Offsets for onshore shale gas in the Northern Territory

Knowledge Transfer Session

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CSIRO | Australian Government, Department of Industry, Science, Energy and Resources | Queensland Government | NSW Government | Supported by Government of South Australia | Northern Territory Government | Australia Pacific LNG | QGC | origin | Santos

Responding to Recommendation 9.8

Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, (2018)

“That the NT and Australian governments seek to ensure that there is no net increase in the life cycle GHG emissions emitted in Australia from any onshore shale gas produced in the NT.”

Purpose

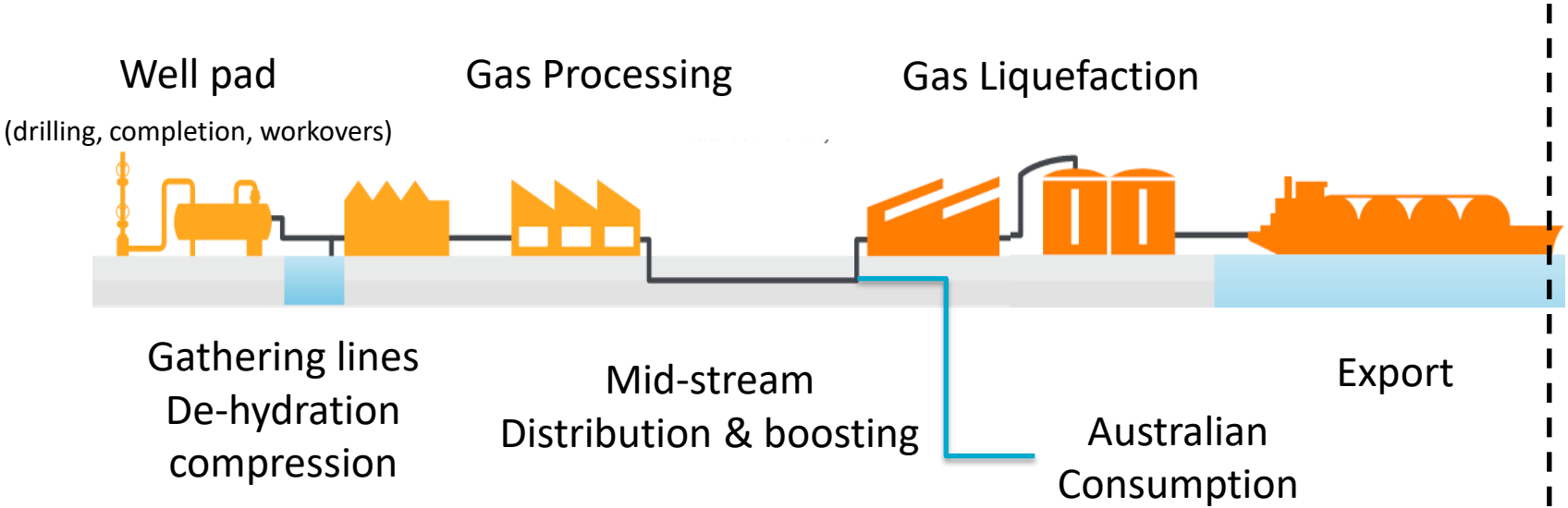
This *is* about:

- Responding to dual aspirations of NT in developing gas and also decreasing greenhouse gas emissions
- Australian greenhouse gas (GHG) emissions from production and consumption of onshore shale gas in the NT

Not about

- Water use or water impacts
- Economic benefits of gas development
- Research on communities, impact on people
- A stage in the formal approval of gas development

