

This file contains several articles and reports from October 2021 describing doubts about Barossa and Bayu-Undan CCS.

<https://www.energyvoice.com/oilandgas/asia/357495/ccs-will-not-save-santos-barossa-lng-project-says-ieefa/>

CCS will not save Santos' Barossa LNG project, says IEEFA

Energy Voice, 20 October 2021.

Despite a proposed carbon capture and storage (CCS) scheme, the Santos-led (ASX:[STO](#)) Barossa liquefied natural gas (LNG) project in Australia, will continue to release financially risky carbon dioxide emissions onsite, onshore and across the supply chain. This makes it one of the more expensive and dirtiest gas projects in the world, according to a new report from the Institute for Energy Economics and Financial Analysis (IEEFA).

[IEEFA's new report](https://ieefa.org/wp-content/uploads/2021/10/How-To-Save-the-Barossa-Project-From-Itself_October-2021_3.pdf) https://ieefa.org/wp-content/uploads/2021/10/How-To-Save-the-Barossa-Project-From-Itself_October-2021_3.pdf claims that investing in unproven and economically unfeasible carbon capture (CCS) technologies will not only delay the Barossa project and significantly increase project costs – polluting emissions will still be released into the climate across the LNG producing operation and supply chain – making the company's net zero target simply “greenwash”.

See p.3

Chemical engineer and IEEFA guest contributor John Robert said that while operator Santos is desperately trying to bend its Barossa proposal into a zero carbon project, it's simply not possible.

“Barossa gas has an unusually high carbon dioxide content which makes the project possibly the dirtiest in the world,” said Robert.

“Whichever way you look at it, Santos' proposed Barossa project is an emissions factory with an LNG by-product – there's going to be more waste than product.”

Moreover, Santos is reportedly unlikely to commit investment into CCS for Barossa until government-backed carbon credits “make it stack up economically”.

Robert goes one step further in his report, suggesting that instead of just making announcements to attract investors and subsidies, Santos should be required to show that it can implement the CCS scheme as part of the Barossa development and to demonstrate its satisfactory operation before commencing exports of Barossa gas as LNG at Darwin in northern Australia.

“The proposed capture and storage adds substantially to the Barossa project's costs, complexity, risks, lengthens its schedule, and thus diminishes its viability,” said Robert.

The report notes the majority of the project's emissions arise from combustion, and suitable capture processes are not economically feasible either onshore or offshore.

“The modifications and new infrastructure required – and yet to be approved – across the project development would be too costly and sure to delay the project beyond its planned 2025 start date,” noted Robert.

Earlier this year, Santos' announced that it planned to use East Timor's ageing Bayu Undan field for a CCS project in the Timor Sea.

"Santos' current partner in Barossa, South Korea's SK E&S, and potential partner Japan's Jera, plus Santos' partners in Bayu-Undan including Italy's Eni, South Korea's SK E&S and Japan's Inpex, Jera and Tokyo Gas should all heed these warnings," warned Robert.

