The Climate Change Commission's draft advice on the fourth emissions budget

Clarus welcomes the opportunity to submit this response the Climate Change Commission's (CCC) consultation on its *Draft Advice on Aotearoa New Zealand's Fourth Emissions Budget*.

Our response is focussed on chapter three (*Developing the proposed path to the fourth emissions budget*) where the CCC asks these questions:

> *Do you agree with the approach we have taken to developing our EB4 demonstration path? If not, why not?*
>
> *Is there anything we haven't considered that we should be including in this approach?*

Our submission is divided into two sections: the first underscores the difficult forecasting task the CCC is faced with; the second contains our detailed comments on energy-related sectors such as pipelines, powerlines, bioenergy (and especially biomethane), hydrogen and natural gas.

Our recommendations from this submission are:

- The CCC should extend its sensitivity analysis to include wholesale electricity prices as this makes a material impact on the pace of decarbonisation. Previous forecasts of wholesale electricity prices have diverged significantly from actual prices, suggesting a broader range of price outcomes should be considered.
- The CCC has expressed a legitimate concern about the financial viability of gas pipeline businesses and the impacts on consumers and emission reductions. However, this lacks coherence with other assumptions about the durability and smooth decline of gas demand. We urge consistency in assumptions.
- The CCC should place more likelihood on the pipeline-connected use of biomethane due to its considerable benefits. Pipelines connect production to markets, achieve the best price (by accessing the hardest to abate customers with the highest willingness-to-pay) and provide security of supply. The first biomethane facility in New Zealand is being connected to the pipeline network, and the trend overseas appears to be shifting towards pipeline connected facilities.

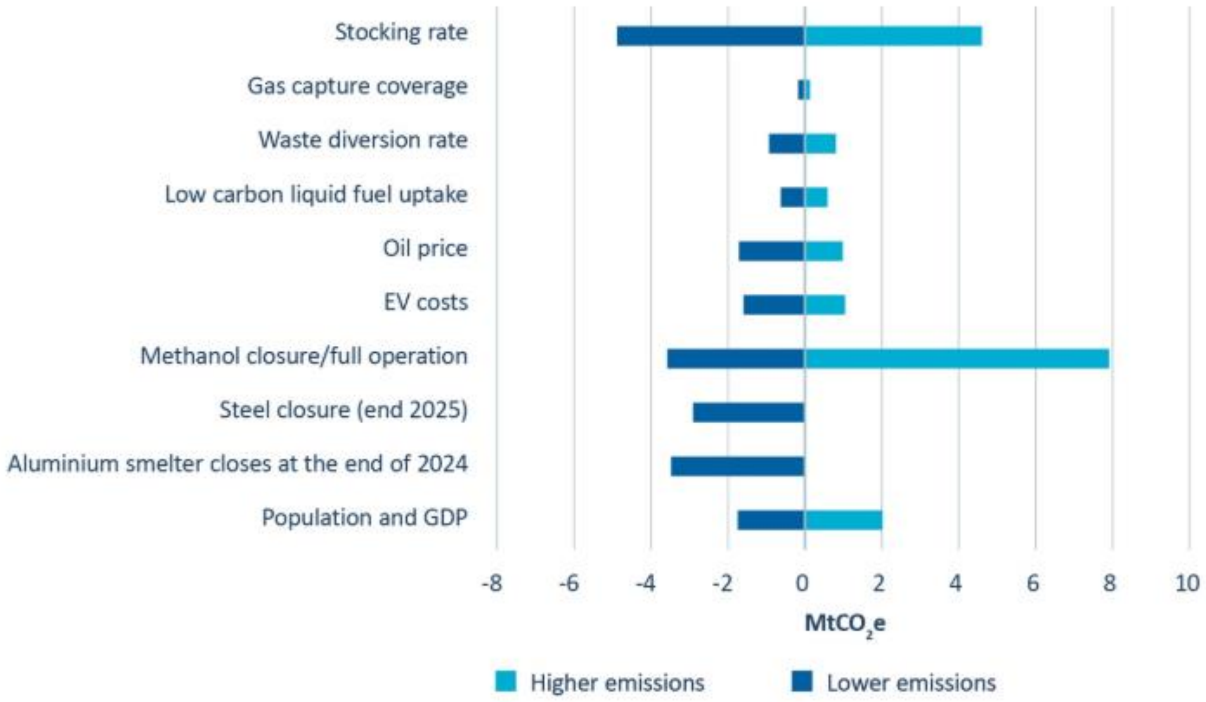
We support the use of scenario analysis to highlight the range of highly uncertain future pathways

