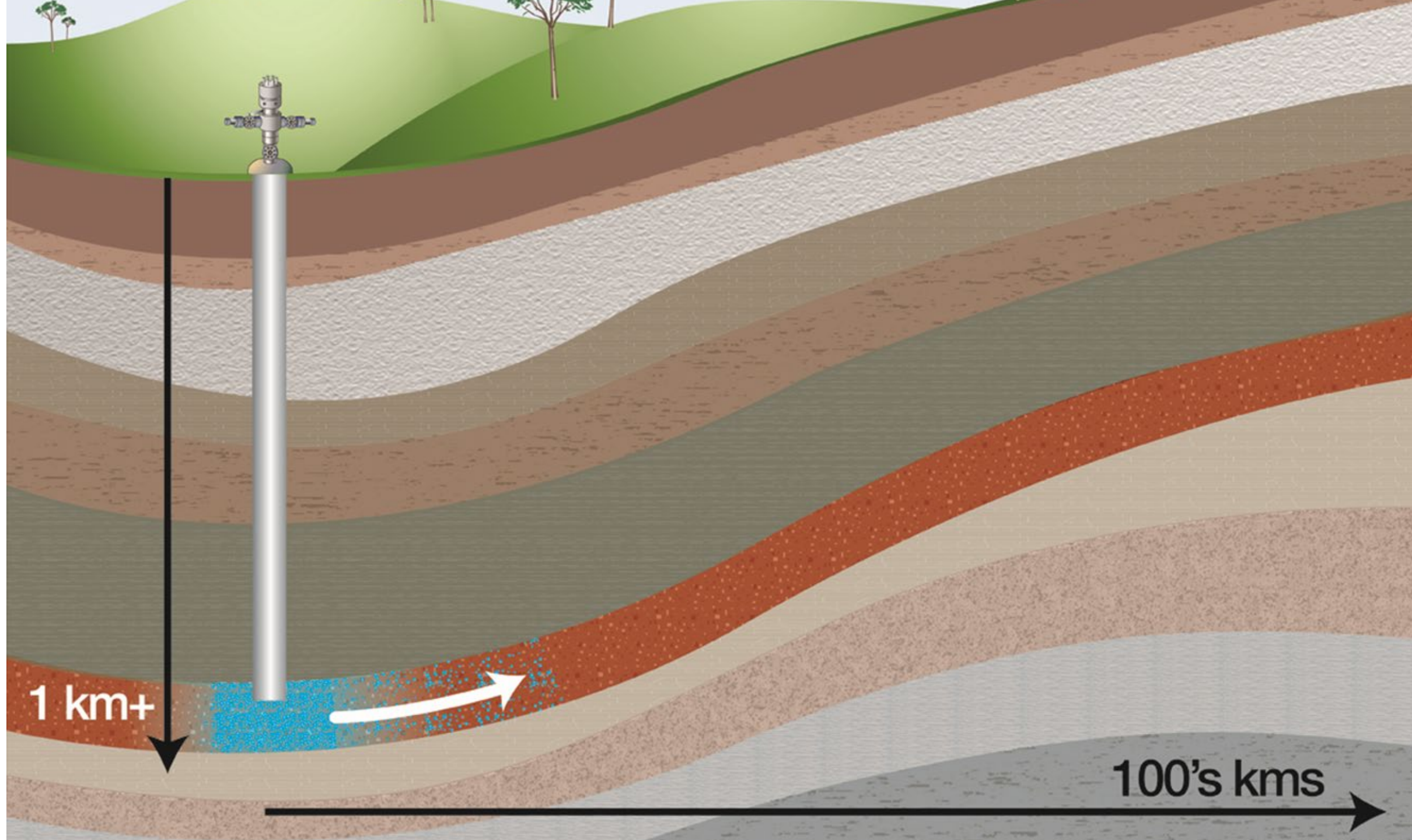
# B4-19: Full stack migration seismic PEP 11















## **CCS Plans for Sea Blue 1 Well**

**30km offshore; water depth approx. 125m**

**Target 2100m but potential to go to 3000m**

**Outstanding opportunity to obtain storage data**

**Conventional coring cost > \$1 million per core, and current subsurface data not adequate for developing a coring programme.**

**Proposal is to selectively use enhanced large diameter sidewall coring technology, once the well is drilled and logged**

**Can get up to 60 sidewall cores of 1.5 to 2.5 inch diameter in reservoirs and seals for determining storage potential**