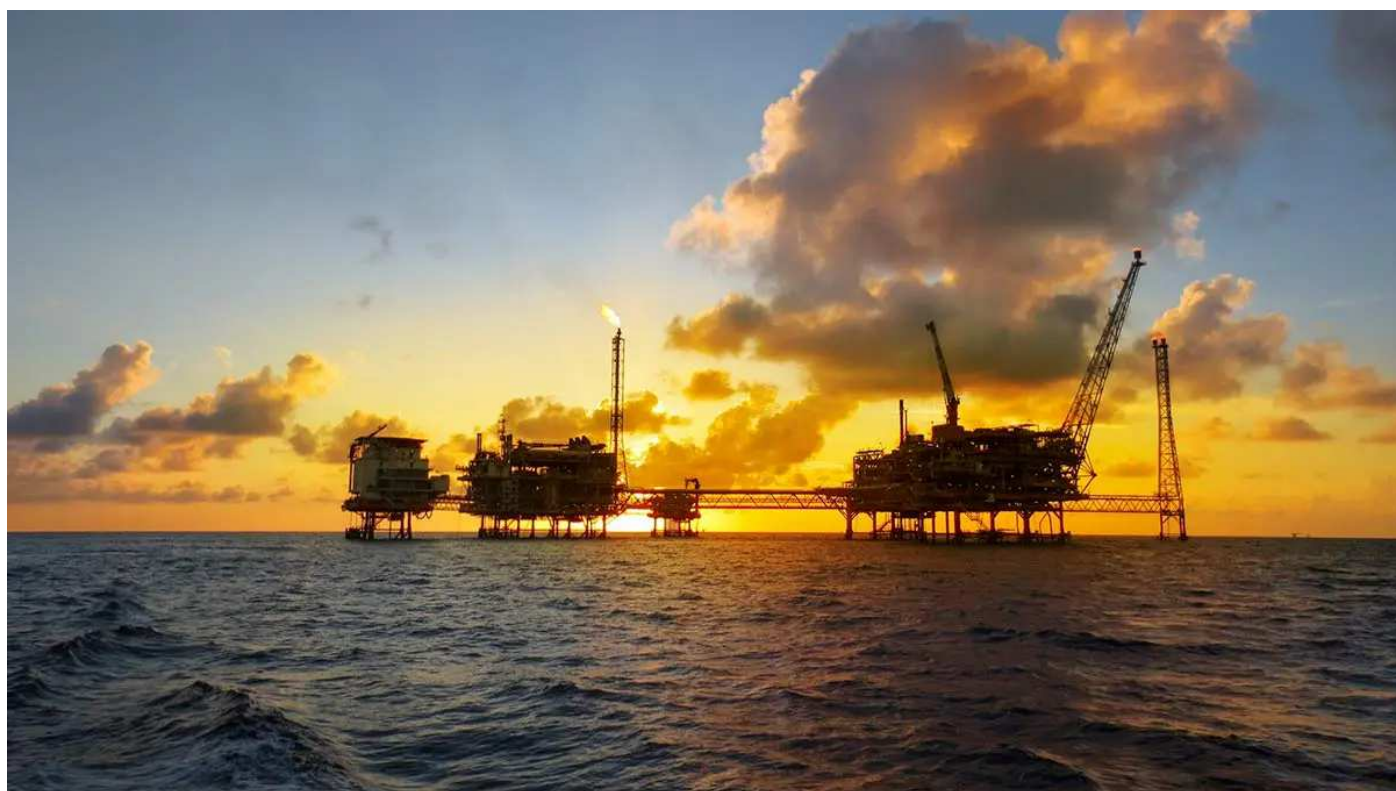
"The carbon dioxide (CO₂) content of Barossa gas is extremely high – about twice that of the next highest gas resources currently being converted to LNG in Australia. It is also much higher again than the gas feeding LNG plants in competitor LNG exporting countries – in a market growing increasingly sensitive to emissions arising from its purchases," noted IEEFA.

"The average emissions intensity of Australian-made LNG is approximately 0.70 tonne CO₂ per tonne of LNG produced, whereas LNG from the Barossa project would have an emissions intensity of 1.47 tCO₂/t LNG before it is transported and burnt in North Asian markets. That makes both the product and the project itself in need of being saved or abandoned, as the majority (57%) of emissions are from combustion, and capture of that is not practical," according to the IEEFA report.

"Unlike Chevron at its Gorgon CCS project, this time around Santos should be obliged to be as good as its word and be required to implement the CCS scheme as part of the Barossa development and to demonstrate its satisfactory operation before reaching full LNG output at Darwin and commencing exports of Barossa gas as LNG," said IEEFA.

Carbon capture and storage won't save Santos' new LNG "emissions factory"

John Robert (<https://reneweconomy.com.au/author/john-robert/>) 23 October 2021



Emissions, logistics and pure economics – combined or individually – pose strong arguments against the Barossa gas project in the Timor Sea.

Producer Santos, in proposing carbon capture and storage to reduce the project's climate impact, has added an impractical Band-aid solution to a haemorrhaging issue.

The LNG project looks like an emissions factory with an LNG by-product.

From offshore wells to initial processing on a floating production storage and offloading (FPSO) vessel, piping 300km to Darwin and onshore processing and conversion to LNG at the Darwin plant, CO2 emissions exceed the LNG production.

Add extra compression and piping and pumping of the proposed captured CO2 into the near-depleted Bayu-Undan gas field, and the project also looks even more economically and technologically impractical.

Barossa gas has an extremely high carbon dioxide content – about twice that of the next highest gas currently being converted to LNG in Australia. It is also much higher again than the gas feeding LNG plants in competitor LNG exporting countries.

Last month, Santos announced it would assess carbon capture and storage in depleted gas reservoirs at Bayu-Undan, 500km west of Darwin, to reduce emissions from the Barossa project.

The average emissions intensity of Australian-made LNG is approximately 0.70 tonne of CO2 per tonne of LNG produced. LNG from the Barossa project would have an emissions intensity more than double that amount *before* it is transported and burnt in North Asian markets.