The CCC's consultation paper demonstrates its understanding of uncertainty:

> *"The future is uncertain, and circumstances change – this is why we use scenarios that incorporate 'what ifs' and recommend a pathway to guide the transition, rather than a detailed step-by-step plan that relies on forecasts about exactly what will happen."*
>
> *"There are inherent uncertainties to arriving at a proposed budget level. Predicting the technologies and systems that will be available to contribute to emissions reductions in 12 years' time is a challenging task."*

The CCC used scenario analysis to inform its forecasting. Furthermore, the CCC have undertaken sensitivity analysis:

Sensitivity analysis of budget period emissions to selected factors or events



Source: CCC's consultation paper (Figure 3.15, page 80)

We appreciate CCC's scenario modelling and sensitivity analysis. However, it should be noted that wholesale electricity prices, which is a significant variable in energy scenario modelling is missing from CCC's sensitivity analysis. Previous modelling by both the CCC and Business Energy Council demonstrated that affordability of electricity is crucial for decarbonisation.[1] Specifically, modelling showed that constraining models to enforce a 100% renewable electricity system resulted in higher wholesale electricity prices and this produced a net increase in economy-wide emissions (even though electricity production produced no emissions). Those conclusions indicate that wholesale electricity price is key and should be included in the CCC's sensitivity for setting the fourth emissions budget.

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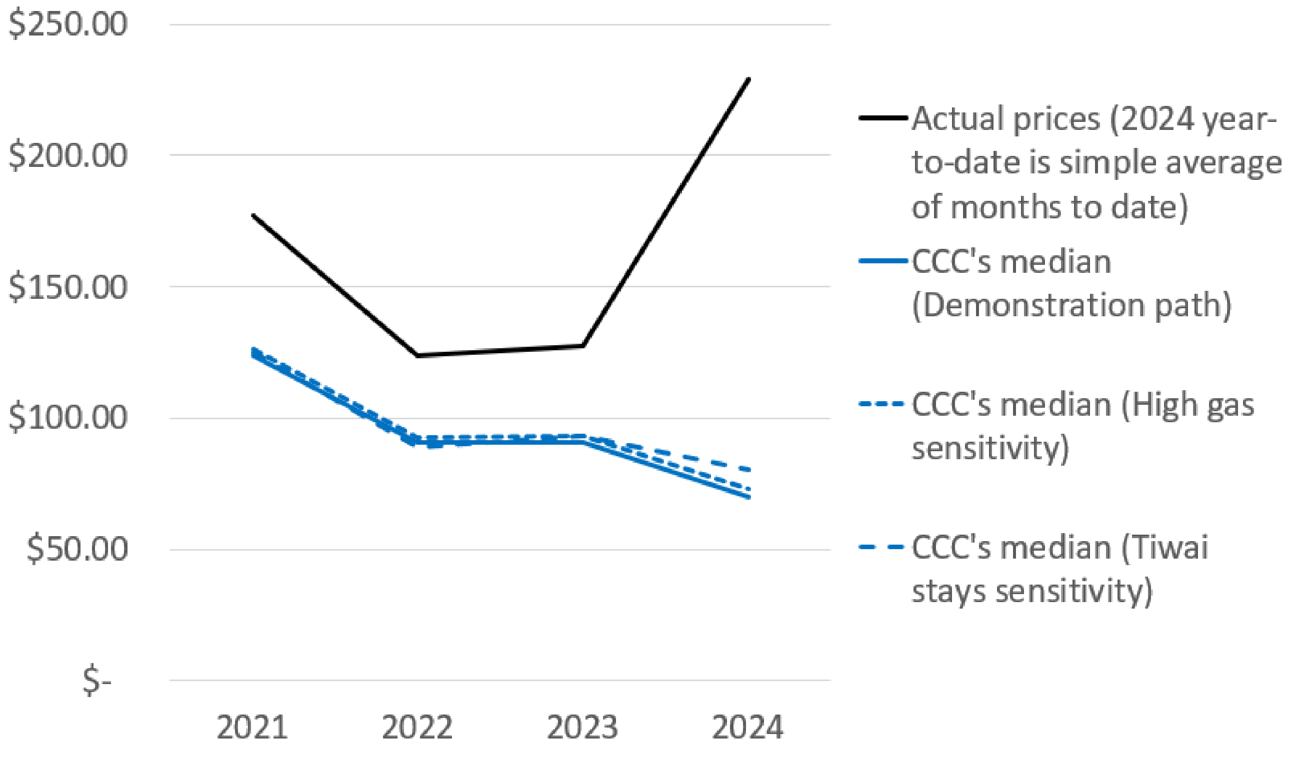
1 The CCC"s Ināia Tonu Nei (https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/inaia-tonu-nei-a-low-emissions-future-for-aotearoa/) and Business Energy Council's TIMES-NZ modelling (as described in paragraph 9.14 of their submission to CCC available https://bec.org.nz/wp-content/uploads/2023/06/BusinessNZ-and-BECs-submission-on-the-CCCs-advice-on-the-second-emissions-budget.pdf)