Physical scope

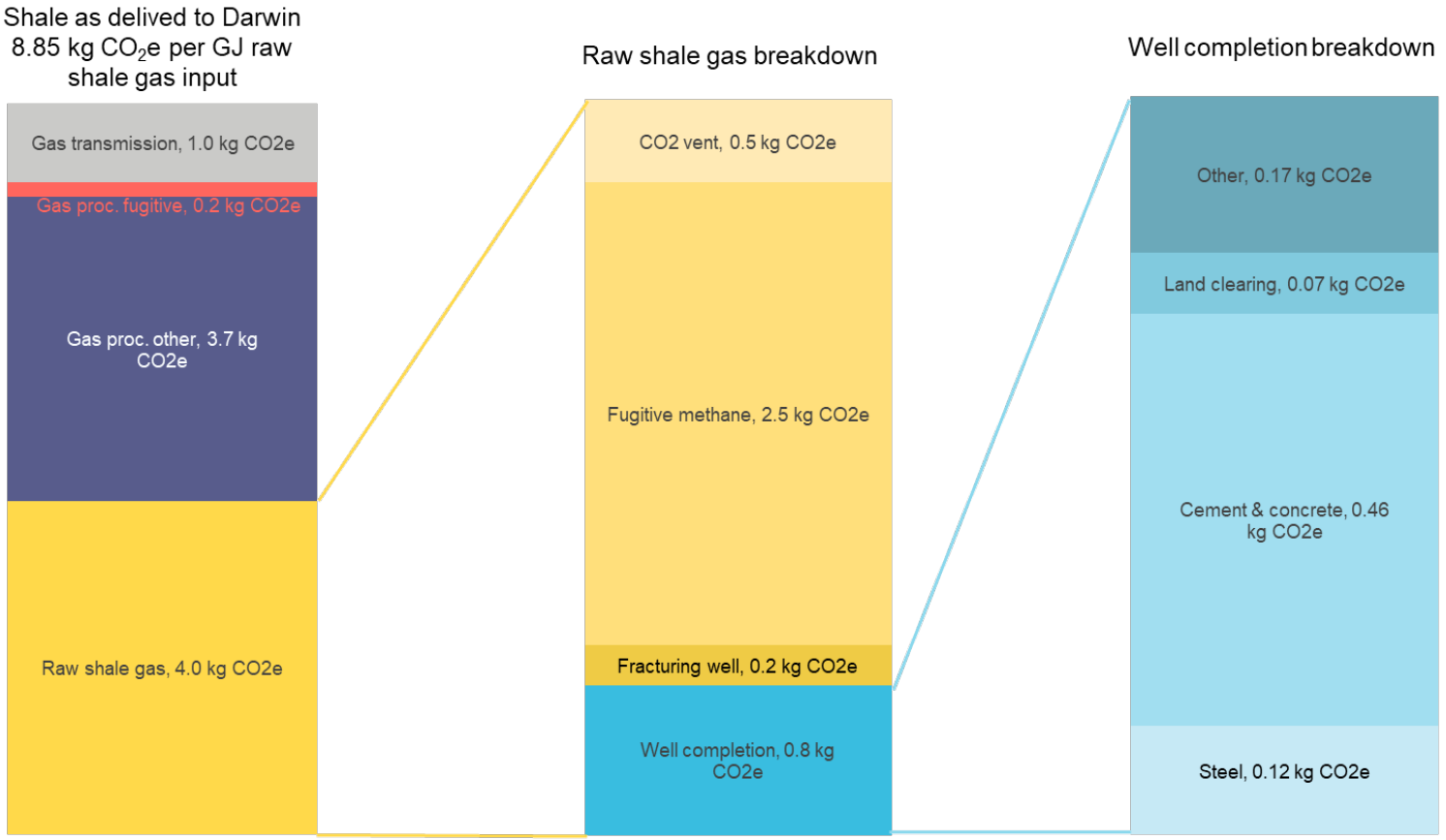


Scenarios of shale gas utilization

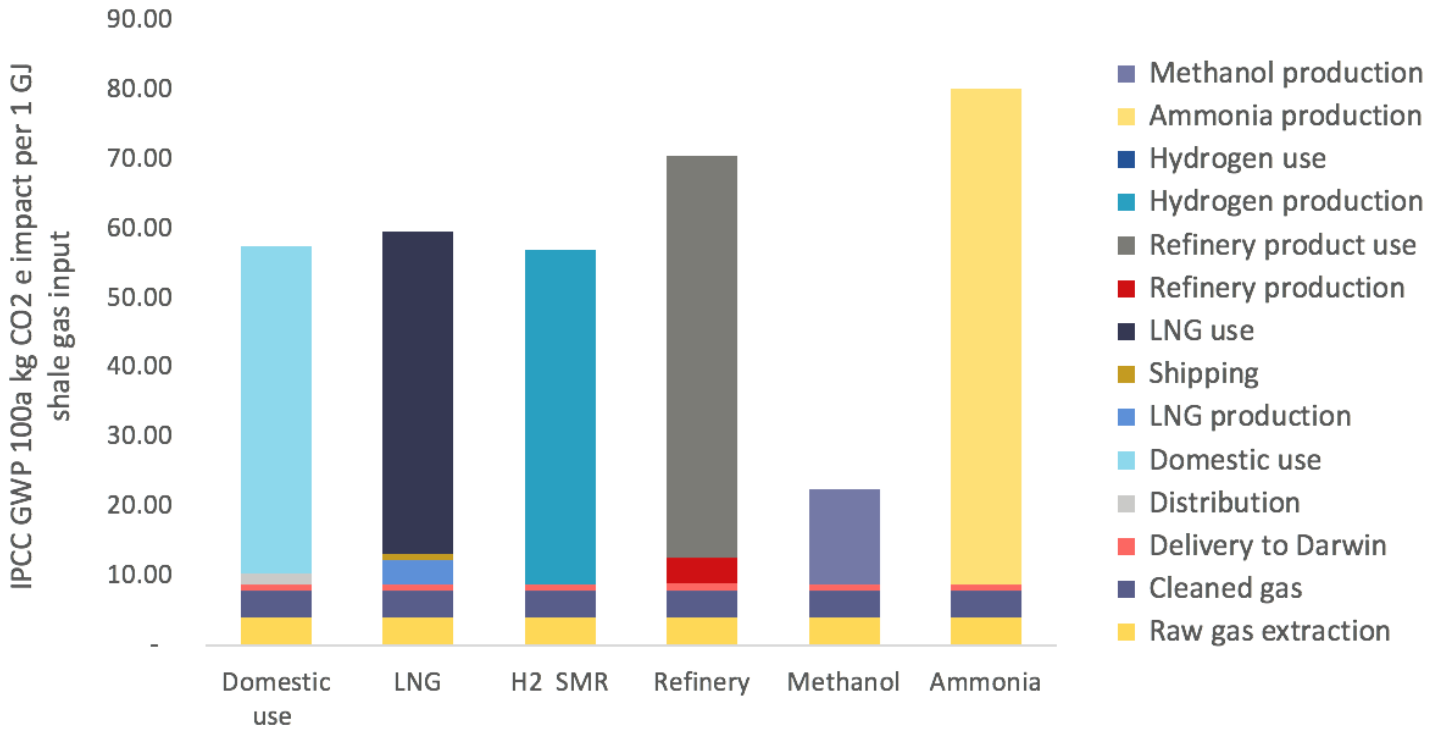
Scenarios of onshore shale gas production and use (PJ/year) – assumed for 25 year life

Scenario name	Output (PJ/year)	Domestic gas supply (PJ/year)	Refinery products (PJ/year)	LNG for export (PJ/year)	Methanol and Ammonia (PJ/year)	Hydrogen (PJ/year)
Sc1 Dom. gas, LNG	365	45		320		
Sc2 Dom. gas, LNG & refinery	365	45	120	200		
Sc3 Dom. gas, LNG & chemicals	365	45		200	120	
Sc4 Dom. gas, LNG & hydrogen	365	45		200		120
Sc5 All	1130	45	120	725	120	120

Upstream emissions intensity breakdown



Total GHG emissions intensity



Results – emissions: the big numbers

Total greenhouse gas emissions by scenario in Mt CO_2 e over 25-year life.

	Gas production	Transmission	Manufacturing	Domestic use	OFFSET NEEDED	Overseas use	Total
Sc1 Dom. gas & LNG	72.1	8.7	28.2	54.7	**164**	377.8	541.5
Sc2 Dom. gas, LNG & refinery	60.5	5.8	43.4	228.5	**338**	236.1	574.4
Sc3 Dom. gas, LNG & chemicals	72.1	8.7	145.1	54.7	**281**	236.1	516.8
Sc4 Dom. gas, LNG & hydrogen	72.1	8.7	161.9	54.7	**297**	236.1	533.5
Sc5 All	211.6	24.1	361.5	228.5	**826**	855.9	1,681.6

Approximately 5-10% of Australia's carbon budget to hold global warming to 1.5°C

Results – emissions: the big numbers/year

Total greenhouse gas emissions by scenario in Mt $CO_{2\text{-}e}$ per year.