The majority (57%) of the project's emissions are from combustion in gas turbines, and capture of CO2 from the dilute exhaust is not practical.

Combustion emissions come from burning some of the raw gas arriving at the FPSO, and then more again at the Darwin LNG plant, as fuel to power the purification, liquefaction, product loading and all the other needs of the two sites.

Almost complete removal of CO2 is necessary before gas can be processed to liquefied natural gas (LNG) product.

The first stage of the proposed CO₂ removal would occur offshore on the FPSO, reducing the CO₂ content from 18 volume percent (v%) to 6v% before the gas is sent by pipeline to Darwin.

The second stage of CO₂ separation would take place at the onshore Darwin LNG plant – from 6v% to almost zero.

The CO₂ removed ('captured' from the methane stream) is simply vented to the atmosphere by design, as in all gas processing and LNG plants, and falsely reported as 'fugitive' emissions.

The capture and storage of CO₂ from the Barossa project would add substantially to the project's costs, lengthen its schedule and diminish its viability due to numerous factors.

If the proposal for capture were to go ahead, major changes to the project would need to be undertaken.

The FPSO, currently understood to be in the detailed design phase, would need redesign to include CO₂ drying and compression.

The project would need an additional 430km pipeline to carry captured CO₂ from Barossa to BayuUndan (and approval sought).

The depleted gas reservoirs at Bayu-Undan must be 'proven' good for permanent CO₂ storage, to be followed after implementation by regular seismic survey to monitor the spread of CO₂ in the reservoir.

The existing compressors on the Bayu-Undan platforms would be unsuitable for CO₂ recompression, and different types would be required.

If gas production at Bayu-Undan has completely ceased when the CO₂ storage phase begins, the compression gas requirements might have to be supplied from the existing gas export line from Bayu-Undan to Darwin, with backflow occurring from the junction with the new Barossa line.

The reservoir gas component of approximately 0.5 MtCO₂/yr captured from the LNG plant feed gas would hardly justify a 500km pipeline to Bayu-Undan for reinjection and storage.

A study (https://ieefa.org/wp-content/uploads/2021/10/How-To-Save-the-Barossa-Project-From-Itself_October-2021_3.pdf) just released by IEEFA compares the base case for the Barossa to Darwin LNG development as approved by NOPSEMA with the CCS alternative scenario and a potentially more effective one – electrification.

The table shows the annual quantities of emissions from the four sources in the project (onshore and offshore, combustion and captured and vented) for the three scenarios.

Table 1: Barossa Project Emissions – Summary of Scenarios and Emissions

Scenario	Offshore at Barossa MtCO ₂ pa		Onshore at DLNG MtCO ₂ pa		Total MtCO ₂ pa	Emissions intensity
	Vent	Combustion	Vent	Combustion		tCO ₂ /tLNG
A: OPP base	1.8	1.6	0.5	1.5	5.4	1.47
B: plus CCS	0	1.9	0.5	1.5	3.9	1.06
C: Electrification plus CCS	0	0	0.5	0	0.5	0.14
				Australian Average		0.7

(<https://reneweconomy.com.au/wp-content/uploads/2021/10/JohnRobertTable.jpg>)

All in all, this makes both the Barossa LNG product and the development project itself in need of being reconsidered or abandoned.

John Robert is a guest contributor with the Institute for Energy Economics and Financial Analysis (IEEFA)

IEEFA Update: Santos won't solve the problem of Barossa LNG with carbon capture and storage

Institute for Energy Economics & Financial Analysis

Guest Contributor: John Robert. October 20, 2021

Leaving the 'dirty' gas in the ground might now be the best course of action

20 October 2021 (IEEFA Australia): Even if it employed carbon capture and storage, Barossa gas will continue to release financially risky carbon dioxide emissions onsite, onshore and across the supply chain, making it one of the more expensive and dirtiest gas projects in the world, finds a [new report from the Institute for Energy Economics and Financial Analysis \(IEEFA\)](#).

In summary:

Barossa gas has an unusually high CO₂ gas content -18 volume % or about twice that of the next dirtiest gas being made into LNG in Australia – Ichthys and Gorgon.

Most of the Barossa project's CO₂ emissions will be from combustion, which cannot be captured. CO₂ capture processes postcombustion are not currently economically feasible onshore, let alone offshore, anywhere in the world.

Using unproven carbon capture and storage (CCS) for the remaining portion of the emissions would still make the Barossa project the 'dirtiest' in Australia and possibly in the world.

