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Woodside's North West Shelf gas extraction project extension: a case study in how opacity in Australia's Safeguard Mechanism increases costs to other companies as it enlarges the mitigation challenge

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Abstract

Woodside's North West Shelf gas facility was recently granted conditional approval to continue operations until 2070. Should the project receive the final go-ahead, followed by an approval of Woodside's connected Browse-to-North West Shelf offshore gas project, significant quantities of greenhouse gases would be released over a roughly 40-year period, points on public record. The novel contribution of this work is to appraise such a scenario's impact on other Australian companies participating in the Safeguard Mechanism (SGM), the country's program with cap-and-trade characteristics, designed to reduce emissions from the highest-emitting industrial facilities.

Here, we use statistical approaches to extend Australian Government emissions projections relating to all SGM-covered facilities, for the twenty-year period leading up to 2050. In doing so, we assess the share of declining annual gross emissions taken up by both these projects, should they be actualised. Extending this, we use publicly available carbon credit price projections and internal abatement costs to estimate the total costs associated with the additional mitigation burden imposed on other SGM-participating companies.

We estimate that in the 20-year period from 2031 to 2050, additional on-site abatement and offsets will cost A$60.9 billion for all companies participating in the SGM, A$5.73 billion for the current highest emitting company, Chevron, and A$276 million for the company owning a hypothetical Safeguard-covered facility with mean annual emissions.

We relate this to the opacity behind modelled assumptions informing the baseline calculation that sets the rate at which SGM-covered facilities are expected to decarbonise. This is contextualised within the ambition associated with Australia's Nationally Determined Contribution pledges, as well as the overall climate mitigation challenge. We posit that including new high emitters while keeping net-zero aligned interim targets steady, would mean other companies must reduce their facilities' emissions

more steeply to compensate. Finally, we argue for greater modelling transparency in setting components of the SGM baseline calculation, and that the SGM should be a vehicle to accelerate progress from an already credible decarbonisation trajectory—not a corrective mechanism for flawed approval decisions.

1. Introduction

The North West Shelf (NWS) project, operated by Woodside, is one of the world's largest liquefied natural gas (LNG) developments, anchored by the Karratha Gas Plant (KGP) and a network of offshore gas fields. As the third largest emitter by industrial facility in Australia (financial year 2024), the NWS project is subject to the Safeguard Mechanism (SGM), the country's scheme designed to cap and reduce emissions from high-emitting industrial facilities, on a pathway to net-zero emissions by 2050.

In May 2025, the Australian Government granted conditional approval for a 40-year extension to the NWS project, permitting operations beyond the original expiry date of 2030, through to 2070. Woodside was initially given 10 days to respond to the conditions, which concerned the project's generation of air pollution that threatens the nearby Murujuga rock art precinct, hosting ancient Aboriginal rock art in the Murujuga National Park. The response deadline has been extended since, and at time of publication, no further developments were on the public record.

In the interim, at least three legal challenges have been initiated. First, the Friends of Australian Rock Art (FARA) are seeking judicial review of Western Australia's (WA) Environmental Protection Authority's (EPA) recommendation to approve the extension. FARA argues that the EPA failed to adequately consider the project's climate impacts, including Scope 3 emissions, or emissions from the downstream combustion of exported LNG, domestic gas, condensate, and LPG. Second, Traditional owner Ms Raelene Cooper is seeking to compel Minister Watt to make a decision on a section 10 application under the Aboriginal and Torres Strait Islander Heritage Protection Act, in relation to special heritage protection of Murujuga. Finally, the group Doctors for Environment is seeking a judicial review of waived project approvals by the National offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.1 A general critique of the conditional approval decision

There are multiple entry points for critique of this decision. The existing project has long drawn criticism for contributing relatively little to public coffers, due to perceived shortcomings of the Petroleum Resource Rent Tax. Its network of offshore gas fields are in the vicinity of a biodiverse marine region, and further development of connected offshore gas fields risks oil and gas leaks, and wastewater and chemical discharge. However, on climate grounds alone, the extension is deeply concerning, most acutely around Scope 3 emissions.

According to Woodside's own estimates (Woodside, 2019a), the extension could result in up to 80.19 million tonnes (Mt) of Scope 3 carbon dioxide equivalent (CO_2-e) emissions per year, resulting in approximately 3,200 Mt over its 40-year operational life. In this context, approval of the NWS undermines the global aspiration of limiting global warming as much as is fair and feasible. It also reinforces concerns about Australia's role in prolonging fossil fuel dependence, with this decision following over a decade of rapid growth in Australia's LNG exports (Australian Government, 2024). On the international stage, such credentials would undoubtedly entrench its reputation as a climate laggard, placing it alongside dominant LNG-exporting authoritarian nations like Russia and Qatar.

In addition, the extension decision reflects an overestimation of the economic case for continued LNG dependence in a low carbon global economy, with Woodside's gas projects both underperforming and not in alignment with Paris Agreement (PA) targets (Australasian Centre for Corporate Responsibility, 2024). There is significant risk of stranded assets if the energy transition continues to accelerate or if climate policy strengthens in response to shifting public sentiment.

Article 4.3 of the PA calls for the progression of NDCs that reflect each Party's 'highest possible ambition', while Article 4.4 calls on developed countries to adopt 'economy-wide absolute emissions reduction targets'. In this context, approving new gas extraction and processing facilities effectively lowers the ceiling on domestic ambition and weakens the basis for strengthening future international commitments—including expectations of setting raised climate mitigation targets. If upstream gas fields are granted approval, NWS will continue operating until 2070, two decades after the global net-zero target is supposed to be reached.

1.2 An extension with final approval opens the door to new gas fields

The extension was justified by Woodside on the basis that it would enable the processing of third-party gas (Woodside, 2025a). Woodside has acknowledged "gradual reservoir decline" across its NWS fields, reflected in steadily falling Scope 1 emissions since 2016 and the shutdown of one of five trains at KGP. This is despite the completion of the Pluto-KGP interconnector in 2022, which allows gas from the Pluto LNG facility to be redirected to spare processing capacity at KGP. Gas reserves at the offshore Pluto and Xena gas fields, which send gas to Pluto LNG, are also known to be declining, with volumes from the Scarborough gas field under development projected to satisfy Pluto LNG's 8 million tonnes per annum (MTPA) capacity.