Wholesale electricity prices are difficult to predict. 2011 analysis by Ministry of Business, Innovation and Employment (MBIE) was forecasting prices of ~$100 / MWh in 2020-2023.[2] The below chart shows the divergence between the CCC's 2021 *Ināia Tonu Nei* forecasting versus the actual prices experienced since then.

Wholesale electricity prices 2021-24: Comparison of CCC forecasts vs actuals



Source: Clarus analysis of CCC's 2021 *Ināia Tonu Nei* forecasts and Electricity Authority data[3]

The CCC's forecasts were in line with market expectations in *early* 2021. On 13 January 2021, long-dated electricity futures for Otahuhu were trading at $101 / MWh.[4] However, market conditions changed rapidly thereafter. The upshot is that the CCC's 2021 forecast for 2024 is out by a factor of three: a forecast median of ~$75 / MWh compared to ~$230 / MWh.

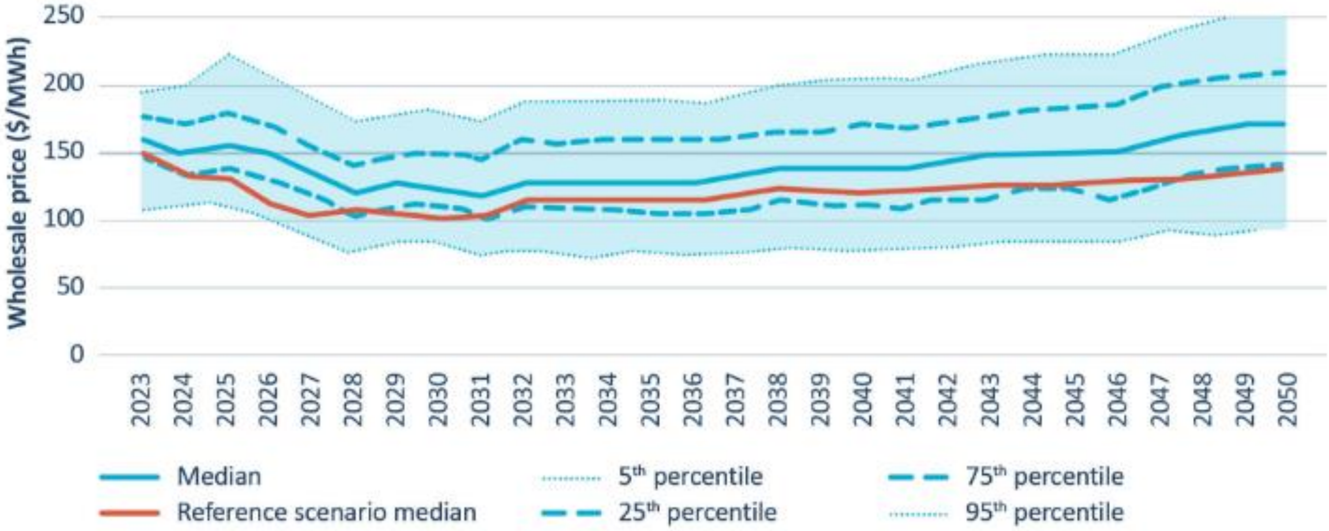
2 MBIE's *New Zealand's Energy Outlook 2011* (refer to page three) is available from https://www.mbie.govt.nz/assets/64061a5af0/reference-scenario-sensitivity-analysis-2011.pdf

3

4 Electricity Authority data available from [link]

The CCC's latest (2024) wholesale price forecast is provided in the consultation paper. Like its *Ināia Tonu Nei* predecessor, it forecasts a decline in wholesale electricity prices in the near-term.