	Gas production	Transmission	Manufacturing	Domestic use	OFFSET NEEDED	Overseas use	Total
Sc1 Dom. gas & LNG	2.9	0.3	1.1	2.2	**6.6**	15.1	21.7
Sc2 Dom. gas, LNG & refinery	2.4	0.2	1.7	9.1	**13.5**	9.4	23.0
Sc3 Dom. gas, LNG & chemicals	2.9	0.3	5.8	2.2	**11.2**	9.4	20.7
Sc4 Dom. gas, LNG & hydrogen	2.9	0.3	6.5	2.2	**11.9 (8.8)**	9.4	21.3
Sc5 All	8.5	1.0	14.5	9.1	**33.0**	34.2	67.3

What are some mitigation & offset options

Mitigation in production

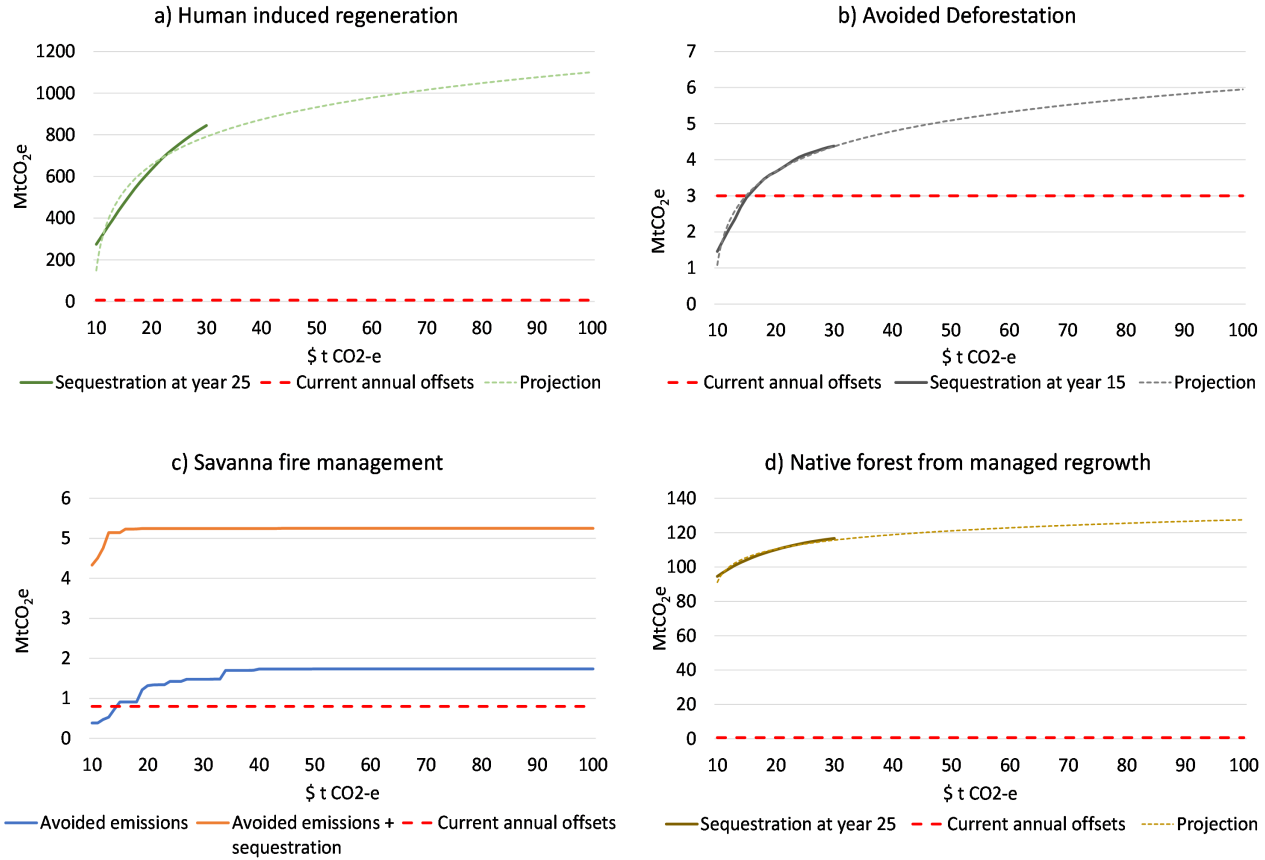
- Avoid using gas to power operations – use low bleed pneumatic controllers
- Electrification of infrastructure
- Renewable energy with storage for electricity supply
- Fast diagnosis and fixing of abnormal operational emissions – digital twin

Offset options at $30/tonne of CO2-e abated (approximate numbers)