As such, current and projected gas volumes relating to the NWS-Pluto architecture are considered insufficient to justify the 40-year extension of the NWS Project on their own. Nevertheless, Woodside points to the interconnector's role in leveraging "future excess capacity at KGP" and its "potential to accelerate future developments of other offshore Pluto gas reserves, as well as third-party resources." (Woodside, n.d.) This indicates that new upstream gas fields—yet to be approved by state and federal regulators—are essential if the project is to reach its stated production capacity of up to 18.5 Mt of LNG per year (Woodside, 2019a).

In this context, the NWS extension is a necessary enabler of expanded fossil fuel production—but it is not sufficient on its own to generate new emissions. These depend on future development approvals and commercial decisions. One such proposal is the Browse-to-North West Shelf (Browse)— first advanced by Woodside in 2018, it proposes to develop three new offshore gas fields in the Browse basin, including one near the ecologically sensitive Scott Reef. The project would involve piping gas approximately 900 kilometres for processing at the NWS project's KGP. Woodside estimates that Browse could produce up to 11.4 million tonnes per year of LNG, LPG, and domestic gas—representing a major potential contribution to restoring or maintaining full utilisation of KGP's capacity.

A separate but related proposal is the Browse Carbon Capture and Storage (CCS) Project, which was submitted for consideration under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act* in October 2024. It proposes capturing carbon dioxide from the reservoir gas stream for sequestration in a deep geological formation.

Both Browse and Browse CCS are backed by a separate Joint Venture from that associated with the NWS Project, although both Joint Ventures involve Woodside and are closely linked through infrastructure and processing plans. In its first quarter report for 2025, Woodside stated it continues to "advance key regulatory approvals and progress commercial discussions to process Browse volumes through the Karratha Gas Plant" (Woodside, 2025b)

The viability of the NWS extension is underpinned by future gas supply from undeveloped fields, including Browse, fields in the Greater Gorgon Basin, and other offshore and onshore resources. Gas could be routed to KGP either directly or via Pluto LNG infrastructure. Notably, the Browse development application was submitted in the same year (2018) as the NWS extension application, suggesting that the extension was premised on access to new upstream gas sources also driven by Woodside. At present, both Browse and the Browse CCS Project are advancing through state and federal approval processes, including environmental assessments and other project-specific regulatory requirements.

This sequence indicates a high degree of confidence in the eventual approval of a coordinated subsea-to-processing operation, spanning at least three separate project proposals, each subject to distinct regulatory processes. These efforts involve two Joint Ventures, both led by Woodside, with the possibility of additional future proponents and gas fields entering the arrangement.

In addition to Browse and the Greater Gorgon Basin, another major source of third-party gas could come from an emerging fracking industry in the Canning Basin, situated in the Kimberley, one of the world's most intact tropical savanna ecosystems. Perhaps the best-known of these efforts is the Valhalla fracking project proposal by Bennet Resources, a subsidiary of Black Mountain Energy. This proposal has progressed to an active WA EPA assessment for up to twenty exploration wells.

Alongside Valhalla, three other companies also have commercialisation plans for fracking projects in the region: Buru Energy, Theia Energy and Rey Resources (Climate Analytics, 2024). Collectively, their exploration licenses cover around 36,000 square kilometers of the Canning Basin. In a "large-scale development" scenario modelled by Climate Analytics, this area would support around 29 million tonnes per year of LNG production, resulting in between 3,200 and 3,900 Mt of Scope 1 and 3 CO_2-e emissions, over twenty years (Climate Analytics, 2024).

1.3 Scope 1 emissions are Australia's chief current policy lever

Gas from the Browse development would entail Scope 3 emissions of approximately 1,200 Mt over the 40-year period[1] the NWS extension is valid for (Woodside, 2019b). This figure represents a substantial portion of the approximately 3,200 Mt of Scope 3 emissions associated with the NWS project extension. However, under the territorial (or production-based) accounting approach used by both the PA and Australia's National Greenhouse Gas Inventory, countries are only responsible for emissions that occur within their own borders.

As a result, Scope 3 emissions are not counted against Australia's emissions targets, and the only current policy lever for climate mitigation are Scope 1 emissions. This leaves a black hole of moral accountability for fossil fuel exporting nations like Australia, with emissions embedded in fossil fuel exports far exceeding domestic emissions. It also makes additional climate impacts invisible in policy decision-making. Nevertheless, on the basis of their contribution to domestic emissions alone, and contextualised within the SGM, Scope 1 emissions warrant analysis.

Scope 1 emissions are measured and reported under the National Greenhouse and Energy Reporting scheme and form the basis for SGM compliance obligations. Under the SGM, net emissions limits known as baselines are designed to reduce over time, bringing down Scope 1 emissions. Facilities that emit below their baseline can generate Safeguard Mechanism Credits (SMC), which can be sold to facilities that emit above their baseline. This is designed to incentivise investment in on-site emissions reduction or abatement. To meet their net emissions obligations, facilities may surrender SMCs or Australian Carbon Credit Units (ACCUs), the latter most often representing emissions reductions or sequestration that occurs off-site. While net-zero by 2050 does not explicitly require ending fossil fuel exports or the Scope 3 emissions they generate, it implies a coordinated global effort will result in a substantial reduction in emissions over time.

1.4 Companies unwittingly compete for emissions space under the Safeguard Mechanism

In paving the way for future upstream gas developments, a final Woodside approval has strong potential to negatively impact other companies with facilities covered by the SGM.

[1] In Woodside's now outdated (with reference to the proposed start year) documentation, 11.4 million tonnes per year of gas (LNG, LPG and Domestic Gas) would generate up to 1,330 Mt of Scope 3 emissions over its extended operational life of 44 years. We adjust to match the 40-year project life of the NWS extension, assuming the rate of reservoir utilisation stays steady.

