Restricting the production of fossil fuels in Aotearoa New Zealand:

A note on the ban on new petroleum permits outside onshore Taranaki

March 2020

Parliamentary Commissioner for the Environment
Te Kaitiaki Taiao a Te Whare Pāremata

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1 Introduction

In 2018, the New Zealand Government decided not to grant any new petroleum prospecting, exploration and mining permits outside onshore Taranaki. The decision, which is effectively a ban, does not affect any existing permits or prevent the government from granting new permits for onshore Taranaki.[1] It was described by the Government as "an important step to address climate change and create a clean, green and sustainable future for New Zealand."[2]

When the ban was announced, limited analysis was offered and the stakeholder consultation process was truncated. In particular, lack of consultation with iwi was seen as a flawed part of the process.[3] The absence of a strong evidence-based case for the ban, coupled with suggestions that it may even increase global emissions, has done the ban few favours. The Opposition described it as "economic vandalism"[4] and pledged it would repeal the ban should it win the next general election. The longevity of the ban is, therefore, far from guaranteed.

The aim of this note is to extend the existing analysis by providing an assessment of what we know about the environmental effectiveness and likely economic impacts of the ban. It does not attempt to advocate for or against the ban. Its intention, rather, is to promote a better-informed debate about its relative merits given that there is cross-party support for the global temperature goals of the Paris Agreement and New Zealand's 2050 target under the Climate Change Response Act.[5]

While there is broad agreement on the climate outcomes that New Zealand is seeking, the policies used to achieve them still need to be subjected to careful scrutiny. If policies are to be durable, their contribution needs to be understood and their limitations admitted. That is my motivation for writing this note.

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[1] See Annex 1 for an explanation of the different types of petroleum permits required under the Crown Minerals Act (CMA) 1991. The ban does not affect the ability to seek changes to a permit under section 36 of the CMA or the ability to surrender an existing exploration permit in exchange for a mining permit.

[2] Beehive, 2018.

[3] Although Te Āti Awa in Taranaki were not opposed to transitioning to a low-emissions economy, they stated that the Crown failed in its obligations to consult with them on the ban (Watson, 2018).

[4] Ambler, 2018.

[5] There was near unanimous support among parliamentarians for the Climate Change Response (Zero Carbon) Amendment Act 2019 (Zero Carbon Act), which amended New Zealand's climate change laws to include the objective of contributing to "the global effort under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels".

2 Different types of climate policies

According to mainstream textbook economics, there are two directions from which environmental policies can bite: policies that target the supply side and policies that target the demand side. Supply-side policies aim to restrict the supply or production of environmentally harmful substances. Demand-side policies aim to reduce demand for those substances.

Supply-side policies have long been used to control substances that are harmful to human health and the environment. Examples include restrictions on the supply of asbestos, timber from clear-felled virgin native forests, certain ozone-depleting substances and petroleum products containing lead.[6] Substances such as these, or their production, have been deemed to be inherently harmful, thereby justifying policies that have led to their complete removal from the market.

Demand-side policies, by contrast, seek to influence consumer behaviour. They are designed to moderate or discourage the consumption of goods or the use of services that impose environmental costs. Examples include levies on waste entering landfills to encourage resource efficiency and recycling, and congestion pricing designed to discourage use of roads at busy times.

In the context of climate policy, supply-side climate policies embrace a range of potential actions including regulatory approaches, such as bans on exploration or extraction of fossil fuels, and price-based approaches, such as production taxes on fossil fuels.[7] Likewise, demand-side climate policies include regulatory approaches, such as mandatory energy efficiency labelling programmes, and price-based approaches, such as emissions pricing (e.g. emission taxes and emissions trading schemes). Table 1 provides a few examples of regulatory and price-based approaches for supply-side and demand-side climate policies.

Table 1: Examples of regulatory and price-based approaches for supply-side and demand-side climate policies.

	Supply-side climate policies	Demand-side climate policies
Regulatory approaches	• Exploration ban • Production quotas	• Mandatory energy efficiency labelling programmes
Price-based approaches	• Production taxes • Export taxes on fossil fuels • Tradeable mining permits	• Emissions trading schemes • Emissions taxes • Petrol excise taxes

[6] Green and Denniss, 2018.

[7] A production tax on fossil fuels is different from a royalty. A royalty is a levy on the net revenue produced from fossil fuels extracted. A production tax is a levy calculated on the basis of the quantity of fossil fuels extracted.

The attractions and limitations of emissions pricing

Economists typically promote price-based approaches to climate action because they are believed to achieve emissions reductions at lower cost than regulatory approaches. This is because businesses and consumers are incentivised to seek out the least costly ways of reducing emissions rather than, for instance, being directed to use particular technologies. Hence, price-based approaches allow different emitters greater flexibility in terms of how to achieve emissions reductions.

They also generate revenues. These revenues can be recycled back into the economy through a reduction in other taxes and charges. For example, revenues from the carbon tax in British Columbia have been used to lower corporate taxes.

Alternatively, the revenue can be used to directly support climate change mitigation efforts, such as supporting research and development into low-emissions technologies or assisting the transition of workers away from fossil fuel industries. These recycling mechanisms can increase the public acceptability of more stringent price-based climate policies.

Regulatory approaches, while typically achieving emissions reductions at higher cost, may deliver lower administrative and adjustment costs compared to price-based approaches. This is because regulatory approaches are relatively easy to design and monitor. Hence, the choice between price-based and regulatory policies may depend on the level of ambition and coverage required. If the policy requires only incremental improvements in targeted sectors, then administrative costs may dominate and a regulatory approach could be preferable. However, if the level of ambition is relatively high because transformational improvements for the entire economy are sought, a price-based approach may be preferred.[8]

Despite the existence of supply-side climate policies, economists have typically promoted price-based demand-side climate policies to address the problem of climate change. Theoretically, at least, given the global nature of the problem, many economists have argued that a global emissions price covering all emitting sectors would be the most efficient way to mitigate climate change. This was the long-term vision of the architects of the Kyoto Protocol signed in 1997.

A focus on pricing emissions makes sense. By making the release of emissions more expensive, emitters are encouraged to emit less.

[8] Joas and Flachsland, 2016.

However, the Kyoto Protocol approach is no longer the favoured vehicle for delivering international cooperation and the bottom-up architecture of the Paris Agreement does not appear to have improved the prospects of achieving a unified global emissions price. In fact, a supply-side climate policy, such as a global production tax on fossil fuels could have a better chance of yielding a global price-based approach. Such an approach could arguably be easier to implement than a global emissions price because the number of countries producing fossil fuels is far fewer than the number of countries consuming them.[9]

Regardless of the theoretical potential of a global supply-side climate policy, most effort to date has gone into establishing national- and regional-level emissions pricing policies.[10] But in practice, the level of ambition as seen in the actual emissions price has been too slight to incentivise businesses and consumers to meaningfully reduce their emissions.[11]

All too often, political economy considerations have hampered emissions pricing. As long as this persists, emissions pricing alone, while an indispensable tool, will be insufficient to reduce emissions or the use of fossil fuels. Emissions pricing needs to be flanked with complementary climate policies.[12]

That is, in part, because complementary climate policies can achieve emissions reductions in ways that often are more politically expedient than raising the emissions price. Indeed, one study found that complementary polices can halve the explicit emissions price needed to achieve deep decarbonisation.[13]

Furthermore, not all market failures can be fixed by emissions pricing alone. For example, businesses still tend to underinvest in research and development of low-emissions technologies.

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[9] A global production tax on fossil fuels would also conceivably have lower administrative costs than global emissions pricing, as there would be no need for each emitter and country to keep track of the emissions released (Yale Center for the Study of Globalization, 2015; Green and Denniss, 2018). This has led to calls for a fossil fuel non-proliferation treaty to deal with emissions at source (Newell and Simms, 2019).

[10] Over 40 governments, including New Zealand, have adopted some sort of emissions pricing policy (World Bank, 2019).