- Human Induced Regeneration — 37 Mt CO2-e/year
- Reforestation, managed native forests, regrowth — 4.8 Mt CO2-e/year
- Savanna fire management — 1 - 5 Mt CO2-e/year

... Converting methane to hydrogen and using carbon capture and storage

Land-based offsets: there's only so much…



Offsets – Carbon Capture and Storage

Could store ~10Mt CO2/year

Need to store > 3Mt CO2/year from Blue Hydrogen in Darwin

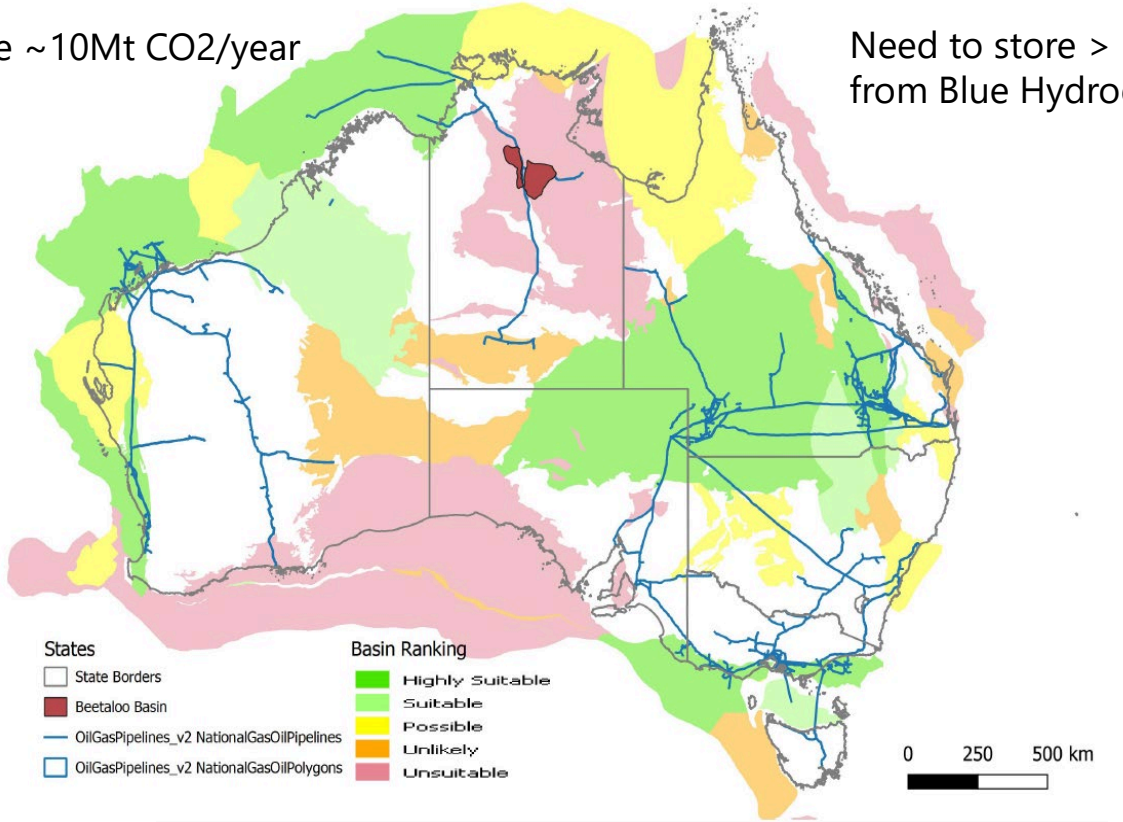
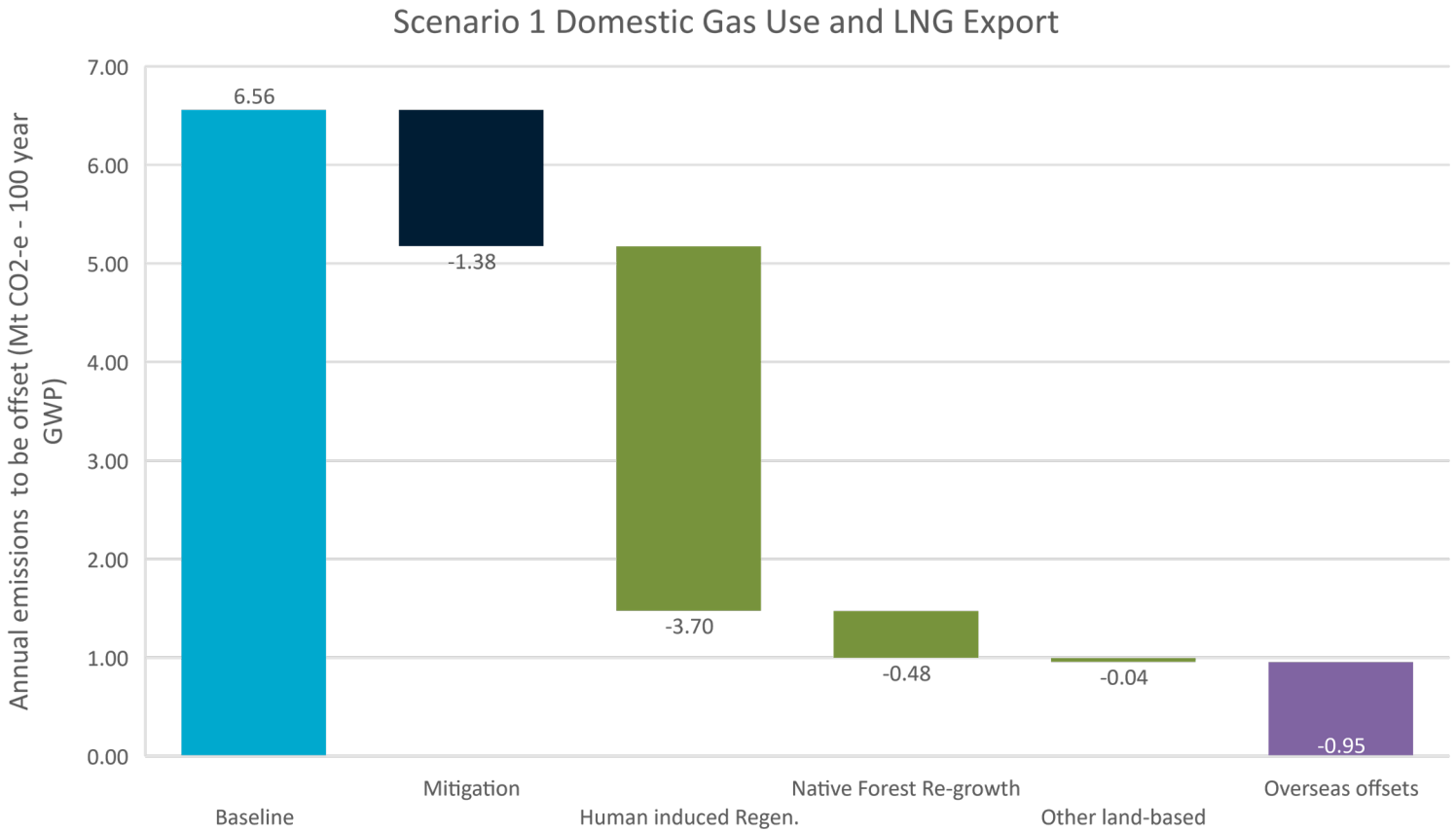