The SGM currently sets three net emissions targets: net-zero in 2049—50; a limit of 100 Mt net emissions in 2030; and a cumulative cap of 1,233 Mt total net emissions from 2021 to 2030. Adding new facilities to the SGM increases gross emissions under the scheme, but occurring pre-2030, wouldn't affect the rate at which individual facilities are expected to decarbonise in the period up to 2030, as reflected by the setting of baseline calculations applied over the 2024 – 2030 period.

To fully grasp how baseline calculation setting interacts with added emissions burdens, it is important to examine the process more closely. This calculation is production-adjusted, which means baselines fluctuate in relation to production levels, as reflected by Production Variables (PV) such as LNG, electricity or crude oil. Another key factor in baseline formulation is the decline rate, which ensures the SGM-wide aggregate baseline falls predictably over time, even as facility-level baselines fluctuate with year-to-year variable production levels. For all facilities except those with a special trade-exposed status, this decline rate has been set at 4.9% annually until 2030.

A formal review of the SGM is scheduled for 2026—27, incorporating Australia's revised Nationally Determined Contribution (NDC) for 2035, with any changes to take effect from 2031. The review is expected to inform the setting of a new five-year decline rate for the 2031—35 period, the last year of which coincides with the 2035 NDC. Thus, after 2030, decline rates will be applied in five-year blocks, aligned with the frequency of revising Australia's NDC under the PA's rachet mechanism.

These decline rates are modelled by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) based on projections of future emissions from unannounced and unapproved new, extended and expanded projects, assumed to be coming online. It appears this process of assumption-making and inclusions involves reviewing project status as reported in official publications—for example, the Office of the Chief Economist's annual Resources and Energy Major Projects—but also by receiving advice from state governments and facilities themselves, regarding the likelihood of unannounced and unapproved projects proceeding. In addition, where future global or domestic demand is projected for a given product, and this is expected to drive new project applications, unannounced projects may be assumed in emissions modelling. It is important to note, however, that the Clean Energy Regulator retains authority over how the SGM is administered and is not obligated to adopt any particular modelling outcomes.

An NWS approval may give modellers more confidence that the upstream gas projects required to fulfil KGP's production capacity will also be greenlit. Importantly, this modelling is opaque and not open to public scrutiny, nor the scrutiny of the Safeguard-participating companies the inclusion of these assumptions will impact.

If Australia maintains its existing mitigation ambition while adding major new point sources in the SGM, rather than lowering ambition accordingly, the next round of baseline setting would entail a relatively steeper decline rate relative to a scenario in which no new points sources are added. This would mean that, at the scheme-wide level, all facilities covered by the SGM would need to achieve baselines lowered more ambitiously each year. This would be achieved through a combination of additional on-site abatement or purchase of carbon credits, starting from 2031. On-site abatement may be especially burdensome for facilities in the hard-to-abate sector. In this way, the added emissions burden from projects such as Browse is redistributed to other facilities—effectively, they pick up the slack.

Despite this decision affecting their bottom lines, other companies in the SGM have not publicly challenged the conditional approval decision—this may arise due to a dearth of studies quantifying the cost of new SGM entrants to companies with existing facilities covered by the SGM.

Accordingly, we present analysis focused on projected Scope 1 emissions from a NWS project extension with final approval, as well as those associated with a hypothetical approval of the Browse development, both considered in the framework of the SGM. Specifically, we estimate the additional emissions reduction burden that would be placed on other covered facilities. Unless otherwise specified, presented years refer to financial years, for example, "2050" represents the financial year 2049—2050. This analysis draws on publicly available SGM facility-level emissions data (Australian Government, 2025a), as well as the latest national greenhouse gas projections to 2040 (DCCEEW, 2024), both published by DCCEEW.

2. Analysis

2.1 The NWS project extension

Woodside estimates the NWS project in at least the first 5 years of the extension period could emit up to 7.71 Mt CO_2-e per year of Scope 1 emissions (Woodside, 2019).[2] The emissions estimates are based on the NWS operating at full capacity, and as such it is important to note that maximum rather than average forecast values are represented.[3]

In its *Greenhouse Gas Management Plan* (Woodside, 2021), Woodside outlines the contribution of the NWS Project extension to the WA Government's aspiration of net-zero emissions by 2050. The plan includes "interim" Scope 1 emissions reduction targets, relative to a 2020[4] starting baseline of 7.71 Mt CO_2-e:

≤ 6.55 Mt CO_2-e per year by 2025;

≤ 5.39 Mt CO_2-e per year by 2030.

These emissions reductions are referred to as being based on a combination of: identified efficiency improvements; expected advances in emissions reduction technology; and current and anticipated gas reserves. Beyond the ≤ 5.39 Mt CO_2-e per year five-year goal, Woodside gives "aspirational" additional 5-year emissions reductions to net-zero (4.08; 2.70; and 1.35 Mt CO_2-e per year), and describes them as "uncertain" due to a range of factors. Therefore, for this analysis, we assume that emissions are maintained at up to 5.39 Mt per year from the 11th year of operation, continuing through the end of the operational life of the project.

We estimate that maximum Scope 1 emissions from the extended NWS project amount to 233 Mt CO_2-e over the 40-year operational life of the NWS project extension.[5] This does not include Scope 1 emissions from at as-yet unannounced upstream gas fields supplying KGP, generated on-site, for example from Browse or future fracking projects in the Canning Basin.

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[2] This figure includes Scope 2 emissions, minimal at 0.002 Mt CO_2-e per year. Accordingly, for the purposes of this analysis, combined Scope 1 and 2 emissions are treated as equivalent to Scope 1 emissions.

[3] This assumes Karratha Gas Plant capacity is satisfied with sources of gas additional to Browse.

[4] The project proposal, submitted in 2018, assumed a 2020 start.

[5] To match with financial year (FY) format given by emissions projections and SGM data, we assume the extension (with associated emissions) begins in FY2031 ((beginning 6 months after the proposed start: start of calendar year, 2030), with the stated five-year targets beginning then, running to FY2070 (ending 6 months after calendar year of 2070). As previously stated, we assume maximum stated emissions reached in each year.