[11] For example, an emissions price of NZ$25 per tonne of carbon dioxide would only increase the price of petrol by about 6 cents per litre.

[12] Kennedy, 2019.

[13] Bataille et al., 2015.

The Paris Agreement and the global carbon budget

In the 2015 Paris Agreement, governments agreed to hold the increase in the global average temperature to well below two degrees Celsius above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 degrees Celsius.[14]

As of January 2018, the remaining global carbon budget for a two-thirds chance of holding warming to 1.5 degrees Celsius was around 420 gigatonnes of carbon dioxide. For two degrees Celsius it was 1,170 gigatonnes of carbon dioxide.[15] If global carbon dioxide emissions were to continue at their current rate, these budgets would be exhausted within around 13 years and 35 years respectively.[16]

Carbon capture, use and storage (CCUS) technologies can lower the carbon dioxide emissions released from fossil fuel combustion at power plants and industrial facilities by preventing the release of carbon into the atmosphere. If CCUS were to become economically viable and deployed at scale, it is possible that fossil fuels could continue to be used a little longer without exceeding the global carbon budget.[17]

However, global development of CCUS remains well off-track to reach the levels required to meet the global temperature goals of the Paris Agreement.[18] The New Zealand Government currently has no policies in place to support CCUS.[19] In the absence of CCUS, the only way continued combustion of fossil fuels could possibly be compatible with the 1.5 degrees Celsius global temperature goal that underpins New Zealand's 2050 target[20] would be to combine it with high and sustained levels of forest planting. But relying heavily on carbon

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[14] UN, 2015.

[15] IPCC, 2018.

[16] Global carbon dioxide emissions from fossil fuel combustion were around 33 $GtCO_2$ in 2018 and 2019 (IEA, 2020).

[17] It is also possible that carbon dioxide could be removed directly from the air using carbon dioxide removal (CDR) technologies. However, CDR technologies (other than planting trees) are even more speculative than CCUS and the Intergovernmental Panel on Climate Change (IPCC) has cautioned that "CDR deployed at scale is unproven, and reliance on such technology is a major risk in the ability to limit warming to 1.5°C" (IPCC, 2018, p.96).

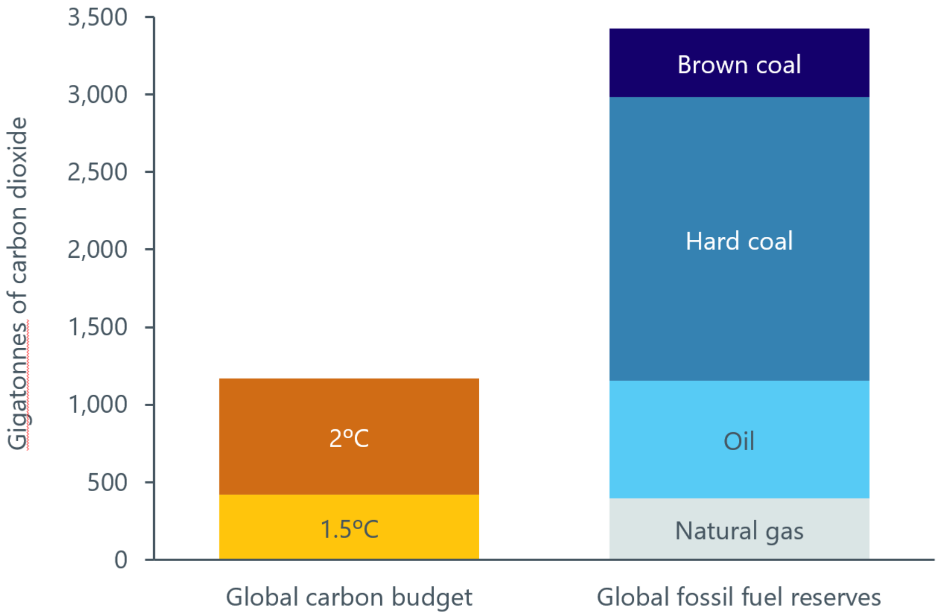
[18] IEA, 2019a.

[19] Plans for a combined power, hydrogen, ammonia and nitrogen-fertiliser plant in New Zealand that uses CCUS technology have been proposed by Pouakai NZ, a related company of 8 Rivers. The project will be privately funded.

[20] The Zero Carbon Act sets a target to reduce New Zealand's net emissions of carbon dioxide and other greenhouse gases other than biogenic methane to zero by 2050.

sequestration by forests to offset New Zealand's carbon dioxide emissions to 2050 and beyond is a risky strategy.[21]

If the world takes sufficient action to meet the global temperature goals of the Paris Agreement, a large proportion of the world's existing coal, oil and natural gas reserves could be rendered "unburnable" (Figure 1).[22] It is therefore perhaps somewhat surprising that the Paris Agreement does not contain a single reference to "fossil fuels".



Source: Based on IPCC (2018) and BP (2019)

Figure 1: A comparison of the global carbon budget and global carbon dioxide emissions if proven fossil fuel reserves were burnt without CCUS.[23]

[21] I have drawn detailed attention to the nature of these risks in the *Farms, forests and fossil fuels* report I published last year (PCE, 2019).

[22] The IPCC has cautioned that "innovations that disrupt entire systems may leave firms and utilities with stranded assets, as the transition can happen very quickly. This may have consequences for fossil fuels that are rendered 'unburnable' and fossil fuel-fired power and industry assets that would become obsolete" (IPCC, 2018, chapter 4, p.323).

[23] For global fossil fuel reserves, the carbon dioxide that would be emitted if all proven reserves of coal, oil and natural gas were combusted without CCUS is shown. Brown coal refers to lignite and sub-bituminous coals. Hard coal refers to anthracite and bituminous coals. Brown coals generally emit more carbon dioxide emissions per tonne than hard coals when burnt. Proven reserves exclude probable and possible reserves in existing fields, contingent resources that are technically recoverable but not currently commercial recoverable, and yet-to-be-discovered fossil fuel deposits. Inclusion of these additional reserves and resources would lead to much higher potential carbon dioxide emissions from fossil fuel combustion.

Modelling indicates that, in the absence of CCUS, 35 per cent of global oil reserves, 52 per cent of global natural gas reserves and 88 per cent of global coal reserves cannot be extracted and combusted if the rise in global average temperature is to be limited to two degrees Celsius. Even in a scenario assuming widespread deployment of CCUS from 2025 onwards, these shares decrease only slightly to 33 per cent of global oil reserves, 49 per cent of global natural gas reserves and 82 per cent of global coal reserves.[24]

Further investment in fossil fuel exploration therefore only makes sense if investors are confident that governments will take insufficient action to meet the global temperature goals of the Paris Agreement. If governments do take sufficient action, any further investment in exploration risks creating stranded assets that at some point prior to the end of their economic life are no longer able to earn an economic return.[25] It could also create stranded jobs and communities unless support is provided for economic diversification and a well-prepared transition to alternative sources of employment.

By implementing weak emissions pricing and other demand-side climate policies, policymakers have failed to send a strong signal to investors and fossil fuel producers about the risks of business as usual. If fossil fuel producers are confident that the cost of future emissions will be not be much higher than it is today, they can make a financial case for continued investment in exploration and extraction.

Given the risk of their assets becoming worthless if emissions prices rise significantly, fossil fuel producers are also incentivised to lobby to keep emissions prices low. Furthermore, new investment once made will reinforce the case for delaying more ambitious climate policies. Politicians face a choice between stranding major fossil fuel investments and the jobs associated with them, and stranding their climate ambitions.

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[24] McGlade and Ekins, 2015.

[25] Carbon Tracker Initiative, 2017.