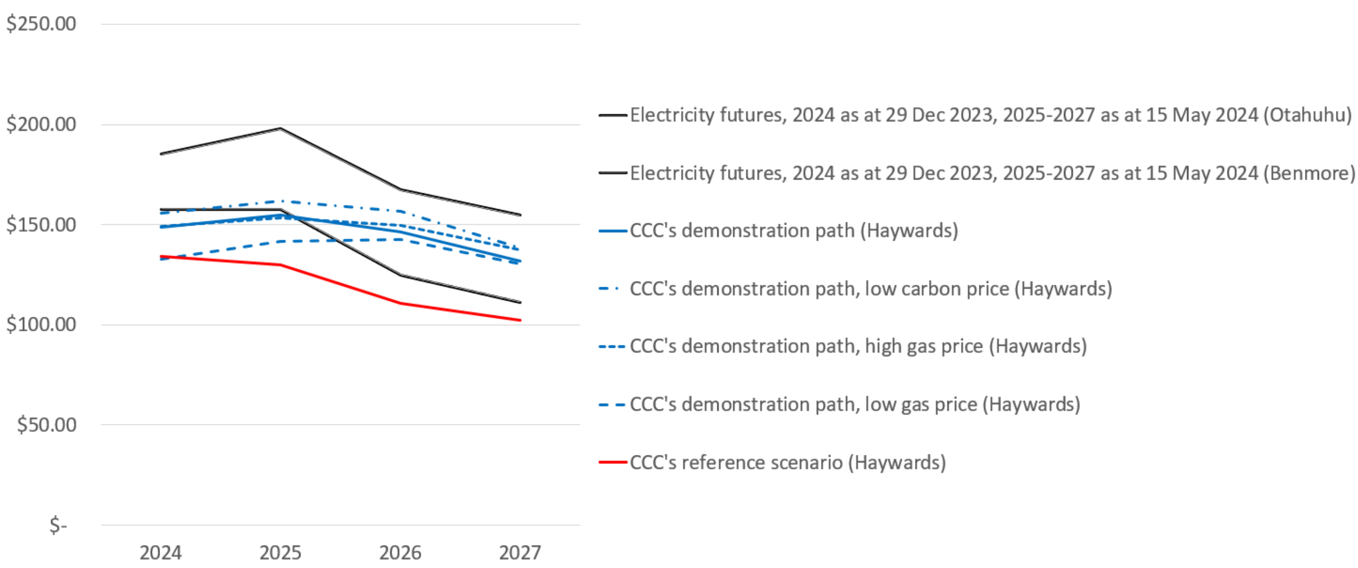
Wholesale price range under the EB4 demonstration path with median price under the reference scenario overlaid



Source: CCC's current consultation (figure 5.3, page 122)

The CCC describes its reference scenario as "*what is expected to happen given the facts on the ground if things stay as they are.*" Oddly then, the CCC's reference scenario for the wholesale electricity price median appears to be much lower than the market's current expectations, as shown in the following chart:

Wholesale electricity price forecasts 2024-27



Source: Clarus analysis of CCC's 2024 forecasts and Electricity Authority data[5]

The red line shows the CCC forecast at the Haywards node (in the Wellington region). The two black lines show electricity futures trading at the Otahuhu node (Auckland) and the Benmore node (South Canterbury). If the CCC's expectations were aligned with the market, we should expect to see the red line somewhere between the two black lines. However, the reference scenario is persistently lower.

5 CCC forecasts were sourced from the current consultation. Electricity Authority data was sourced from the forward price curves published at www.emi.ea.govt.nz/r/aihu2

The demonstration path lines (in blue) may appear to be more aligned with market expectations. However, it seems the CCC believes there are reasons to suppose the demonstration path will—relative to the reference scenario—lead to higher wholesale electricity prices of $10-20 / MWh. If so, the best interpretation of the data is that the CCC's demonstration path is—in effect—forecasting a price increase relative to market expectations.[6]

All this difficulty of forecasting one commodity for the next few years serves to demonstrate the enormous challenge of what the CCC has been tasked with in advising on an economy-wide emissions budget for 2036-40. We appreciate the candour and humility shown by the CCC in this consultation. We look forward to this manifesting in future advice on the *direction of policy* in emission reduction plans.

Our comments on various energy-related sectors

Our following comments relate to these parts of the energy sector:

- Gas pipelines
- Electricity distribution
- Bioenergy and waste
- Hydrogen
- Natural gas.

Gas pipelines

Gas pipeline owners formed the Gas Infrastructure Futures Working Group (GIFWG) as a forum to research and inform on transition risks. There are many public sector observers, including the CCC. We contributed to, and support, the submission from GIFWG.