The extension's annual emissions of up to 7.7 Mt CO_2-e in 2035, also the year Australia's next intermediate mitigation target is focused on, would represent 8% of the projected 2035 gross emissions of 96 Mt CO_2-e from all Safeguard-covered facilities.[6] Appling linear interpolation between the government's 5-yearly projected gross emissions of Safeguard-covered facilities, Safeguard aggregate baselines, on-site emissions reductions and Safeguard net emissions (2025, 2030, 2035 and 2040) [7], we estimate Safeguard-covered facilities undertake annual year-on-year gross emissions reductions of:

5 Mt CO_2-e per year from 2031 to 2035, and;

4.2 Mt CO_2-e per year in the 2036 to 2040 period.

In the period 2031 to 2035, the NWS project extension's maximum emissions value of 7.7 Mt CO_2-e per year would represent the equivalent of 1 year and 6 months' worth of average annual collective abatement for Safeguard-covered facilities. From 2036 to 2040, the maximum emissions value of 6.55 Mt CO_2-e per year represents the likewise equivalent of 1 year and 6 months sector-wide average abatement.

2.2 The Browse-to-NWS and Browse CCS projects

According to Woodside's joint environmental review submitted to both State and Federal regulators, the Browse development is projected to emit 163 Mt of Scope 1 CO_2-e over an extended operational life of 44 years (Woodside, 2019b). This figure excludes estimated Scope 1 emissions from downstream processing at KGP. To match the NWS extension's lifespan of 40 years, we adjust the emissions estimates[8] from the extended project lifespan of 44 years, as outlined by Woodside (2019b)[9] and assume a parallel start with NWS extension.

In spite of the inherent uncertainty in CCS effectiveness regarding projects such as Chevron's Gorgon CCS project, whereby only 30% of removed carbon dioxide was captured in 2024, against a stated target of 80% (Denis-Ryan & Morrsion, 2024), we include a CCS effect based on reported figures in

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[6] In accordance with DCCEEW definitions, Safeguard-covered facilities are defined as facilities that remain above the 100,000 metric tonnes (t) CO2-e threshold for inclusion of an industrial facility in the SGM, after on-site abatement.

[7] We assume a constant annual rate of change.

[8] This assumes production is not ramped up because of a 4-year contraction in project life, but rather that annual production is run at design capacity for economic reasons.

[9] For this analysis, we base our emissions assumptions on the total Scope 1 emissions scenarios provided in the Browse EIS/ERD (Woodside, 2019b). The reservoir CO_2 composition of the Browse Basin gas field is uncertain, and emissions estimates differ depending on the assumed reservoir gas composition—classified into "expected" and "high-CO_2" scenarios (Woodside, 2019b). Most of Woodside estimates of the project's scope 1 CO_2-e, throughout the document, appear to be based on a "high-CO_2" scenario , with this estimate excluding potential emissions reductions from CCS. On this basis, we assume the stated average annual Scope 1 emissions value of 4 Mt CO_2-e per year, for a "high-CO_2" scenario, as given by Woodside. This amounts to 160 Mt over a 40-year life.

Woodside (2024).[10] On this basis, Browse-to-NWS Scope 1 emissions would fall between 85 and 160 Mt CO_2-e over the project's operational life, with lower and upper bounds representing complete success and complete failure of CCS, respectively.[11] This ranges from 2.1 to 4 Mt CO_2-e per year. Assuming that CCS is 50% effective against its claims, this results in 122 Mt total Scope 1 CO_2-e emissions over 40 years, or 3.1 Mt CO_2-e per year—which we use here as the mid-range CCS effectiveness emissions scenario.

Under the mid-range CCS effectiveness scenario, Browse is projected to account for approximately 3.2% of the projected 2035 gross emissions from all Safeguard-covered facilities, which total 96 Mt CO_2-e in that year. This annual emissions figure is equivalent to approximately 9 months' worth of the annual year-on-year gross emissions reductions expected across all Safeguard-covered facilities between 2031 and 2040.

2.3 The extended NWS project and Browse development, cumulatively

We assume a scenario in which both the NWS project extension and the combined Browse projects—including CCS at mid-range effectiveness—are approved, with operations commencing in 2031.[12] Woodside (2019b) note that Browse would account for 2.8 Mt CO_2-e worth of reservoir and processing emissions at the NWS project in an average year, yet we assume production capacity is reached at KGP, accounting for the range of extended NWS project-associated emissions (starting from 7.71 Mt CO_2-e) though as done previously, not accounting for on-site Scope 1 emissions at as-yet unannounced upstream gas field development projects additional to Browse. As such, this analysis does not capture the full extent of emissions upstream of KGP, when running at production capacity.

In 2035, the combined emissions from these two projects account for approximately 11.2% of the projected 96 Mt CO_2-e in gross emissions from all Safeguard-covered facilities. From 2031 to 2035, combined emissions remain steady at 10.8 Mt CO_2-e per year, before falling to 9.6 Mt CO_2-e per year from 2036 to 2040. These emissions levels are equivalent to approximately:

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[10] While the CCS application documents specify a 35-year project length (2030—2065), we assume an extension is applied for and granted, aligning Browse and the Browse CCS project duration with the 40-year NWS extension lifespan. We therefore assume both Browse and Browse CCS receive approval and commence in parallel.

[11] Woodside estimates that its proposed CCS system for the Browse development could reduce Scope 1 emissions by 53 Mt CO_2-e (47%) over the project life, by capturing a portion of reservoir-derived CO_2. This figure and corresponding percent proportion of total emissions, seem to relate CCS potential to emissions from an expected field life of 31 years and a "low-CO_2" scenario, of 112 Mt CO_2-e stated in Woodside (2019b). We instead use a high-CO_2" scenario given by Woodside (2019b) as was used to calculate pre-CCS emissions, and calculate an annual reduction of 1.88 Mt CO_2-e, amounting to 75.2 Mt CO_2-e over an adjusted 40-year life.

[12] Both in this scenario and a counterfactual scenario of neither project being approved, we assume that the Commonwealth's 2024 emissions projections remain static, i.e. they respond to NDC emissions reductions targets rather than additional emissions load. This may or may not reflect the currently opaque reality.