Even with CCS, Santos' proposed Barossa project remains an emissions factory with an LNG by-product – more waste than product.

Australia's Barossa: High CO₂ LNG Development

Expensive emissions controls cannot bring CO₂ to zero

	Offshore at Barossa		Onshore at DLNG	
	Vent	Combustion	Vent	Combustion
Scenario A OPP Case	1.8	1.6	0.5	1.5
Scenario B CCS		1.9	0.5	1.5
Scenario C CCS + Electrification			0.5	Million tonnes CO ₂ pa

Sources: OPP, IEEFA calculations

IEEFA

Santos [recently](#) suggested it would reduce the high emissions of its Barossa gas found some 300kms north of Darwin in the Northern Territory, Australia, by injecting captured carbon dioxide (CO₂) into its nearly depleted Bayu-Undan gas field in the Timor Sea.

IEEFA's new report reviews this strategy against the original scope of the Barossa project and concludes that investing in unproven and economically unfeasible carbon capture technologies will not only delay the project and significantly increase project costs – polluting emissions will still be released into the climate across the LNG producing operation and supply chain, making the company's net zero target simply 'greenwash'.

Chemical engineer and IEEFA guest contributor John Robert says while operator Santos is desperately trying to bend its Barossa proposal into a zero carbon project, it's simply not possible.

"Barossa gas has an unusually high carbon dioxide content which makes the project possibly the dirtiest in the world," says Robert.

"Whichever way you look at it, Santos' proposed Barossa project is an emissions factory with an LNG by-product – there's going to be more waste than product."

Santos is reportedly unlikely to commit investment into CCS for Barossa until government-backed [carbon credits](#) 'make it stack up economically'.

Robert goes one step further in his report, suggesting that instead of just making announcements to attract investors and subsidies, Santos should be required to *show* that it can implement the CCS scheme as part of the Barossa development and to *demonstrate* its satisfactory operation *before commencing exports* of Barossa gas as LNG.

"The proposed capture and storage adds substantially to the Barossa project's costs, complexity, risks, lengthens its schedule, and thus diminishes its viability," says Robert.

The report notes the majority of the project's emissions arise from combustion, and suitable capture processes are not economically feasible either on- or off-shore.

"The modifications and new infrastructure required – and yet to be approved – across the project development would be too costly and sure to delay the project beyond its planned 2025 start date.

"Both the product and the project itself is in need of being saved or abandoned."

The International Energy Agency's recently released Net Zero to 2050 roadmap clearly states there must be no new oil and gas projects globally from 2021 if the world is to have any chance of reducing rapidly increasing emissions and getting anywhere close to 1.5 degrees Celsius, with the world now on a 3-4 degree C trajectory.

"The Barossa project is clearly a lemon and a stranded asset in the making," says Robert.

"The partner companies involved must rethink their backing of what Australian billionaire Dr Andrew Forrest has described as 'an atrocious project'.

"Santos' current partner in the Barossa, South Korea's SK E&S, and potential partner Japan's Jera, plus Santos' partners in Bayu-Undan including Italy's Eni, South Korea's SK E&S and Japan's Inpex, Jera and Tokyo Gas should all heed these warnings."