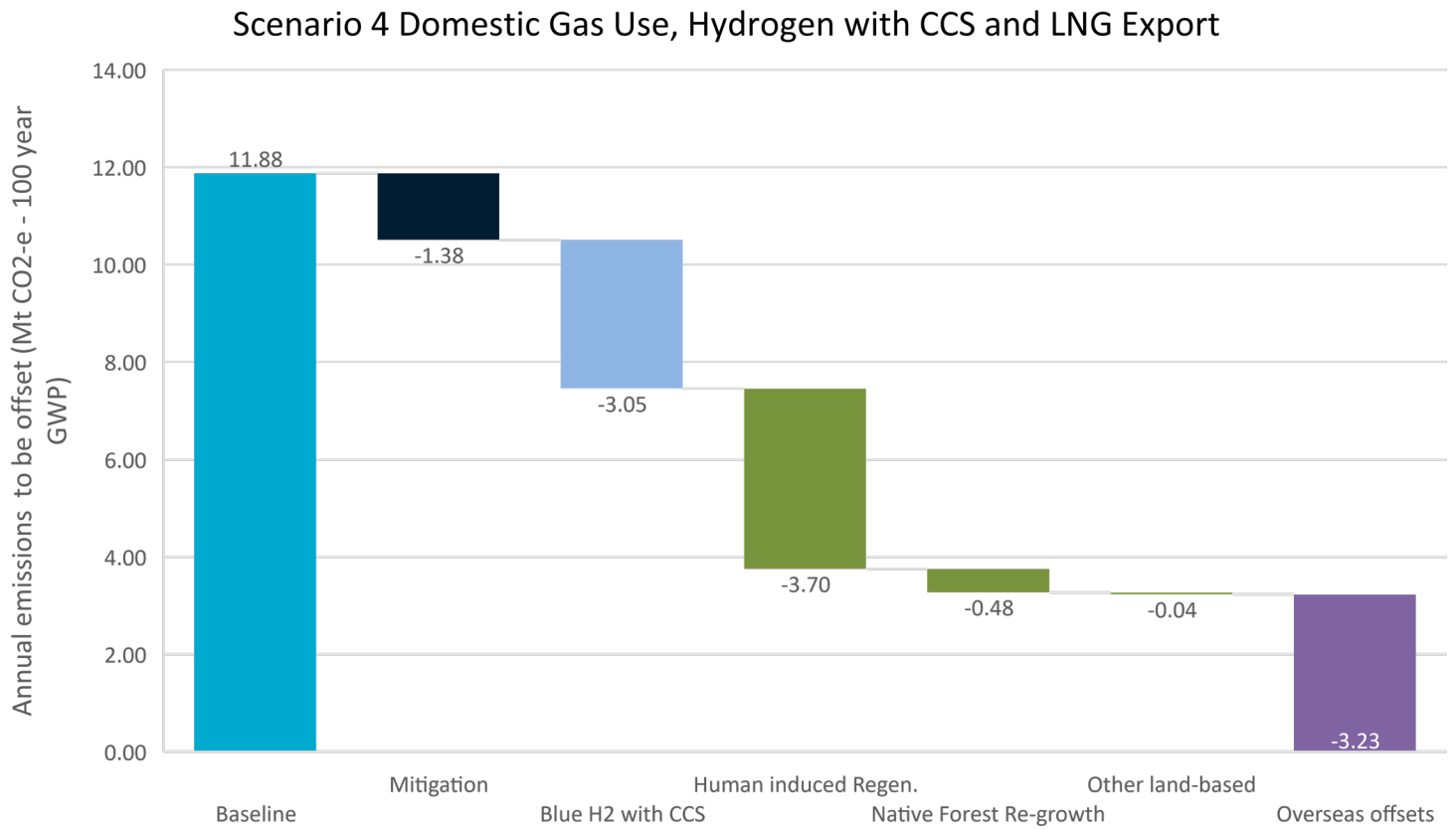
Figure 4 location of basins for carbon capture and storage (CCS) relative to Beetaloo Sub Basin (in red) and existing oil and gas pipelines (blue).