2 years and 2 months' worth of annual year-on-year gross emissions reductions projected across all Safeguard-covered facilities in the 2031–2035 period, and;
2 years and 3 months' worth in the 2036–2040 period.

Thus, in the 2030s, these projects stand to add more than double the total year-on-year gross emissions reductions expected across the Safeguard Mechanism. This is akin to removing cups of water from a bathtub in which new Safeguard-covered facilities are still running the taps, forcing the cup-holding Safeguard-covered companies to quicken the pace at which they remove water.

Total emissions from the NWS and Browse projects combined are projected to reach 186 Mt CO_2-e between 2031 and 2050.[13] We applied a linear regression to model gross annual emissions and on-site emissions reductions (as compared with a business-as-usual scenario[14]) from 2041 through to 2050, using DCCEEW projections data infilled with our previously interpolated annual figures, projecting gross emissions of 33.2 Mt CO_2-e in 2050.[15] Accordingly, across all Safeguard-covered facilities, we calculate: a reduction of 82.7 Mt CO_2-e of gross emissions in the year 2050, compared with 2031, with cumulative gross emissions over that period totalling 1,470 Mt CO_2-e; and a total of 1,138 Mt CO_2-e of emissions abated, and 1,764 CO_2-e of emissions mitigated (both abated and offset[16]).

Fig. 1 shows these modelling results over the period 2031 to 2050, including the share that would be taken up by both Woodside projects. Net demand for carbon credit units reflects the difference between gross emissions by Safeguard-covered facilities, and aggregate baseline emissions across the SGM. With time, the reliance on carbon credit units to reach baselines increases both proportionally and absolutely.

[13] As discussed in section 3.1, this assumes interim NWS Scope 1 emissions reduction target of 5.39 Mt CO_2-e annual cap (2041 – 2045) are maintained through to at least 2050, with "uncertain" aspirational goals out of reach.

[14] Defined by DCCEEW as emissions expected without reform of the SGM, derived by holding emissions intensity of Production Variables fixed at 2024 levels.

[15] In such a case, the equivalent volumes of ACCUs are surrendered, to offset remaining gross emissions, bringing net emissions to zero in 2050.

[16] To derive offset volumes, we assumed an even decrease to net zero from the aggregate baseline in 2040 given by DCCEEW, and calculated net demand for units as the difference between gross emissions and aggregate baselines (a duplication of DCCEEW's approach).

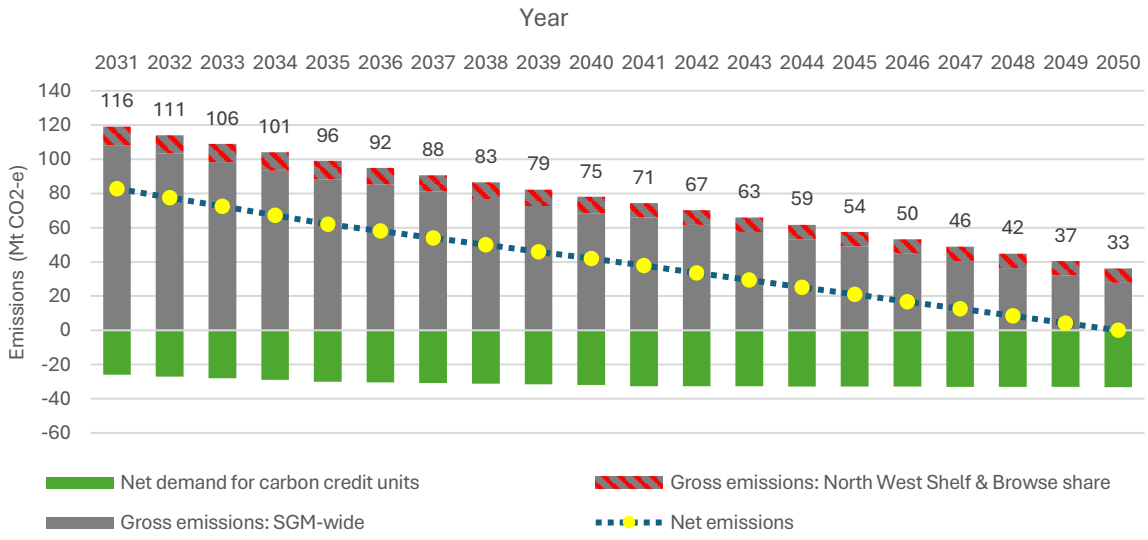

Figure 1: Annual projected Safeguard Mechanism emissions with North West Shelf & Browse project's share: 2031 – 2050. This shows a decline trend of annual projected emissions (grey, and red and grey hatch) across all SGM facilities from 2031 to 2050, including the extended North West Shelf project and Browse-to-North West Shelf project share of emissions (red and grey hatch). Also shown are projected net emissions (yellow dots, with dashed line showing trend), and projected net demand for carbon credit units, both Australian Carbon Credit Units and Safeguard Mechanism Credits (green).

The 186 Mt CO_2-e emitted by the extended NWS project and Browse developments between 2031 and 2050 represents approximately 12.6%, or approximately an eighth, of the total projected gross emissions of 1,470 Mt CO_2-e from all Safeguard-covered facilities over the same period.[17] As can be seen in figure 1, this share of overall emissions increases from year to year, as baselines tighten. Stated another way, these developments represents 16% of the 1,138 Mt CO_2-e emissions expected to be abated across the SGM in this period.

Crucially, if both Woodside projects are realised by 2031, it might be expected that Safeguard emissions projections models accounted for this, resulting in a higher 2031 – 35 decline rate and a steeper emissions reduction challenge and concomitant cost burden for companies.[18]

We base our projections of internal abatement costs on modelling provided by EY Net Zero Centre's EY-CARBON-VIEW model (Ernst & Young, 2023; Hatfield-Dodds et al., 2023). This scenario-based analysis conducted after the 2023 SGM reforms gives prices per ton of CO_2-e as a function of SGM on-

[17] In such a case, the additional emissions burden would be met through a combination of on-site emissions reductions, and the surrender of approved carbon credits (SMCs and ACCUs).
[18] This assumes that neither project was already accounted for in the 2024-2030 decline rate formulation. In this case, the additional emissions burden would have also applied in the 2024 – 2030 period, even if the associated emissions were/are not emitted.

site abatement volumes for three static years: 2023; 2030; and 2040.[19] For 2030, at 22 Mt CO_2-e of abatement across the SGM in that year,[20] their model gives a value of -A$2, implying that companies can expect to *earn* $2 for every ton of CO2-e internally abated e.g., from savings generated through energy efficiency and on-site renewable energy.