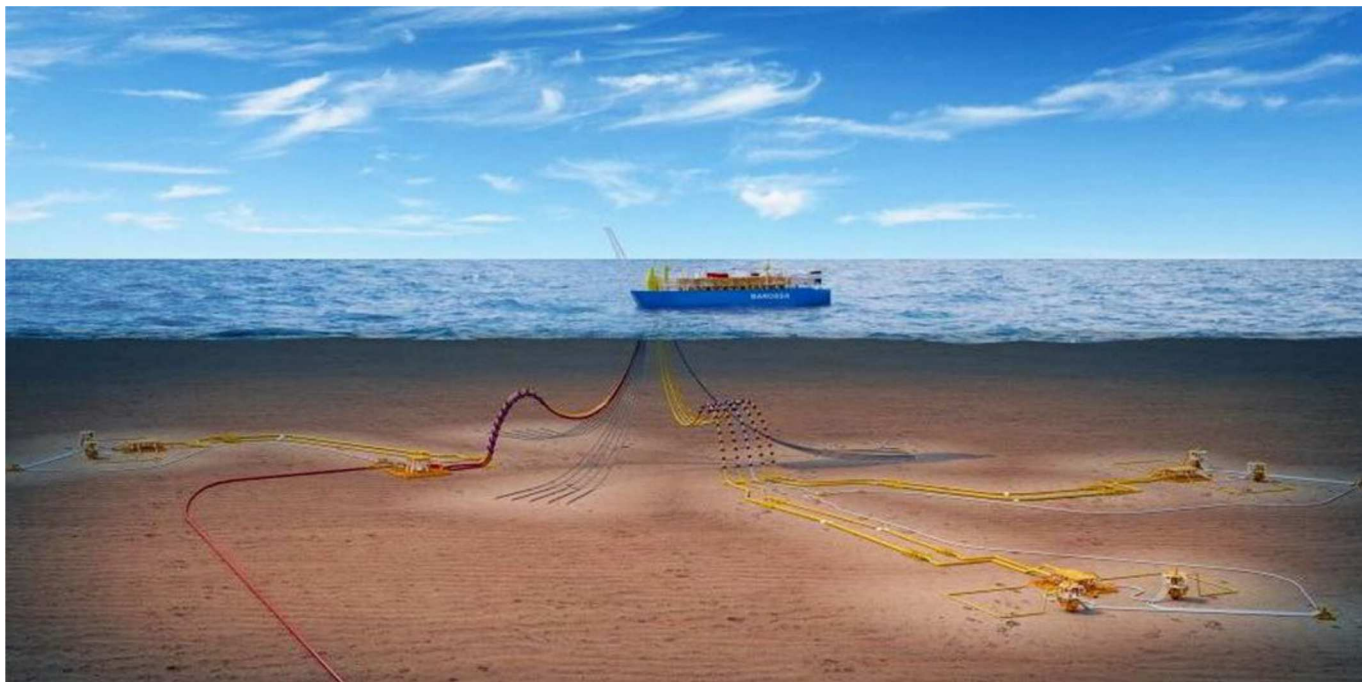
Read the report: [How to Save The Barossa Project from Itself – Carbon Capture and Storage Will Not Help as Barossa Gas Is High-CO2 Gas](#)

https://ieefa.org/wp-content/uploads/2021/10/How-To-Save-the-Barossa-Project-From-Itself_October-2021_3.pdf

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About IEEFA: The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends, and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. (www.ieefa.org)



High emitter: the current field development plan for Barossa without CCS Photo: SANTOS

CCS may not be enough to save Santos' Barossa LNG development from huge emissions

IEEFA report finds that even with carbon capture, Barossa would still be among the 'dirtiest' LNG developments in the world

21 October 2021 0:45 GMT *UPDATED* 21 October 2021 6:52 GMT

By [Josh Lewis](#) in **Perth**

The Santos-led Barossa development, offshore Australia's Northern Territory, could still emit large volumes of carbon dioxide, even with carbon capture and storage (CCS), according to a new report from the Institute for Energy Economics and Financial Analysis (IEEFA).

Barossa has a CO₂ gas content of roughly 18%, which IEEFA claims is roughly twice that of the next "dirtiest" gas in Australia being converted to liquefied natural gas.

Santos has recently indicated that it could utilise CCS to offset emissions at Barossa, launching [a study with Italy's Eni to explore utilising the nearly depleted Bayu-Undan field](#) in the Timor Sea to store captured CO₂ emissions from Barossa.

"The Barossa project is clearly a lemon and a stranded asset in the making"



CCS has key role to play in decarbonising LNG but concerted effort needed: Wood Mackenzie

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Without the use of CCS, IEEFA states Barossa would emit roughly 5.4 million tonnes per annum of CO₂, with an emissions intensity of 1.47 tonnes of CO₂ per tonne of LNG.

IEEFA claims CCS would only reduce emissions at Barossa by about 28%, emitting roughly 3.9 million tpa of CO₂, with an emissions intensity of 1.06 tonnes of CO₂ per tonne of LNG.

The report claims this would still make Barossa "the 'dirtiest' in Australia and possibly in the world" when it comes to emissions per tonne of LNG.

The report also warns that adding CCS to Barossa will add "substantially" to the project's costs, lengthen its schedule and "diminish its viability".

Turning Barossa net zero 'not possible'

Chemical engineer and IEEFA guest contributor John Robert, who wrote the report, claims turning Barossa into a net zero development is not possible.

"Whichever way you look at it, Santos' proposed Barossa project is an emissions factory with an LNG by-product – there's going to be more waste than product," he said.

"The modifications and new infrastructure required – and yet to be approved – across the project development would be too costly and sure to delay the project beyond its planned 2025 start date. Both the product and the project itself is in need of being saved or abandoned."