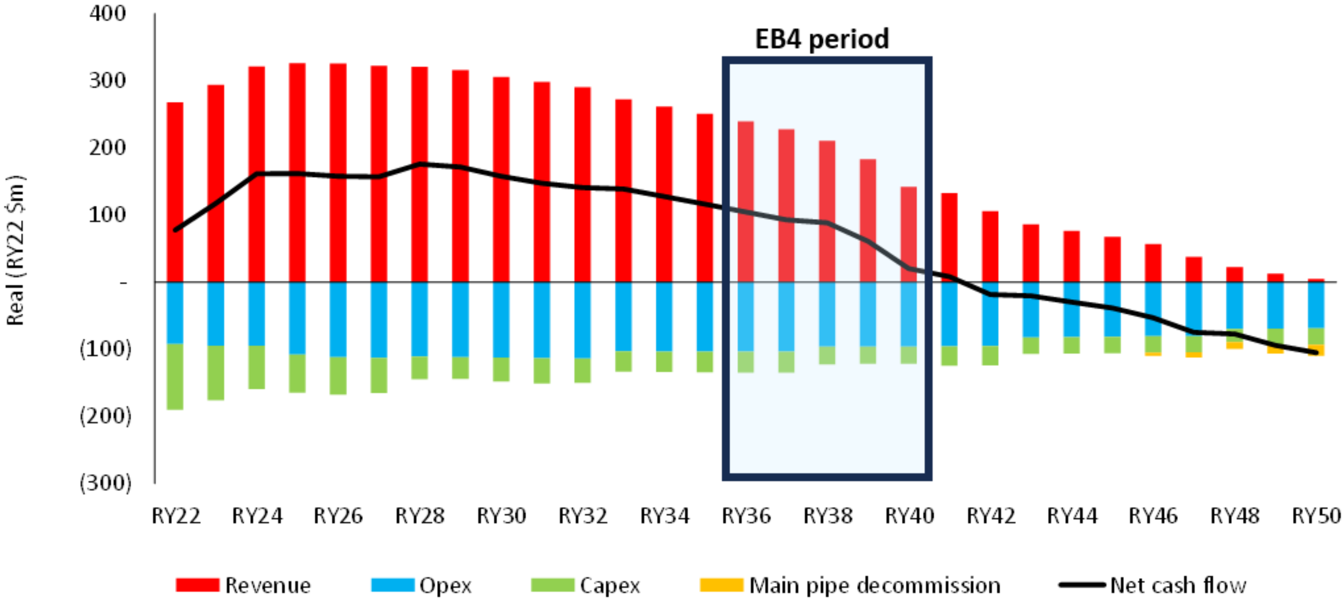
The CCC clearly recognises the emerging affordability risk for gas pipeline users:

> *"...as fossil gas phases down, it is likely to become less viable to maintain fossil gas transmission and distribution infrastructure as there will be too few consumers to generate the revenue required."*
>
> *"...the cost of maintaining the gas distribution network will need to be recovered from a smaller number of customers... It is difficult to predict exactly what will happen, as the speed at which households switch away from fossil gas will affect the prices for those who remain, and therefore their incentive to switch too."*

We agree this is a legitimate risk. The Commerce Commission has recognised the potentially shortened lives of gas pipeline assets and permitted owners to accelerate their depreciation of assets. This helps to mitigate the later affordability risk by bringing forward cost recovery while the user base for pipeline services is larger. Not only is it difficult to predict *if* this risk is likely to manifest, but it is materially important predicting *when* this risk could manifest. The CCC projects that natural gas will still be in use in 2050 (a new 250 MW gas peaker is built in 2037 under all scenarios and in 2050 it is producing 850-1,690 GWh under the scenarios), however this is not coherent if the modelling also suggests that gas pipeline businesses are not financially viable many years earlier. In 2023, one of the GIFWG's modelling scenarios suggested that gas pipeline businesses would—despite Commerce Commission approval of accelerated depreciation of regulated asset bases—become cash flow negative in 2042. No single policy can address this risk to consumers—it will need a suite of coherent and durable gas industry policy changes.

[6] An alternative interpretation could have been that the market's expectations are already pricing in similar assumptions to the CCC's demonstration path. However, the misalignment of market expectations and the demonstration path in 2024 and 2025 makes this less plausible.