To calculate expected abatement costs for each year between 2030 and 2040 at a specific abatement volume, we use annual abatement volumes from DCCEEW emissions projections, with our previously interpolated values.[21] For each year from 2031–2039, the abatement volume was matched to Ernst & Young's (2023) respective abatement cost estimate series for 2030 and 2040.[22] This produced two cost point bounds for each year, a lower bound from the 2030 series and an upper bound from the 2040 series. A single cost was then estimated between the lower and upper bound cost points in each year, using linear interpolation with time-based weighting: for example, the 2031estimate was calculated as 90% of the lower bound plus 10% of the upper bound. This gradual shift in weighting approximates a straight-line change in costs between the values associated with each of the two series. All prices are expressed in real 2023 AUD and brought forward to nominal 2025 prices. Negative prices in EY's 2030 series reflect low-cost abatement opportunities with net savings.

For 2040, at 55 million tonnes of abatement, Ernst & Young's (2023) model calculates 13 prices between $609 and $707 per ton of CO2-e internally abated, reflecting the expectation that on-site abatement costs will rise over time as the low-hanging fruit of abatement interventions are exhausted. From 2040 to 2050, we use the averaged value across these 13 prices for each year, as fixed abatement cost. This likely entails an underestimate: the cost of on-site abatement will most likely rise beyond 2040 (controlling for total volumes abated) as may the marginal volumes abated each year. This is suggested by the authors' conclusion that "by the early 2040s, we anticipate most of the lower cost abatement opportunities will be realised" (Hatfield-Dodds et al., 2023).

We then combine on-site abatement across these two time periods, with projected real ACCU market price trajectory values[23] (Ernst & Young, 2023; Hatfield-Dodds et al., 2023) in the 2031 to 2050 period. This gives final cost estimates of on-site abatement and carbon offsets required to offset the additional

[19] The internal abatement cost diagrams can be understood as comprising marginal abatement cost curves averaged across abatement choices available across the SGM.
[20] Defined by DCCEEW as aggregate emissions from facilities with business-as-usual emissions above 100 000 tonnes in a given year.
[21] These abatement volumes are referred to as "on-site emissions reductions" in DCCEEW's dataset and are derived relative to Business-As-Usual emissions.
[22] Abatement volumes from Ernst & Young (2023) are expressed in Mt of CO_2-e. In each series, reported costs (expressed in A$ per tonne of CO_2-e) are given for each 1 Mt CO_2-e increments, so our own abatement value projections, in units of Mt and to 6 decimal places, are rounded to zero decimal places. We assume, as is standard practice, that provided internal abatement cost curves have amortised upfront capital costs for abatement measures over the respective project/technology lifetimes.
[23] We use the central estimate under the assumption of a moderate market outlook.

emissions burden from both Woodside projects over the 20-year period, which we term costed additional mitigation burden.[24]

Over the 20-year period leading up to 2050, we estimate the costed additional mitigation burden across all SGM facilities, arising from both Woodside projects, to be A$60.9 billion, expressed in 2025 nominal prices.[25]

As of 2024, Chevron Australia had a seven-year run of being the highest emitting company in the Safeguard, with two facilities now covered by the SGM, Gorgon and Wheatstone gas facilities. To accommodate the realisation of both Woodside projects while still achieving the projected 2050 SGM-wide gross emissions target of 33.2 Mt CO_2-e, we estimate a costed additional mitigation burden for Chevron of A$5.73 billion,[26] representing an extra 15.5 Mt CO_2-e mitigated.

As part of the avoidance and reduction strategies in its asset decarbonization policy, Woodside applies an internal carbon cost of US$80 (approximately A$123)[27] per tonne of CO2-e, using this value as a threshold for commercial viability, initiating abatement interventions below this threshold (Woodside, 2025c). Woodside is the only domestically operating fossil fuel company to publicly and consistently disclose its internal carbon cost, and unlike Woodside, Chevron does not publicly disclose theirs. It may therefore be the case that from 2031 to 2033, when abatement costs we calculate are lower than this threshold figure, we underestimate abatement costs. We follow the conservative approach for methodological consistency.

[24] The additional emissions burden is represented by Woodside emissions from both projects, starting in 2031. It is qualified against a counterfactual zero-added-burden scenario that neither project is approved, and projections models do not account for either. We applied linear interpolation and regression to government projections of on-site emissions reductions, as described prior. We then calculated the proportional reliance on ACCUs (net demand for units) versus that on gross emissions reductions for each year from 2031 to 2050, using calculations also described prior, and as applied to the annual combined emissions from both operations. We assume the price of an SMC matches that of an ACCU. These assumptions are repeated in the remainder of this section.

[25] EY-CARBON-VIEW model estimates are in 2023 real terms. As such, all values were treated as 2023 real dollar values, and inflated to nominal 2025 dollar values, using 30 June 2023 and 30 June 2025 CPI rates from https://www.ato.gov.au/tax-rates-and-codes/consumer-price-index.

[26] For both of their facilities, Chevron's covered emissions were marginally below baseline in 2024, indicating there was still headroom to be eliminated. We assume that covered emissions equilibrate with baselines in 2025, calculated using the decline rate calculation and assuming Production Variables (i.e., production quantities) remain fixed. We calculate the proportion this represents of SGM-wide aggregate gross emissions projected for 2025 by DCCEEW, and assume this proportion remains fixed through time, with gross emissions falling annually in proportion to projected annual SGM-wide gross emissions declines previously calculated. This proportion is applied to the Woodside projects' emissions, annually from 2031 to 2050, and it is assumed that the mix of on-site abatement and offsets remains proportionate with the SGM-wide ratio.