In this way, ongoing investment in fossil fuels can perpetuate dependency on them through technological and economic lock-in.[26] At least in democracies, there is a mismatch between the relatively short-term horizon of electoral cycles and the long-lived nature of many capital investments in fossil fuel infrastructure. If the projected future price of emissions is highly uncertain beyond the political short term, policies aimed directly at the production of fossil fuels may provide an alternative way to overcome fossil fuel dependency. This may explain the recent renewal of interest in supply-side climate policies.

Supply-side climate policies may also be able to mitigate the impact of a so-called 'green paradox'.[27] This paradox arises if fossil fuel producers expect emissions prices to rise in the long term, which may perversely incentivise them to increase fossil fuel production in the short term. This is because fossil fuel producers may choose to increase extraction while the 'going is good', thereby increasing emissions in the short term.

At the same time, it is also likely that fossil fuel producers would seek to expand alternative markets for their products that do not involve direct combustion for transport, heat and power. There is already some evidence of such diversification of demand occurring. For example, demand for oil to make plastics, fertilisers, clothing, detergents and other petrochemical products is rapidly increasing and is expected to account for more of the growth in global oil demand to 2050 than trucks, aviation and shipping.[28]

Given these incentives and political economy considerations, it is perhaps not surprising that fossil fuel production is still expanding globally. While global capital expenditure on oil and natural gas extraction projects contracted in 2015 and 2016, it is once again increasing and is forecast to total US$1.4 trillion between 2020 and 2024.[29] These new projects increase the probability of a 'carbon bubble' growing within global financial markets.[30]

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[26] Technologies and the systems that evolve to support them tend to perpetuate themselves. A combination of linked technical, economic, and institutional factors can favour the persistence of a particular technology or cluster of technologies in a way that locks out alternatives. This technological path dependency in respect of fossil fuel energy systems is termed 'carbon lock-in'. In many cases future fossil fuel production would still be expected to take place even if the market price of the products is lower than the long-run marginal costs of production. This is because rational producers will ignore 'sunk costs' and continue to produce as long as the market price is sufficient to cover the marginal cost of production (Erickson et al., 2015).

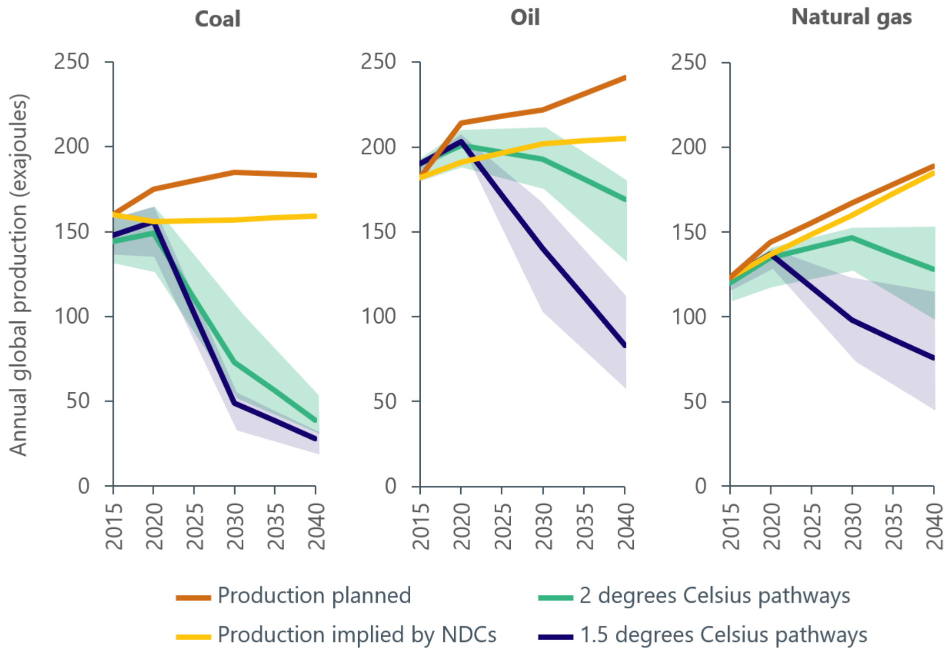
[27] Sinn, 2008; Green and Denniss, 2018.

[28] IEA, 2018.

[29] Global Gas and Oil Network, 2019. This includes capital expenditure by both state-owned and privately owned companies.

[30] Carbon Tracker Initiative, 2011.

At a global level, increased fossil fuel production will limit the ability of countries to collectively meet global temperature goals. The *Production Gap Report 2019* estimates that fossil fuel producers are planning to extract about 50 per cent more fossil fuels by 2030 than would be consistent with a two-degree Celsius pathway, and 120 per cent more than would be consistent with a 1.5-degree Celsius pathway.[31] The global production gap is largest for coal (see Figure 2).



Source: UNEP et al. (2019)

Figure 2: The production gap between global fossil fuel production plans and least-cost global pathways to 1.5°C and 2°C.[32]

Given that only a fraction of existing reserves can be burnt if the global temperature goals of the Paris Agreement are to be met, it has been argued that developed countries should curtail their fossil fuel production first. This would allow developing countries that have fossil fuel reserves to extract rents from them for a little longer to help accelerate their development.[33]

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[31] UNEP et al., 2019a. Note this study excluded global scenarios that rely heavily on CDR technologies.

[32] The 1.5°C-compatible and 2°C-compatible pathways include CCUS but scenarios with very high levels of reliance on carbon dioxide removal technologies were excluded. NDCs are nationally determined contributions under the Paris Agreement.

[33] Caney, 2016. Another possibility is that developed countries could compensate developing countries for leaving their fossil fuel reserves in the ground (Harstad, 2012). This would be similar in principle to existing payments for not cutting down rainforest under the United Nations' Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme. In 2007 the Government of Ecuador invited the international community to pay Ecuador US$3.6 billion to not develop almost one billion barrels of crude oil in the Ishpingo-Tambococha-Tiputini oilfields. However, the project

However, such an approach may risk locking-in emissions-intensive infrastructure in developing countries and make future decarbonisation more expensive.[34] Furthermore, renewable energy technologies are already the least-cost sources of new power generation in many regions, especially if the external costs of different energy sources are accounted for.[35]

Overall, if widely adopted, supply-side climate policies could help close the production gap and avoid global over-investment in fossil fuel production, thereby supporting efforts to meet the global temperature goals of the Paris Agreement. If well designed, supply-side climate policies could also minimise the risks of the green paradox occurring by restricting exploration and extraction of fossil fuels in the short term.[36]

Meeting the global temperature goals of the Paris Agreement will require well-aligned climate policies that work effectively together. If both supply-side and demand-side climate policies are used, they should be mutually reinforcing, enabling policymakers to "cut with both arms of the scissors."[37] Using both together can increase the coverage and ambition of climate policies.[38]

Emissions reporting and accounting

All countries currently report and account for their emissions on a territorial basis. That is, only emissions that occur within a country's borders are considered. Emissions that occur due to exported fossil fuels or imported emissions-intensive goods and services are attributed to the country burning the fuels or producing the goods. Territorial accounting enables countries that shut down emissions-intensive industries to 'outsource' their emissions by importing finished products manufactured elsewhere.

Arguably, countries that are net importers of emissions-intensive goods and services should bear part of the responsibility for emissions occurring overseas as a result of their imports.[39] This line of thinking led to the development of consumption-based accounting, which considers the global emissions footprint of a household, city or indeed an entire country.[40] For example, the

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only succeeded in raising US$13 million and was shelved in 2013 (Sovacool and Scarpaci, 2016).

[34] UNU-INRA, 2019; Bradley et al., 2018.

[35] IRENA, 2019.

[36] Green and Denniss, 2018; Roberts, 2018.

[37] Green and Denniss, 2018.

[38] Lazarus and van Asselt, 2018.

[39] Moss, 2019.

[40] Peters, 2008.