Cash flows to all gas pipeline businesses



Source: GIFWG submission to CCC, itself a repeat of Figure 4.9 of the 2023 Gas Transition Analysis Paper[7]

The CCC expects that as an increasing number of natural gas users disconnect, that major process heat users will shift to liquified petroleum gas (LPG).

> *"For some industrial activities that are hard to decarbonise, such as high temperature furnace heat, our EB4 demonstration path assumes liquefied petroleum gas would replace fossil gas until gas can be fully phased out. This is because as fossil gas phases down, it is likely to become less viable to maintain fossil gas transmission and distribution infrastructure as there will be too few consumers to generate the revenue required."*

The circumstances in which this is worthwhile for the customer will be fairly limited. Larger LPG users typically need onsite storage tanks. For the CCC's purposes, assuming storage needs are equal to weekly usage is reasonable. Twenty tonnes of LPG storage would cost in excess of $750,000 and typically have an asset life over 30 years. Fifty tonne LPG tanks cause the site to be classified as a 'major hazard facility' (which brings significant additional costs). Natural gas produces fewer emissions than LPG for the heat delivered. If gas pipeline owners set network prices sufficient to drive large natural gas process heat users to LPG despite those switching costs, either their approach to pricing is self-destructive or the pipeline business is not viable and ceases.

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[7] GIFWG's paper is available https://comcom.govt.nz/__data/assets/pdf_file/0012/323130/Gas-Infrastructure-Working-Group-GIFWG-Attachment_-Gas-Transition-Analysis-Paper-13-June-2023-Submission-on-IM-Review-2023-Draft-Decisions-19-July-2023.pdf

Bioenergy and waste

We agree with the CCC that anaerobic digestion is a technology that will continue to have greater and greater application through the bioeconomy. A 2023 report by Coriolis, commissioned by MBIE, examined thirty different technology platforms in the bioeconomy.[8] One of the thirty platforms was using organic waste methane sources to produce biogas. Coriolis scored this platform 41/50 which was second only in its ranking of prospects for New Zealand's bioeconomy to 'feed milling' (where edible wastes are fed to livestock).

However, we disagree with the CCC about the prevalence of onsite production and consumption of biogas by feedstock owners. It is reasonable to assume that feedstocks and digestates will not typically be transported far. Blunomy, in their *Vision for Biogas in New Zealand*, assumed that feedstocks would not be transported more than 150km and digestates not more than 50km.[9] However, many feedstock owners are also large energy users and, in the North Island are often natural gas customers with existing pipeline connections.

- For North Island pipeline-connected feedstock owners, onsite anaerobic digestion makes a lot of sense. In some of those cases, the gas produced may instead be sold via a renewable gas certificate even if the gas never physically leaves the site. In such a case, the feedstock owner gets security of supply from their existing natural gas pipeline connection, even in the rare cases where their onsite production is well-matched to onsite demand.
- For North Island feedstock owners not connected to a natural gas pipeline, we expect many of these will prefer to either (if distance to pipelines is short and volumes are sufficiently large) connect to pipelines or transport their feedstock offsite to a pipeline-connected processing facility.
- The feedstock owner's willingness-to-pay the green premium of a renewable gas relative to the willingness-to-pay of another consumer elsewhere is vital. If an offsite user has a willingness-to-pay that is sufficiently higher, this can justify any additional capital or operational costs involved.

Central to the CCC's conclusion about the prospects of biomethane is the competing value of onsite usage and the price the biomethane would need to be sold for. On the topic of the cost/price of biomethane, we emphasise the variety of revenue streams associated with anaerobic digestion and how it is difficult to treat any single revenue stream in isolation. In Beca's *Biogas and Biomethane in New Zealand* they include a case study of a financially viable food waste anaerobic digestion facility in Hamilton.[10] Beca expected that facility to earn $3.2m annually from all revenue streams if the biomethane sold for $15 / GJ. If we hold that total revenue constant and vary the revenue