[27] Averaged exchange rate over the 90-day period prior to 04/08/2025

On a smaller scale, for the hypothetical average Safeguard-covered facility with mean annual emissions, an additional 847,000 metric tonnes of CO_2-e would need to be offset or abated annually over the 20-year period, equating with a cost of A$276 million for the facility owner.[28]

In all cases—SGM-wide, Chevron, and the hypothetical average SGM facility—these figures represent around an eighth of the mitigation bill they would face without either Woodside project going ahead.

3. Discussion

3.1 A final NWS extension approval would be bad for business.

Our findings indicate that both these projects would significantly increase the volume of required emissions reductions post-2030. This would not only impose an additional mitigation burden on other facilities covered by the SGM but also compound the challenge of meeting the country's 2050 net-zero targets, as well as the five yearly net-zero aligned interim targets associated with its NDCs.

In addition to the cost imposed on other SGM-participating companies, the NWS extension's final approval and a Browse approval would present a mitigation cost to Woodside that would become increasingly challenging to pay for. The 186 Mt of total gross emissions of both Woodside projects dwarfs the 28 Mt of Scope 1 and 2 emissions reduction opportunities to 2050 Woodside had identified from over the remaining life of assets across its operations, as reported in 2025 (Woodside, 2025c). 15 Mt of this was counted by Woodside as savings from designing in emissions reductions to Scarborough and Trion, relative to an absence of a climate price signal, yet additionality as is found in baseline-and-credit offsetting approaches is not a feature of the SGM. Woodside anticipates that emissions reduction opportunities mainly arise from "energy efficiency, methane reduction, flaring reduction and the use of renewables"—once this low-hanging fruit has been picked, low-cost abatement opportunities from existing infrastructure shrink, and increases the risk of jeopardising the economic viability of the operation, intersecting with the falling costs of renewables and investment in abatement options for the hard-to-abate sector increases. For example, Woodside estimates that retrofitting electrical and mechanical turbines cost in the range of US$200-500 per tonne of CO2-e (Woodside, 2025c).

[28] As of 2024, there were 219 facilities covered under the SGM. From 2030 onward, we assume the number of covered facilities remains steady at 220 facilities, where the Browse development is registered as a separate facility. New facilities entering the scheme are assumed to offset those falling below the 100,000 t CO_2-e inclusion threshold. It is also assumed that the mix of on-site abatement and offsets remains proportionate with the SGM-wide ratio.

In 2023, an indicative post-2030 decline rate of approximately 3.3% per year—representing a linear trajectory from 2030 to net-zero under the SGM—was published to assist industry planning. As posited, the approval of the NWS project extension and future project approvals delivering the gas it requires, implies that a steeper decline rate will likely be required, relative to a counterfactual scenario in which the extension is not granted final approval. In such a scenario, increased ambition embedded in Australia's 2025 revised NDC, via its impact on the setting of the new post-2030 decline rate, may catch Safeguard-participating companies off guard: Large differences between the indicative and new decline rates may signal underinvestment to date in emissions reduction technologies by covered facilities, potentially squandering opportunities to already be on an abatement footing. Companies may need to rapidly scale investment in emissions reduction technologies and strategies in preparation for an increased post-2030 compliance burden.

Depending on the constraints companies face in achieving steeper annual baseline reductions—and assuming production levels remain constant—incorporation of new emissions sources into the decline rate may result in lower on-site abatement per facility. For companies whose covered emissions fall below their baselines, and in so doing generate SMCs, tighter baselines would reduce the number of SMCs generated for a given level of production and decarbonisation investment.

This especially matters if these companies made abatement investments with an expectation of recovering costs through SMC revenues. If companies generate fewer SMCs, already forecast to decline under tightening baselines (Australian Government, 2025b), this may increasingly rely on ACCUs to meet compliance obligations. If companies opt to meet their obligations through short-term ACCU purchases rather than investing in additional low-emissions technologies, this could increase demand for ACCUs—already dominated by SGM-related demand—placing upward pressure on prices. Rising ACCU prices, particularly if they converge with international carbon price norms, would impose further financial strain on covered facilities. Should domestic supply of ACCUs fail to keep pace with demand, the SGM may need to incorporate high-quality international compliance units or offsets, which may come at a higher cost.

3.2 New point emissions sources increase mitigation burden for other companies, and/or water down Australia's climate migitation goals

New, expanded, or extended projects under the SGM give rise to two broad outcomes. First, as discussed, adding emissions into the "emissions pot" must be offset by deeper reductions elsewhere

to preserve the same level of net abatement as in a counterfactual scenario without those projects. Second, if facilities are unable to fully absorb this additional burden through abatement, or if the additional burden resulted in their becoming significantly less competitive, Australia's NDC ambition may ultimately need to be revised downward.

In 2024, the SGM accounted for approximately 31% of Australia's total domestic Scope 1 emissions—a descriptive share, not one set by a formal allocation under policy. If emissions in the rest of the economy remain relatively stable, additional emissions such as those from Woodside's extended NWS project and any future associated gas field developments, risks increasing the SGM's proportional share of the national emissions reduction task over time—without broadening the scheme's coverage to include additional sectors or economic activity.

In practice, policy responses are likely to fall somewhere between these two poles, reflecting real-world constraints on emissions reduction capacity, economic competitiveness, and political palatability (Leinaweaver & Thomson, 2021; Wright et al., 2021).

3.3 The NWS project extension is a test case demonstrating lack of transparency underpinning the SGM

The decline rate is a crucial figure that determines the pace at which SGM facilities decarbonise. Yet, as discussed, the assumptions underlying its formulation remain opaque to the public. As discussed in the introduction, the size of projected cumulative emissions post-2030, and the pace at which these are expected to decline, is directly shaped by unannounced and proposed projects' emissions, as well as approvals of new, expanded and extended SGM facilities in the lead-up to 2030. This creates a self-reinforcing policy feedback loop: projections of future emissions influence the decline rate, meaning space is created in the scheme for new emissions sources to come online, with all companies working harder to get to a lower level of ambition than might otherwise have been achieved.