United Kingdom has published estimates of its consumption-based emissions that account for the embodied emissions in traded goods and services.[41]

The idea of taking responsibility for global emissions footprints is not by any means new. Some businesses, responding to consumer concern about climate change, have adopted an approach based on producer responsibility that accounts not just for their direct emissions but also some of those incurred by their suppliers and customers. Ikea, for instance, has estimated and taken responsibility for the global emissions footprint of its entire value chain, including third-party suppliers, customer travel to its stores and the use of its products.[42]

By only accounting for emissions produced within their borders, fossil fuel exporting countries can profess to be pursuing ambitious domestic climate policies secure in the knowledge that the emissions associated with burning their exported fossil fuels will be the responsibility of importing countries. Arguments have been advanced that fossil fuel exporting countries should accept, at least, partial responsibility for the emissions associated with their fossil fuel exports.[43]

Applying the logic of producer responsibility, already accepted by some businesses,[44] to fossil fuel producers leads to extraction-based reporting and accounting.[45] Extraction-based accounting attributes the emissions from fossil fuel combustion to the producer of the fossil fuels, and hence results in higher emissions totals for large net exporters of fossil fuels.

For example, Norway's emissions of carbon dioxide in 2017 as reported in its national inventory were around 44 million tonnes (equivalent to around seven tonnes of carbon dioxide per person). But using extraction-based accounting, its carbon dioxide emissions were around 470 million tonnes (around 88 tonnes of carbon dioxide per person).[46]

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[41] The United Kingdom's carbon dioxide emissions in 2016 were around 400 $MtCO_2$ on a territorial basis (Brown et al., 2018) and around 600 $MtCO_2$ when calculated on a consumption basis (Defra, 2019).

[42] Ikea, 2019.

[43] Moss, 2019.

[44] This includes some businesses in the fossil fuel sector. For example, BP has a target to reduce net emissions from its operations and production activities to zero and half the carbon intensity of its products by 2050 (BP, 2020).

[45] Davis et al., 2011.

[46] Territorial emissions from Norwegian Environment Agency (2019). Extraction-based emissions from UNEP et al. (2019b).

Australia, which is currently the world's largest exporter of coal and liquefied natural gas, accounted for 1.2 per cent of global carbon dioxide emissions on a territorial basis, but 3.8 per cent on an extraction basis in 2017.[47] Despite its large extraction-based emissions, Australia has assumed no responsibility for emissions overseas due to its fossil fuel exports.

The rationale for not doing so with respect to Australia's coal exports was explained by one former Australian Environment Minister in these terms: "I hope you would agree the poorest countries should be able to decide their own energy future. I am not a neo-colonialist. I think the poorest should be able to make their own decisions."[48]

In contrast, the Suva Declaration on Climate Change adopted by the Pacific Islands Development Forum in 2015 expresses "grave concern that the continued increase in the production of fossil fuels, particularly the construction of new coal mines, undermines efforts to reduce global greenhouse gas emissions and the goal of decarbonising the global economy".[49]

Like Norway, New Zealand's territorial carbon dioxide emissions per capita in 2017 were around seven tonnes of carbon dioxide per person. But unlike Norway, New Zealand is a significant net importer of oil and petroleum products. As a result, its carbon dioxide emissions were four tonnes of carbon dioxide per person in 2017, if extraction-based accounting is used (Figure 3).[50]

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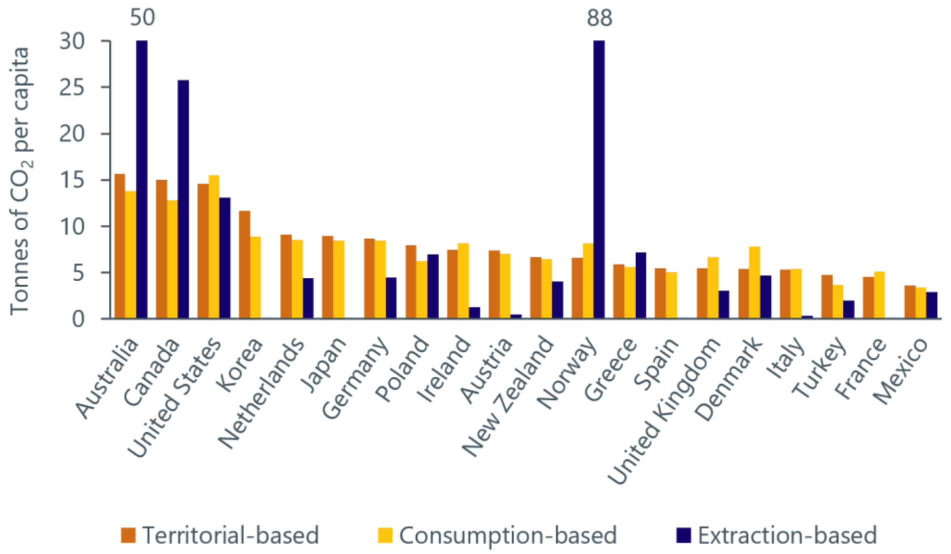
[47] Calculated using territorial emissions from IEA (2019c). Extraction-based emissions from UNEP et al. (2019b).

[48] Taylor, 2015.

[49] Pacific Islands Development Forum, 2015, p.6. The Suva Declaration on Climate Change also calls for "a new global dialogue on the implementation of an international moratorium on the development and expansion of fossil fuel extracting industries" (p.8).

[50] Territorial emissions from MfE (2019). Extraction-based emissions from UNEP et al. (2019b).



Source: Based on IEA (2019b), OECD (2019), UNEP et al. (2019b) and UN (2019)

Figure 3: Territorial-based, consumption-based and extraction-based carbon dioxide emissions per capita in selected OECD countries.[51]

The Paris Agreement provides limited guidance regarding the content of nationally determined contributions and how they are to be accounted for.[52] The emissions reduction targets put forward so far by developed countries in their nationally determined contributions have focused on reducing territorial emissions and followed the international norm of using territorial emissions accounting. Targets that only address territorial emissions do not explicitly incentivise countries to adopt policies to reduce production of fossil fuels for export.

Furthermore, asymmetries in climate policy stringency are likely to persist under the Paris Agreement for some time. So long as these asymmetries remain and nationally determined contributions are framed in terms of territorial emissions,[53] there will be a risk of emissions leakage[54] and a risk that fossil fuel producers in countries with tightening demand-side climate policies increasingly export their fossil fuels to countries with weaker climate policies.

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[51] Territorial-based and extraction-based emissions are for the year 2017; consumption-based emissions are for the year 2015.

[52] The Paris Agreement stipulates that in accounting for their nationally determined contributions, countries shall "promote environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting" (UN, 2015, p.5).

[53] There is the potential for nationally determined contributions to include targets to limit fossil fuel supply alongside enhanced targets to reduce emissions, and to specify the policies that will be used to do so (Verkuijl et al., 2018).

[54] Emissions leakage occurs when businesses in one country are required to pay more for their emissions than their overseas competitors, and the cost difference is enough to result in their production moving offshore.

Simply reporting extraction-based emissions (and, for that matter, consumption-based emissions) alongside territorial emissions would not eliminate these risks, but it would improve transparency and highlight the intuitive contradiction that ambitious climate policies at home can go hand in hand with increasing production of fossil fuels for export. Importantly, the adoption of extraction-based emissions reporting (or even targets for extraction-based emissions, in addition to targets for territorial emissions) would help incentivise the adoption of supply-side climate policies.

Supply-side climate policies in New Zealand

The ban is not the only supply-side climate policy promoted by the New Zealand Government. It has, for example, been a long-term advocate of the progressive elimination of subsidies for fossil fuels, including subsidies for fossil fuel production.