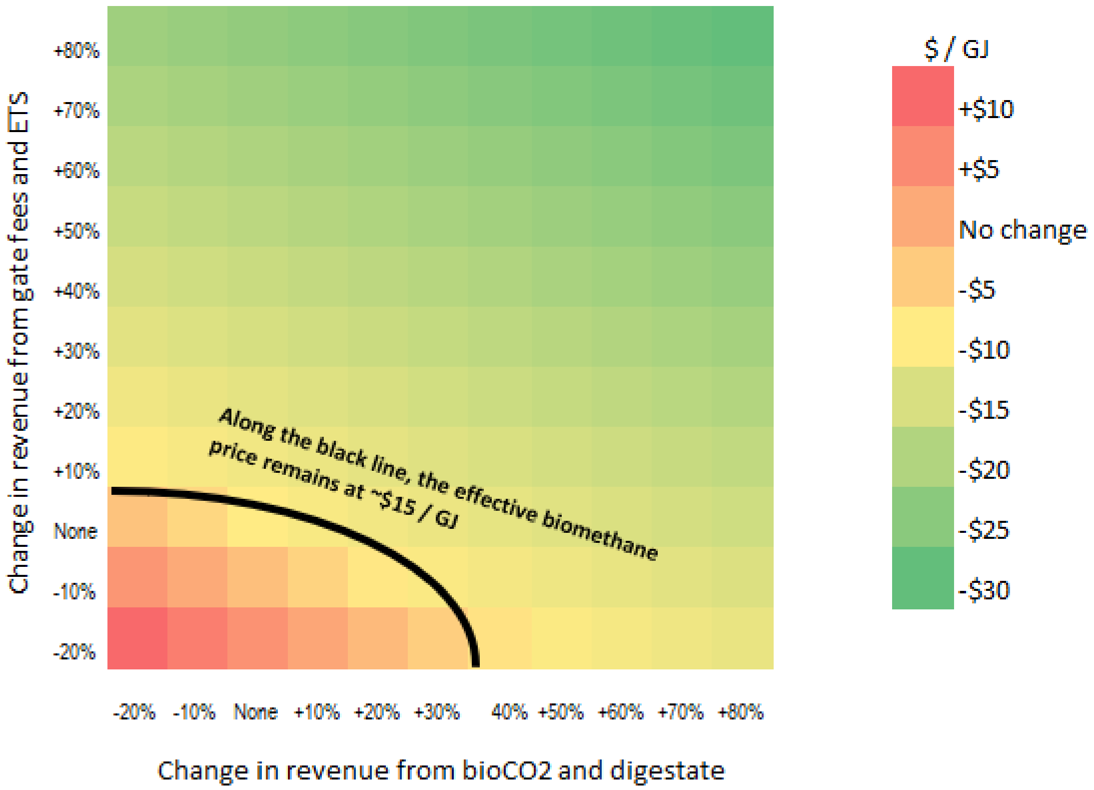
8 Coriolis' *Thirty Opportunities: Emerging and future platforms in New Zealand's bioeconomy* is available from https://www.mbie.govt.nz/assets/thirty-opportunities-emerging-and-future-platforms-in-new-zealands-bioeconomy.pdf

9 Blunomy's report, commissioned by Clarus, Ecogas and Powerco, is available from https://clarus.co.nz/about-us/regulatory-compliance

10 Beca's report sets out this case study on pages 54-58 and is available from https://www.beca.com/ignite-your-thinking/ignite-your-thinking/year-2021/biogas-and-biomethane-in-nz-report

from the other four revenue streams we can see how sensitive the $15 / GJ for biomethane is to changes in other revenue sources. The following heat map illustrates that sensitivity:

Sensitivity of effective price of biomethane to variation in other anaerobic digestion revenue streams



Source: Clarus analysis of Beca's 'Case Study 1' data from *Biogas and Biomethane in New Zealand*

Varying the other four revenue sources from 20% lower to 80% higher than Beca's assumptions shows sensitivities ranging from an $8 / GJ increase if all four other revenues were 20% lower than Beca's assumptions to a $32 / GJ decrease if all four other revenues were 80% higher than Beca's assumptions. As the revenue from gate fees is the greatest source of revenue, the effective biomethane price is most sensitive to changes in gate fees.

The heatmap also shows there are different ways to achieve the same biomethane price. The black line approximates the other combinations of revenues that would keep the biomethane price at $15 / GJ and total revenue constant.

If government policy increased the waste levy from $60 / tonne to the $100 / tonne previously recommended by Ministry for the Environment[11], this would add ~$40 / tonne to the gate fees achieved by Beca's case study facility. That would be equivalent to a 30% increase of Beca's assumptions for gate fees and ETS. In that case, the facility would need $8.15 less per GJ to maintain the same total revenue. While other projects are likely to start with a higher effective $ / GJ than Beca's case study, the above analysis highlights how sensitive any such figure is to other variables.