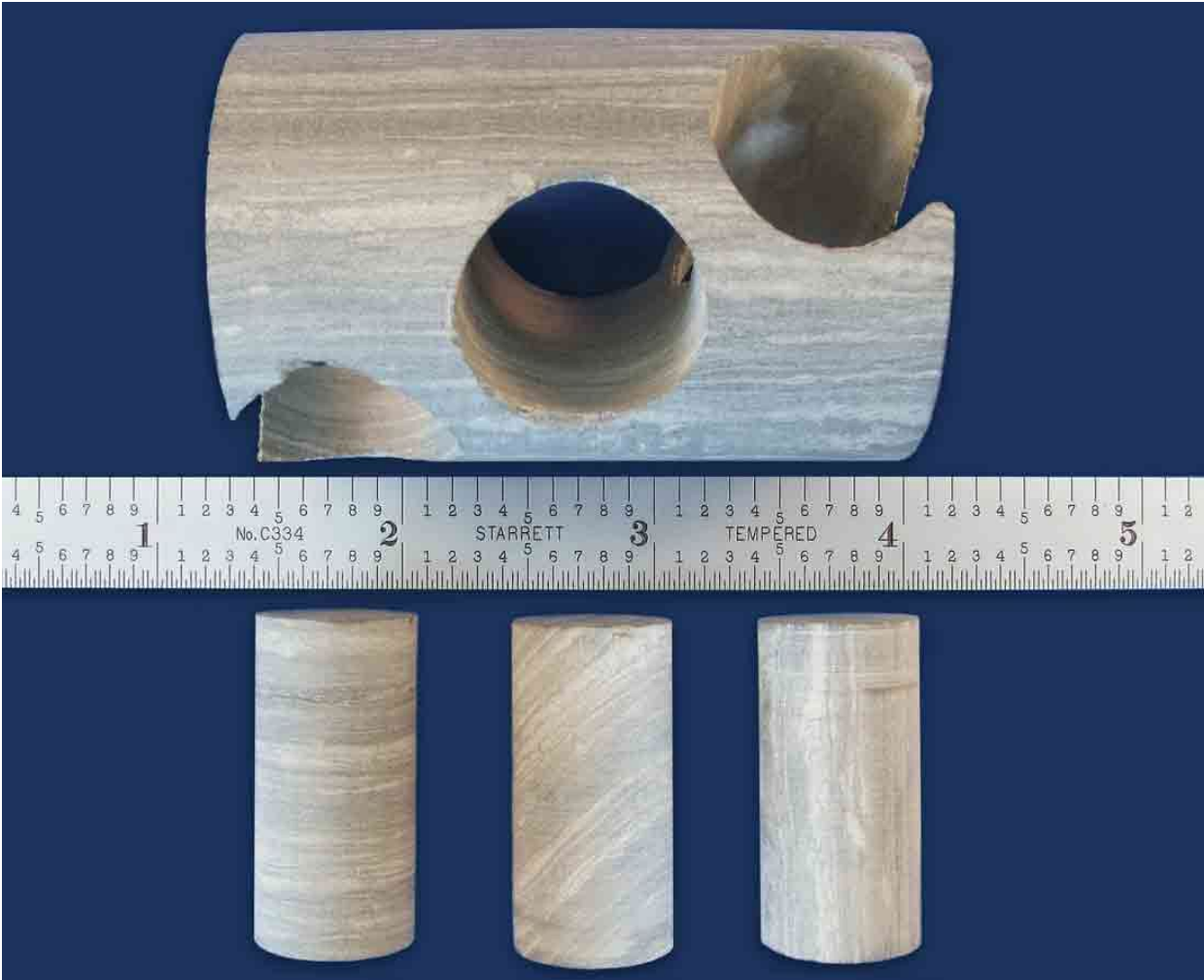
## CCS plans for Sea Blue-1

Well designed to penetrate to Permian at 2150m with the option of deepening to 3150m for further testing of reservoir-seal pairs

Water-based drilling fluid to minimise formation damage

Propose to undertake

- Logging while drilling
- Vertical seismic profiling
- Wireline logging
- Resistivity
- Gamma
- NMR
- Rotary sidewall coring