The worldwide removal of these supply-side subsidies is essential if clear signals are to be given about the transition to an energy system freed from reliance on fossil fuels. In 2015 these subsidies for fossil fuel production have been estimated globally to total a staggering US$444 billion.[55]

New Zealand is not the only country to take a renewed interest in supply-side climate policies. For example:[56]

- Denmark has banned all exploration and drilling for oil, gas and shale gas on land and in inland waters.
- Canada has placed a moratorium on offshore oil and natural gas activities in Canada's Arctic waters.
- France has decided not to renew exploration permits for conventional and unconventional fossil fuels and to phase out all oil and natural gas production by 2040.
- Costa Rica has banned offshore and onshore exploration and extraction of fossil fuels.
- Belize has placed a moratorium on offshore oil exploration and drilling.
- Spain has committed to phasing out coal production.
- Germany has phased out subsidies for the production of hard coal.

However, while there is renewed political and academic interest in supply-side climate policies coupled with reasons to justify their introduction, this does not mean that the ban itself necessarily has merit as a climate policy. An analysis of the ban requires an assessment of both its likely economic impacts and environmental effectiveness, and how it interacts with the New Zealand Emissions Trading Scheme (NZ ETS).

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[55] Bast et al., 2015.

[56] UNEP et al., 2019a.

While New Zealand accounts for tiny fractions of global fossil fuel production and emissions, its emissions per capita are high. The global nature of the climate change problem demands that any assessment of the effectiveness of climate policies is placed in a global context – in particular, whether or not other countries make sufficient efforts to meet the Paris Agreement.

As to the likely economic impacts of the ban, the principal concern will be for the distributional consequences both nationally and regionally inside New Zealand. But some of the distributional consequences of domestic policies could also have implications for New Zealand's negotiating position on climate change. The remainder of this note attempts to survey these issues.

Source: Bernard Spragg, Flickr

Figure 4: The Kakariki crude oil tanker was built in 1999 and sailed under the New Zealand flag until it was replaced in 2017. The tanker delivered more than 142 million barrels of oil to New Zealand ports.

3 Economic impacts of the ban

To examine the economic impacts of the ban, it is necessary to understand the extent and characteristics of New Zealand's fossil fuel production. In 2018, New Zealand produced 172 petajoules (163 billion cubic feet) of natural gas, 60 petajoules (11 million barrels) of oil and 83 petajoules (3.2 million tonnes) of coal.[57] In the absence of new discoveries, oil and natural gas production is expected to significantly decline over the next two decades (see Figure 5).

Globally, New Zealand's production of oil and natural gas is tiny. Its share of world oil production has fluctuated between 0.02 per cent and 0.08 per cent since the 1990s.

Despite these relatively small production levels, the New Zealand Government has in recent years collected on average around NZ$650 million per year in royalties and taxes from oil and natural gas producers.[58] These businesses have been estimated to contribute over NZ$2.5 billion to New Zealand's annual gross domestic product (GDP),[59] and directly and indirectly employ many thousands of people across New Zealand. Most of this employment is concentrated in Taranaki.

Figures 6 and 7 illustrate the flows between supply of and demand for natural gas and oil in New Zealand respectively, including imports and exports. All the natural gas produced in New Zealand is currently consumed domestically. On the other hand, New Zealand imports nearly all the oil it consumes. Almost all of the crude oil produced in New Zealand is exported, primarily to refineries in Australia and Singapore. New Zealand does not currently produce or import any liquefied natural gas.

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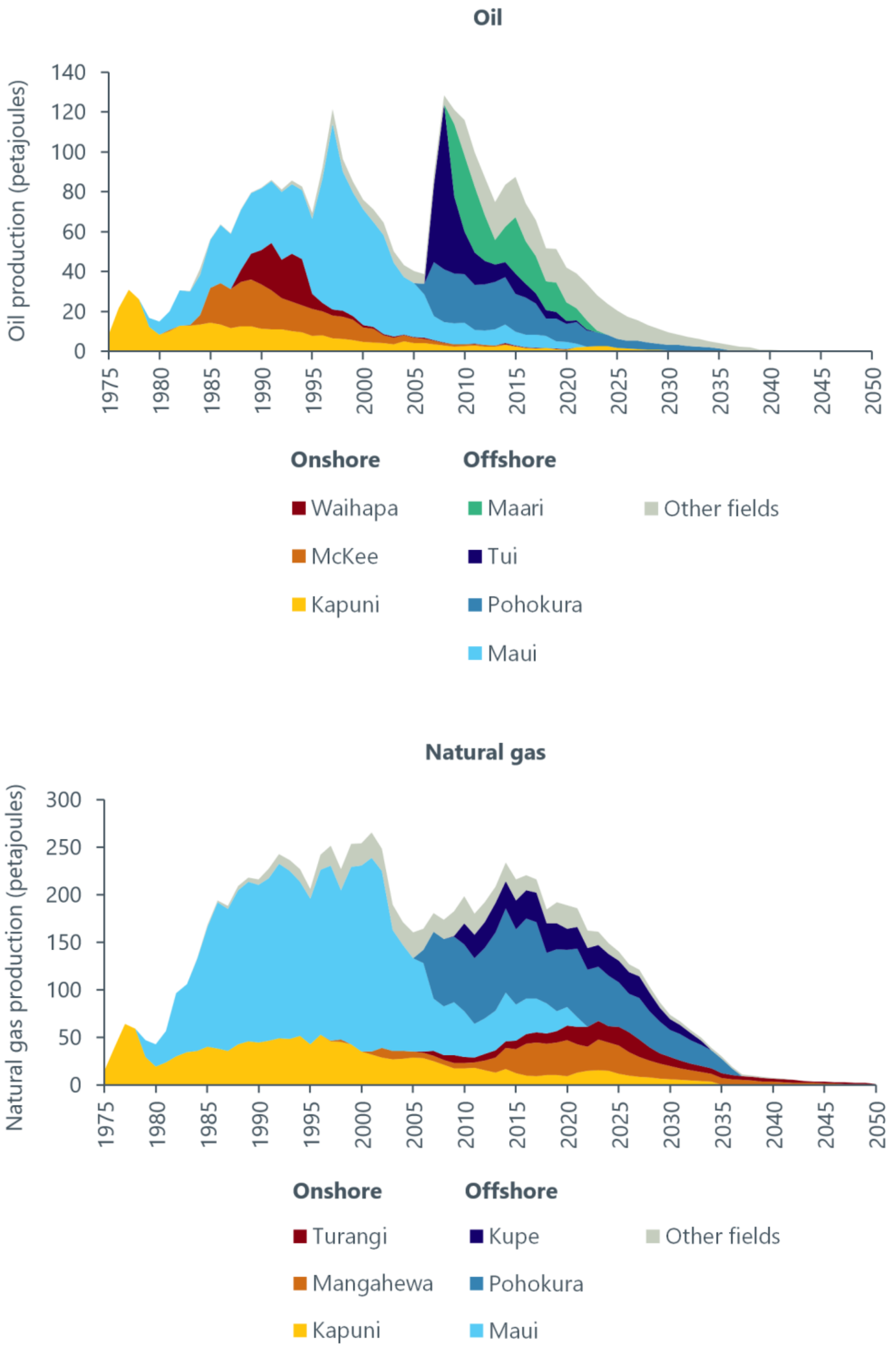
[57] MBIE, 2019a. Note that 1 PJ of primary energy is contained in approximately 25 million cubic metres of natural gas at atmospheric pressure, 180,000 barrels of oil, and 40,000 tonnes of sub-bituminous (hard) coal.

[58] NZ$653 million is calculated as a historical average between 2009 and 2017 (MBIE, 2018a). The royalty regime in New Zealand requires that any business producing and selling oil and natural gas in New Zealand is required to pay a royalty to the Government. This royalty is calculated as either 5% of net sales revenue or 20% of accounting profit, whichever is higher.