Hydrogen

We agree with the CCC's plausible use cases for hydrogen: urea production, steel production, and low carbon liquid fuels for international aviation and e-methanol. To this list we add ultra-long-duration energy storage for the

[11] The Infrastructure Commission recorded this in footnote 275 of their New Zealand Infrastructure Strategy available https://tewaihanga.govt.nz/the-strategy/references

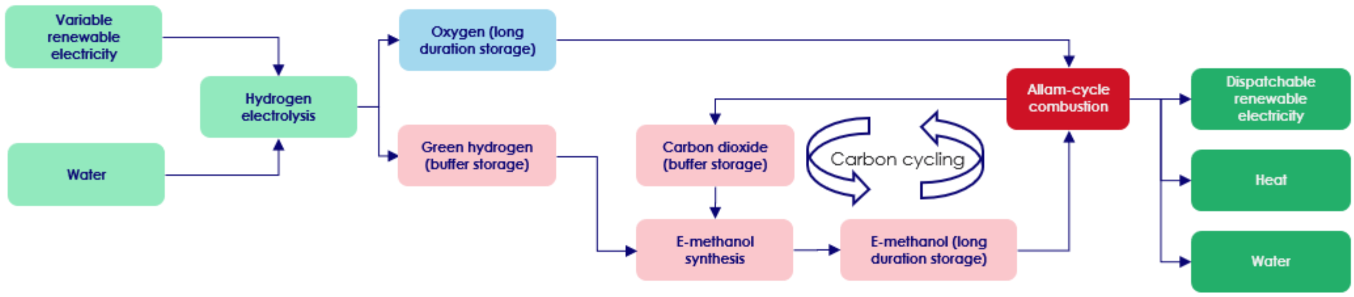
electricity system. The Pūhiko Nukutū project is investigating underground geological hydrogen storage in New Zealand.[12] Research in 2022 by EnergyLink concluded that:

> *"Taken overall then, large-scale hydrogen storage has a number of attractive features, and may also be cost effective for electricity-related storage, relative to the alternatives modelled. There is already work underway in New Zealand to investigate the feasibility of large-scale storage of hydrogen in depleted natural gas fields, and this study confirms that a hydrogen storage strategy warrants further investigation."*[13]

The CCC notes that "*Methanol production can be decarbonised by using green hydrogen, in place of fossil gas, combined with a clean source of carbon dioxide.*" We agree that this is plausible but too uncertain to warrant inclusion in the fourth emissions budget. We note that exporters of e-methanol may be able to achieve a price premium overseas because it offers decarbonisation and diversification of supply sources.

There may be strategic value in e-methanol production in New Zealand. Methanol is a credible option for long-term, inter-seasonal storage of energy for electricity system supply shortfalls lasting weeks-to-months.[14] When combusted with pure oxygen in an Allam-cycle turbine, the outputs are electricity, heat, water and pure carbon dioxide. Because the carbon dioxide is the only gaseous output it is easy to capture and reuse in the manufacture of more e-methanol.

Process flow for e-methanol as long-term energy storage for the power system



Source: Clarus adaptation of Brown and Hampp's process flow[15]

Natural gas

We agree with the CCC's assessment that "we do see small amounts of fossil gas electricity continuing to play a supporting role in ensuring the security of supply through to 2050." The CCC forecasts that slow-start combined-cycle gas turbines would not be used by 2037 and that fast-start open-cycle gas turbines' contribution to the power system will fall initially and then, with some variation be somewhat stable from 2026 (881 GWh produced in the reference scenario) to 2050 (850 GWh).

The CCC also assumes that Methanex shuts down, process heat electrifies, households electrify and no biomethane is produced. As noted in the GIFWG's submission and earlier in this submission, it is credible to be concerned that gas pipeline businesses would become cash-flow negative and cease operations under such a scenario. The CCC's set of assumptions may not be coherent in this regard. Natural gas producers would be well-placed to comment on whether it is credible to have a small amount of natural gas production operating in the 2040s as the CCC's assumptions imply.

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12 Project details available https://www.puhikonukutu.nz/

13 Energy Link's *Hydrogen Storage as a Dry-year Solution* report is available https://gasnz.org.nz/publications/energy-link-report-hydrogen-storage

14 Modelling by Brown and Hampp found methanol with closed cycling of carbon to be a credible option for ultra long-term energy storage in a variety of European countries. A hydrogen-based system with underground storage performed even better, but is dependent on salt caverns (which New Zealand does not have, though depleted gas fields may provide this functionality). Refer to https://www.tu.berlin/en/ensys/news-details/new-paper-on-ultra-long-duration-energy-storage-methanol-with-carbon-cycling

15 As referenced in footnote 14