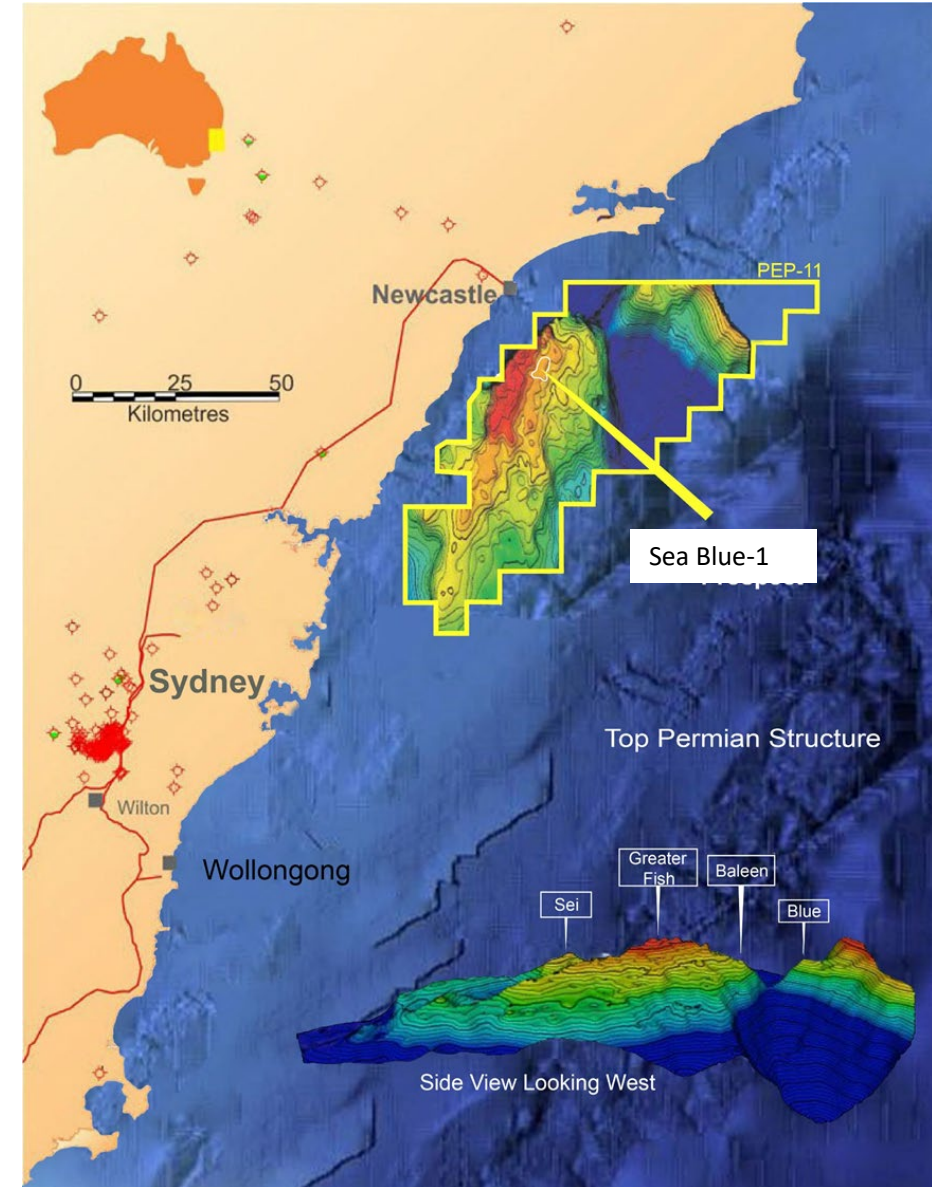




# The proposed PEP 11 CCS Project

With Baleen and Sea Blue -1 as the starting point, what **additional** activities could be used to assess the carbon storage prospectivity of the offshore Sydney Basin?

- Sidewall cores of potential reservoirs and seals for extensive porosity and permeability measurements
- More comprehensive suite of well logs
- Deepen the well?
- Downhole testing of selected intervals?
- Reinterpret the 2D seismic using new core data
- Review use of OBN (Ocean Bottom Nodes) for enhanced seismic research and reservoir imaging?
- Comprehensive geomodelling post drilling
- Comprehensive dynamic modelling of possible CO<sub>2</sub> migration pathways
- Assessment of injectivity, capacity, security
- Financial feasibility
- Assess the future use of PEP 11 for CO<sub>2</sub> storage without and with a producing gas field

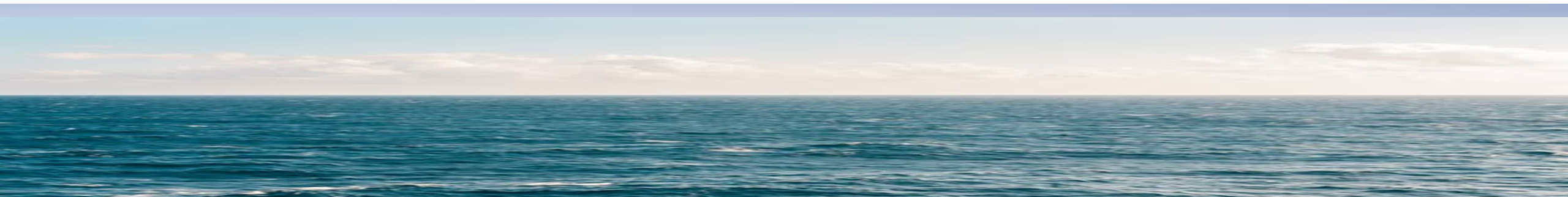




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## NSW WILL NEED CCS

- Advent Energy proposes to drill a gas exploration well, Sea Blue-1, in the offshore Sydney Basin.
- The exploration lease (PEP 11) is located close to the Newcastle-Hunter region - and major emission sources which will need to be cut if NSW is to meet its target of NET Zero by 2050.
- CCS is a key technology option to do this - and maintain (and grow) an industrial base.
- The offshore Sydney Basin has storage potential but it has never been definitely evaluated due to lack of well data
- Sea Blue- 1 will provide the opportunity to start to cost-effectively assess CO<sub>2</sub> storage potential.
- Confirmation of offshore geological storage potential would be a game changer for NSW and its NZE target





Thank you





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