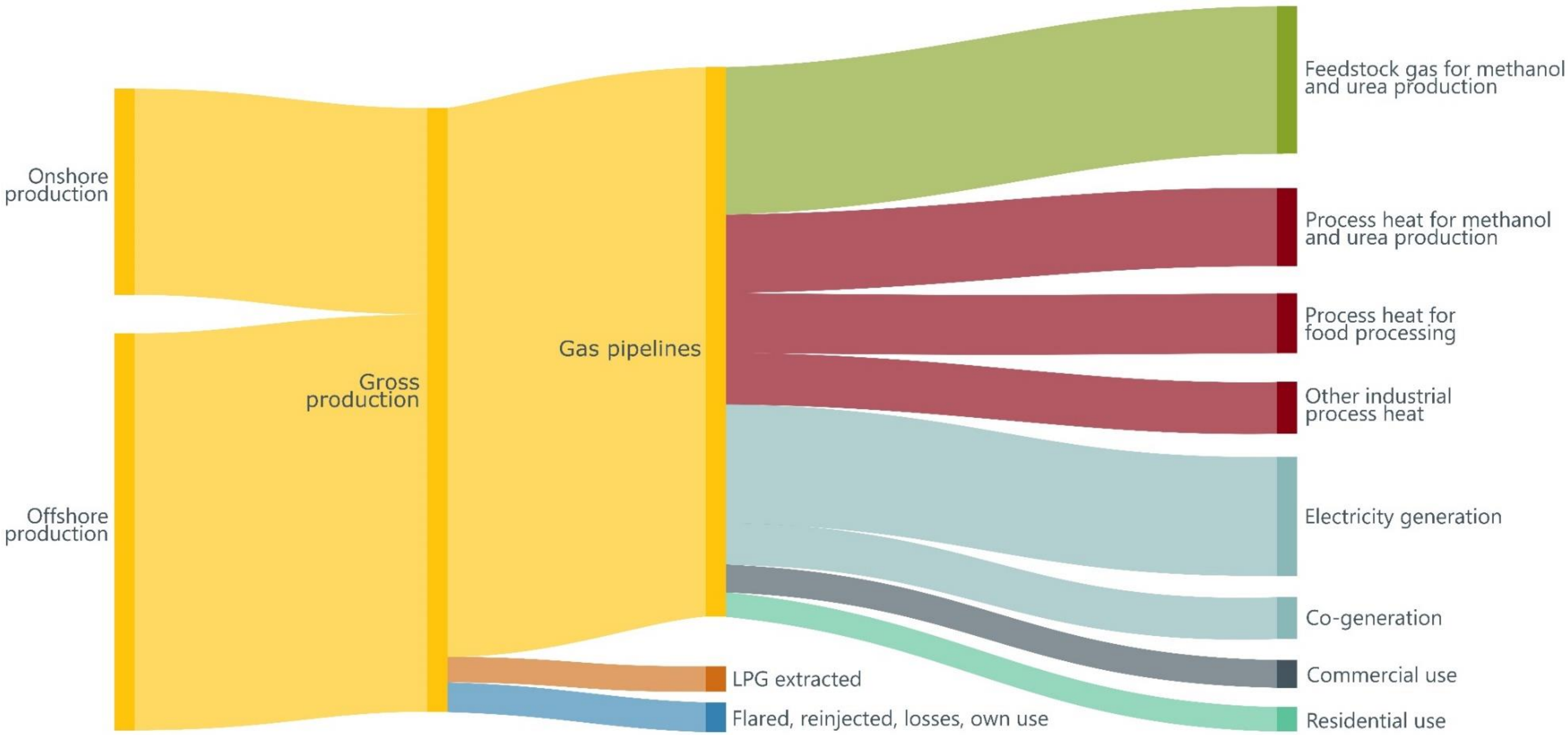
[59] PEPANZ, 2019; Venture Taranaki, 2015.



Source: Based on MBIE (2019b, 2019c and 2019d)

Figure 5: New Zealand's oil and natural gas production.[60]

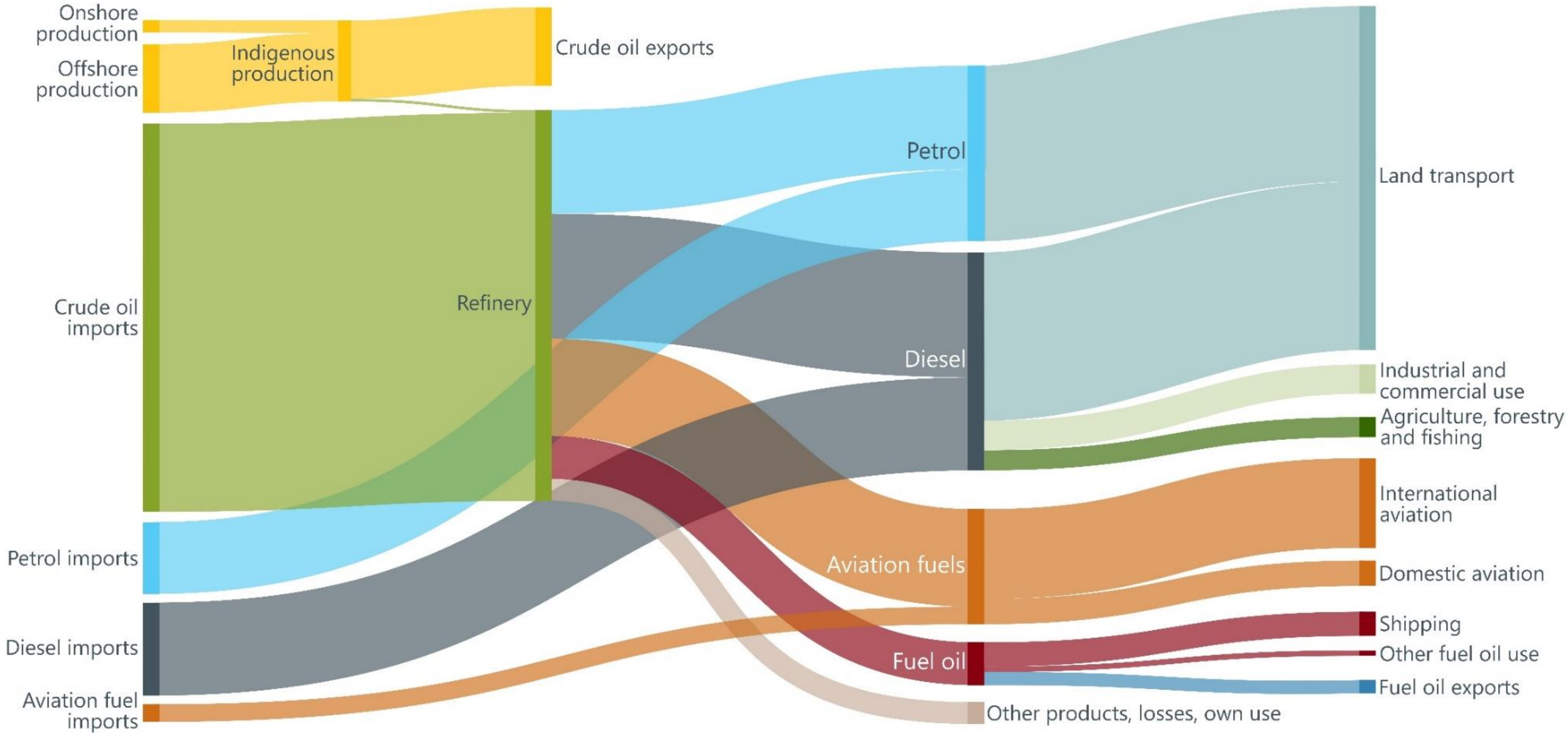
[60] Projections are in the absence of new discoveries or additional investment in the development of contingent resources in existing fields. 'Other fields' include both offshore and onshore fields.



Source: Based on MBIE (2019d)

Figure 6: Flows of natural gas in New Zealand.[1]

[1] The width of each flow is roughly proportional to its magnitude in 2018. Stock changes and other small flows (such as use of natural gas for transport and production losses, and own use in the electricity sector) are not shown.