International Offset Schemes

Synthesis


Scenario 1 Domestic Gas Use and LNG Export
Annual emissions to be offset (Mt CO2-e - 100 year GWP)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
6.56
-1.38
-3.70
-0.48
-0.04
-0.95
Baseline
Mitigation
Human induced Regen.
Native Forest Re-growth
Other land-based
Overseas offsets

Synthesis


Scenario 4 Domestic Gas Use, Hydrogen with CCS and LNG Export
Annual emissions to be offset (Mt CO2-e - 100 year GWP)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
11.88
-1.38
-3.05
-3.70
-0.48
-0.04
-3.23
Baseline
Mitigation
Blue H2 with CCS
Human induced Regen.
Native Forest Re-growth
Other land-based
Overseas offsets

Conclusions

- Total needed to be offset ~**164 – 338 Mt CO2-e over 25 years** or **6.6 – 13.5Mt CO2-e/year**
- Mitigation and alternative gas products could reduce the need for land-based and other offsets
- **Mitigation** – investment in renewable power but possibly cheaper than offsets over the long-run
- **Blue Hydrogen** increasing in demand and will be cheaper than Green Hydrogen at scale until 2035-2040 – **need to secure > 3 Mt/year CCS for 25 years**
- **Land based offsets**: possible but there's a limit on supply even at high carbon prices, and already some market saturation
- Unless a Beetaloo gas project can obtain >~10-20% of Australia's land-based offsets, then overseas offset schemes would be needed to cover 15-30% of annual emissions from onshore shale gas

Thank you