In order for CCS to be introduced at Barossa, it will require modification to the gas processing capabilities on the yet-to-be built floating production, storage and offloading vessel to include extra compression to send CO₂ by pipeline to Bayu-Undan.



Timor-Leste signs up in support of reshaping Bayu-Undan field

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Running that extra compression will also add to the power requirements of the FPSO, which IEEFA claims will add a further 20% to Barossa's offshore combustion emissions, taking them to about 1.87 million tpa.

It claims that capturing these emissions from power generation is unlikely to be feasible "as the exhaust stream from a gas turbine is quite dilute in CO₂ and suitable capture processes are not currently economically feasible onshore, let alone offshore".

It also claims the extra space required on the FPSO for the additional compression could require a major redesign to the layout of the processing space, or even to the FPSO vessel itself.

With the FPSO already potentially in the detailed design phase, IEEFA claims such a rework to the layout or design now would be expensive.



Current proposal: a visual of the proposed Barossa FPSO Photo: SANTOS

The report also warns that compression would be needed at Bayu-Undan, further increasing the cost of the project, with the existing compressors on the Bayu-Undan platforms unsuitable for CO₂ recompression.

IEEFA also claims that combustion emissions form a major part of the 2.05 million tpa of CO₂ it estimates will be released into the atmosphere from the onshore Darwin LNG plant, which, just as for the offshore combustion emissions, are unlikely to be feasible to capture.

Roughly 500,000 tpa of CO₂ could be captured from the reservoir gas at the plant, however, IEEFA adds it would be hard to justify the 500 kilometre pipeline from Darwin to Bayu-Undan for re-injection and storage of such a small volume.



Santos looks to move on Moomba with Australian CCS projects now able to generate carbon credits

[Read more](#)

"The Barossa project is clearly a lemon and a stranded asset in the making," Robert said.

"Santos' current partner in the Barossa, South Korea's SK E&S, and potential partner Japan's Jera, plus Santos' partners in Bayu-Undan including Italy's Eni, South Korea's SK E&S and Japan's Inpex, Jera and Tokyo Gas should all heed these warnings."

Electrification with CCS

IEEFA did highlight a way Santos could reduce emissions from the project to as little as 500,000 tpa, with a carbon intensity of just 0.14 tonnes of CO₂ per tonne of LNG.

This would require the use of CCS as well as electrification — utilising renewable electricity to drive electric motors instead of burning gas for all the compression and other power needs of the project, both onshore and offshore.

However, this would require a long-term power purchase agreement with a renewable energy supplier near Darwin.

Santos betting big on carbon capture in bid to drive down emissions

[Read more](#)

“An agreement for supply to a continuous load of about 250 megawatts may be attractive to a domestic renewable power supplier and should be able to provide an economic price for the LNG producer,” the report claims.

High voltage direct current cables would then need to be laid from Darwin to the Barossa FPSO and to the Bayu-Undan platforms to supply the power, while the Darwin LNG plant would also need to be converted to all electric drives, adding additional costs.

This would still see 1.82 million tpa of CO₂ captured offshore and sent for storage at Bayu-Undan, however, the same feasibility issues remain for sending the roughly 500,000 tpa of CO₂ captured from the LNG plant feed gas to Bayu-Undan, with IEEFA assuming those emissions would still be vented.



Long distance: the Darwin LNG plant lies roughly 500 kilometres away from Bayu-Undan Photo: SANTOS

Santos' CCS credentials being challenged in court

IEEFA's report comes as [Santos is currently facing legal action from shareholder advocacy organisation the Australasian Centre for Corporate Responsibility \(ACCR\)](#), which is challenging the company's plan to reach net zero emissions by 2040.

Climate litigation could do more harm than good

[Read more](#)

The lawsuit hones in on CCS in particular, claiming more than 80% of Santos' net zero plan relies on the technology, which the ACCR claims is unreliable.

IEEFA notes in its report that Santos could do away with the CCS component altogether at Barossa and instead rely on electrification alone to reduce emissions.

It claims that electrification from renewable energy would reduce emissions to about 2.33 million tpa, with an emissions intensity of 0.63 tonnes per tonne of LNG, which it noted was below the average of 0.7 tonnes of CO₂ per tonne of LNG across Australian LNG projects.

While this could eliminate the risk of CCS failure, IEEFA notes extra investment and operating costs will still be required.

A Santos spokesperson declined to comment when contacted by Upstream for a response to IEEFA's report, while also declining to comment if electrification was an option currently being explored to further reduce emissions at Barossa. ([Copyright](#))