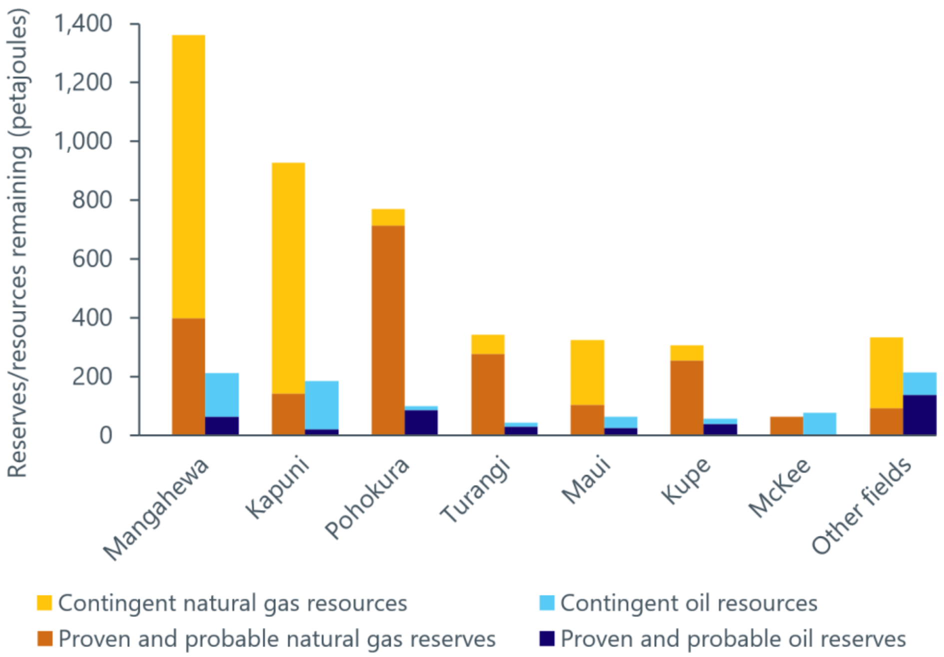
Source: Based on MBIE (2019b)

Figure 7: Flows of oil in New Zealand[62]

[62] The width of each flow is roughly proportional to its magnitude in 2018. Stock changes and other small flows (such as industrial use of fuel oil, use of diesel by the residential and electricity generation sectors, and flows of liquified petroleum gas, bitumen, lubricants, solvents, waxes, petroleum coke, white spirit and other liquid fuels) are not shown.

New Zealand's remaining reserves of natural gas are estimated to be around 2,000 petajoules, as of January 2019.[63] If current rates of extraction continue and no major new gas fields are discovered through current exploration efforts, this is equivalent to around 12 years' supply.

In reality, however, fossil fuel reserves are a function of economics. The extent to which the extraction of these dwindling reserves remains commercially viable depends largely on what happens to future demand for natural gas. The available gas for recovery may be more than double the 2,000 petajoules reserve estimate once additional resources from existing fields not yet economically viable to extract are also considered (Figure 8).[64]



Source: Based on MBIE (2019c)

Figure 8: New Zealand's oil and natural gas reserves as of 1 January 2019.

[63] These estimates refer to proven reserves and probable reserves. These reserves have a 50% probability of being produced.

[64] Contingent resources reflect fossil fuel resources from existing fields that could be recovered with current technology, but which are not economically viable at the current time. Published data indicates the amount of contingent resources from existing fields (at a 50% confidence level) is almost the same magnitude as the quantity from proven reserves. However, while there is high confidence that proven reserves will be extracted, it is likely that a smaller proportion of contingent resources will be developed. Funnell et al. (2015) indicated a 50% probability of undiscovered gas in the Taranaki basin of approximately 6,000 PJ. This volume of gas is equivalent to 30 years' worth of current demand. However, Funnell et al. (2015) highlighted it was extremely unlikely all this gas would be discovered, let alone developed.

While the ban has been framed by the Government as a climate policy, its most immediate impact is economic. Potentially, some immediate economic impact from the ban may already have occurred. For example, the ban may have meant that financial resources expended by geophysical service companies for prospecting (e.g. undertaking seismic surveys and seafloor sampling) under existing permits prior to exploration have been written off.

But a far greater impact of the ban is likely to be foregone fiscal revenues to the Crown and future contributions to GDP that might have been expected from the oil and natural gas industries. This section focuses on clarifying these economic impacts.

Fiscal costs

In its regulatory impact assessment (RIA), the Ministry of Business, Innovation and Employment (MBIE) used its oil and gas model to estimate the fiscal costs or lost revenues from foregone Crown royalties and taxes as a result of the ban.

The oil and natural gas modelling consisted of two sub-models: a simulation sub-model and a financial sub-model. The simulation sub-model estimated a range of variables, including the probabilities of exploratory success and the likelihood of finding oil versus natural gas. The financial sub-model accounted for the costs involved in oil and natural gas exploration in each basin, including operating costs, development costs and appraisal costs.

The modelling analysed three scenarios:

- a low scenario reflecting a low oil price, low exploratory success and a high emissions price
- a middle scenario reflecting a medium oil price, medium exploratory success and a medium emissions price
- a high scenario reflecting a high oil price, high exploratory success and a low emissions price.[65]

These scenarios are analogous to scenarios developed by the International Energy Agency (IEA). The modelling results indicated that oil and natural gas supply with the ban averages 87 petajoules from 2027 to 2050. This level of production is less than half current levels.

[65] The low scenario, referred to by the IEA (2019c) as the Sustainable Development Scenario, reflects an oil price of US$64 per barrel of crude oil in 2040 and a global emissions price of US$140/t$CO_2$-e. The middle scenario, referred to by the IEA as the Stated Policies Scenario, reflects an oil price of US$111 per barrel of crude oil in 2040 and a global emissions price of US$48/t$CO_2$-e. The high scenario, referred to by the IEA as the Current Policies Scenario, reflects an oil price of US$136 per barrel of crude oil in 2040 and a global emissions price of US$40/t$CO_2$-e.

As a result of the ban, this projected level of production results in fiscal costs to 2050 of between NZ$2.7 billion and NZ$14.4 billion for a three per cent discount rate, and between NZ$0.5 billion and NZ$3.1 billion for a ten per cent discount rate (Figure 9).[66] The middle scenario estimates are NZ$7.9 billion and NZ$1.8 billion in foregone revenue for a three per cent and ten per cent discount rate, respectively.

It is important to stress that these figures are cumulative fiscal costs out to 2050. Annual average revenue foregone for the middle scenario under a three per cent discount rate is less than NZ$350 million between 2027 and 2050.

Source: Based on MBIE (2018a)

Figure 9: Fiscal impacts of the ban on future Crown revenue to 2050.

MBIE notes in its RIA that the modelled estimates were highly uncertain given that "the business of quantifying undiscovered petroleum resources is fraught with difficulty and there are numerous possibilities for error".[67] Accepting the inevitable uncertainty surrounding the estimates, there are at least five reasons why the modelled fiscal costs in the RIA are likely to be overestimates.

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[66] P50 estimates were used for these fiscal costs. P50 estimates are defined as 50% of estimates exceed the P50 estimate (and by definition, 50% of estimates are less than the P50 estimate).

[67] Funnell et al., 2015, p.19.

First, there is the choice of discount rate.[68] While MBIE analysed both a three per cent and a ten per cent discount rate, MBIE largely reported fiscal costs using the three per cent discount rate. A three per cent discount rate was argued to be appropriate because it was previously used to assess oil and natural gas field development plans in 2013.[69] However, the Treasury recommends a six per cent discount rate as the default rate for both general policy analysis and energy-specific policy analysis.[70]

Low discount rates inflate the net present value of future costs, especially costs occurring in the medium to long term. If a six per cent discount rate had been used, the estimated fiscal costs would be somewhere between the fiscal costs for a three per cent and ten per cent discount rate.