Projections of future emissions also likely underpin the ambition of Australia's NDC targets: the larger the projected emissions "pot," the more constrained future ambition is likely to be. Future emissions shape the level of ambition reflected in NDCs, and the NDCs in turn provide an emissions goal that a decline rate must reach. For example, the current 4.9% annual decline rate, valid for the period 2024 to 2030, was derived from the 2030 NDC, holding steady for the proportion of the Australian economy represented by the Safeguard Mechanism. However, the exact interdependencies between NDC setting, decline rate formulation and project approvals are all fairly opaque.

Under the EPBC Act, the Environment Minister must pass on scope 1 emissions information for approvals to the Minister for Climate Change. Should they not be satisfied that the emissions reduction objectives contained in the relevant Act, this may stimulate changes to the SGM rulebook Yet, with the decline rate potentially already considering these additional emissions sources, and the associated targets accounting for them, it may be a foregone conclusion that the Minister for Climate Change will give the SGM a clean bill of health.

The modelling-accounting artefact behind baseline setting obscures the contribution of new emissions sources to the overall mitigation challenge, highlighting the need for transparent and forward-looking emissions accounting. Such accounting should ideally be aligned with 2°C and 1.5°C carbon budgets. It also leaves companies with no clear signal on how they are competing for a shrinking emissions space.

While the government published regulatory impact analysis ahead of the SGM reforms—providing an overview of policy options and their potential impacts—these assessments did not include a breakdown of policy modelling that explicitly considered all potential future emissions sources. A move toward open governance would involve making publicly accessible what is currently a shroud of modelling and modelling assumptions underpinning the formulation of decline rates. With a review of the SGM due in 2026-2027, the Australian Government would do well to consider open governance measures for this aspect of the baseline setting process.

Transparently quantifying the influence of unannounced, newly approved or proposed facilities, and other anticipated emissions sources on future decline rates could incentivise companies to assess the potential costs of such developments, while enabling them to apply informed pressure through advocacy and lobbying. Based on the Safeguard Mechanism facility-level emissions data (Australian Government, 2025a), Table 1 shows the top 10 emitters by company for 2024, their associated emissions, and number of facilities, providing an illustration of which companies have the highest absolute stakes in the Woodside decision, and which may profit from informed lobbying efforts.

Table 1. Top 10 companies by covered emissions and number of facilities in 2024. Covered emissions rounded to one decimal place. Adapted from:

Company	Covered emissions (Million tonnes of carbon dioxide equivalent)	Number of participating facilities
Chevron Australia Pty Ltd	12.9	2
INPEX Operations Australia Pty Ltd	6.7	1
Woodside Energy Ltd.	6.4	2
BlueScope Steel (Ais) Pty Ltd	5.9	1
Qantas Airways Limited	4.5	1
Santos Limited	3.6	9
Alcoa of Australia Limited	3.6	3
South32 Worsley Alumina Pty Ltd	3.2	1
Queensland Alumina Limited	3.1	1
BM Alliance Coal Operations Pty Limited	3.1	7

More broadly, it would also empower researchers to better scrutinise how added emissions (including exported Scope 3 emissions) may affect Australia's share of global carbon budgets, and the broader implications for public health, disaster resilience, the land-use sector and ecosystems. In addition, such transparency is essential to scrutinize selective claims about the volumes of gas needed for the energy transition, as well as resource extraction like rare earth mining and other industrial objectives tied to the Future Made in Australia agenda. Australia stands to gain immensely by avoiding unnecessary lock-in of infrastructure projects that do not serve the public interest—it can do so by hardwiring full transparency into initiatives such as the Net Zero Plan for economic sectors.

To illustrate, the Office of the Chief Economist's 2024 *Future Gas Strategy*—drawing on modelling from the AEMO *Integrated System Plan*—indicates that gas demand for these purposes is highly uncertain beyond 2035 (Australian Government, 2024). Similairly, the International Energy Agency, in its net-zero pathway modelling, states that "as of 2021, there are no new oil and gas fields approved for development in our pathway… " (IEA, 2021), highlighting that the global energy transition may require far less new gas development than is often claimed.

NWS is a major supplier of LNG to Asia. In climate-ambitious scenarios, even international demand for LNG is highly uncertain beyond 2035 (Australian Government, 2024). Continued investment in gas infrastructure at this pivotal juncture risks crowding out capital and policy focus from forward-looking, low-emissions industries, while deepening long-term reliance on fossil fuels. Already, oil and gas extraction facilities dominate the upper tier of emitters, with six of the ten highest-emitting SGM facilities in 2024 falling in that category (Australian Government, 2025a). Rather than exercising

strategic restraint in response to an urgent societal and planetary challenge, the current policy approach appears to reinforce established pathways—prioritising short-term considerations over long-term transformation.

4. Conclusion

While multiple variables are in play, what appears certain is that new, expanded, and extended facilities will drive increased compliance costs for existing Safeguard participants. This analysis shows that in the Woodside case, the additional offsetting and abatement costs could rack up hundreds of millions for companies with medium-sized facilities in the SGM, billions for the highest emitting SGM company, and tens of billions across the SGM, in the 20-year period leading up to 2050. Yet, the NWS extension may be greenlit until 2070, two decades after net-zero is intended to be reached, and despite Woodside's unclear plans for reducing annual Scope 1 emissions of 5.39 Mt CO_2-e per year.

From 2031 on, companies will not only need to invest more in reducing gross emissions than may have been projected, but may face technological, operational or financial constraints to decarbonise at the required speed, risking non-compliance with their baselines. The Climate Change Authority's 2024 Sector Pathways Review underscores this challenge, noting that "the high cost of implementing most emissions reduction levers is a significant barrier across the resources sector." (Commonwealth of Australia, 2024). If replicated across enough Safeguard Mechanism facilities, these constraints stand a higher chance of jeopardizing the achievement of Australia's post-2030 emissions targets, and/or lowering mitigation ambition entailed in future NDCs.

While the authors supports more ambitious baseline decline rates for SGM facilities, that ambition should not serve merely to compensate for the additional emissions of an expanded and overstretched SGM.

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