Second, at least one and possibly two of the three scenarios modelled were not particularly realistic. The high scenario reflected a world in which New Zealand and other countries take no further action at all on climate change. This is clearly unlikely. However, the IEA's high scenario was never intended to be a plausible future. Rather, it was designed as a baseline against which plausible future scenarios could be assessed.

The middle scenario is more plausible.[71] The IEA designed it to account for existing policies and, importantly, new climate policy initiatives that governments have announced. This scenario includes the impact on global energy markets of nationally determined contributions under the Paris Agreement. However, it still reflects a world not on track to meet the global temperature goals in the Paris Agreement.[72]

The middle scenario does not reflect New Zealand's own stated level of climate policy ambition, which is to contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5 degrees Celsius above the pre-industrial level. For example, to meet New Zealand's 2050 target, it has been estimated that the domestic NZ ETS price needs to rise to at least NZ$140 per tonne of carbon dioxide equivalent by 2050.

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[68] The discount rate reflects the Crown's social rate of time preference.

[69] MBIE, 2018a.

[70] Treasury, 2020.

[71] The IEA (2019c) designed the Stated Policies Scenario (referred to in the RIA as the middle scenario) to account for existing policies, and importantly, new policy initiatives that governments have announced. Hence, this scenario, for example, includes the impact on global energy markets from nationally determined contributions under the Paris Agreement.

[72] The middle scenario reflects a world not on track to meet the Paris Agreement with global temperatures held only to between 2.7°C and 3°C of warming (Mission 2020, 2019).

At this NZ ETS price there would be a significant impact on New Zealand's natural gas consumption, irrespective of the ban. In the middle scenario, the emissions price reaches only US$48 per tonne (i.e. NZ$72) of carbon dioxide equivalent by 2040.[73]

The use of expected average global emissions prices in the RIA is justifiable for oil production because most of the oil produced in New Zealand is exported. But it is less appropriate for natural gas because nearly all of the natural gas produced in New Zealand is used domestically and is covered by the NZ ETS. As for coal, approximately 60 per cent of the coal produced in New Zealand is consumed domestically and therefore covered by the NZ ETS.

The decision not to account appropriately for New Zealand's stated level of climate policy ambition is somewhat surprising. Even though the Climate Change Response (Zero Carbon) Amendment Act 2019 had not yet been passed at the time of the ban's introduction, it was a leading government policy initiative. The RIA should have at least broadly taken it into account. The RIA was, after all, signed off by MBIE at the end of August 2018. By that time various modelling efforts were publicly available as to possible NZ ETS price pathways needed to reach the 2050 target and other proposed targets.[74]

One of these modelling efforts was the work commissioned by the Productivity Commission. In that modelling, the fossil fuel and chemical production industries contracted (in the absence of a ban) by at least 28 per cent by 2050 in pathways compatible with meeting the 2050 target as a result of a rising NZ ETS price.[75] The fiscal costs of the ban as reported in the RIA are likely to be inflated since they ignored the impact of a rising NZ ETS price to reach the 2050 target, and instead assumed no contraction of the natural gas industry.

By contrast, the impact of the NZ ETS on the oil extraction industry is limited because almost all of the oil New Zealand produces is exported. Similarly, Methanex, New Zealand's largest consumer of natural gas, currently receives freely allocated NZ ETS units because it is categorised as an emissions-intensive and trade-exposed (EITE) industry. This means Methanex only faces a small percentage of the full NZ ETS price for its domestic emissions.[76]

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[73] The New Zealand emissions price calculated uses an exchange rate of US$0.66 for NZ$1, which reflects the middle exchange rate applied in the RIA.

[74] MfE, 2019a.

[75] Productivity Commission, 2018.

[76] Methanol production currently receives a free allocation of units that equates to a level of assistance of 90% multiplied by its allocative baseline (currently 0.7854) multiplied by the annual quantity of methanol it produces that is of saleable quality. The allocative baseline for methanol production is intended to reflect the 'industry average' emissions intensity (i.e. tonnes of carbon dioxide emitted per tonne of methanol produced). If the allocative baseline reflects the actual emissions intensity of Methanex's methanol production, then the free allocation reduces the effective NZ ETS price it pays for its domestic emissions to 10% of the full price. If the actual emissions intensity is lower than the allocative baseline, the effective price it pays will be lower than 10%.

Because of these factors, the middle scenario remains plausible, albeit perhaps representing the worst-case scenario where global action on climate change is insufficient to meet the global temperature goals in the Paris Agreement.

On the other hand, the low scenario represents a world where action is sufficient to hold the global temperature rise to below two degrees Celsius. This scenario holds the global temperature rise to below 1.8 degrees Celsius with a 66 per cent probability and would be insufficient to hold the global temperature rise to 1.5 degrees Celsius of warming.[77]

Third, the RIA indicates royalties in the middle scenario would average NZ$917 million per year between 2027 and 2050. This estimate is considerably higher than the recent historical average of NZ$653 million per year between 2009 and 2017, when emissions prices in New Zealand and internationally were low. A 40 per cent increase in average annual royalties is significant. MBIE has justified this increase from the historical average largely on the assumption that global oil prices will, as a result of growing oil demand, increase from US$41 per barrel in 2016 to US$111 per barrel in 2040 for the middle scenario.[78]

An oil price of US$111 per barrel is significantly higher than current market expectations of future oil prices. For example, oil prices on the futures market were around US$50 per barrel in 2030 as of early March 2020.[79]

If oil prices in 2040 reached well over US$100 per barrel, they are likely to induce innovation and substitution effects that were uneconomic at lower oil prices. On the other hand, high oil prices would also spur greater exploration efforts. The relationship between oil prices and exploration activity is seen in Figure 10.[80]

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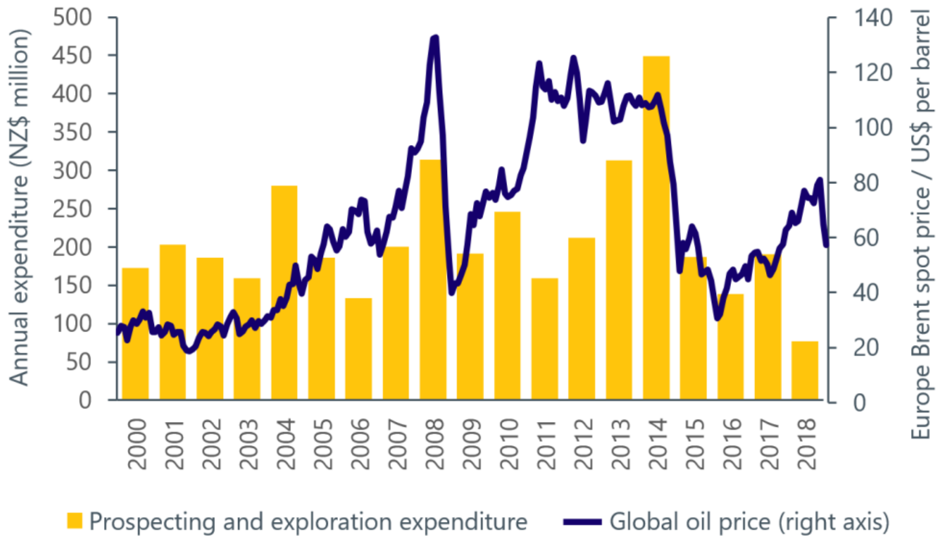
[77] IEA, 2019c.

[78] While there is no definitive breakeven oil price to move forward with exploration, oil prices lower than US$50 per barrel are typically less than the cost of oil production in many parts of the world (Knoema, 2020). On the other hand, oil prices over US$60 per barrel are sometimes used as a benchmark for renewed exploration activity (Gas Industry Company, 2017). Analysis by Oil Change International (2017) has indicated that for a new oil and natural gas field in Norway, a constant real oil price of US$60 per barrel will result in the field breaking even by 2032, at US$50 per barrel the field would be marginal, and at US$40 per barrel the field would be uneconomic.

[79] CME Group, 2020.

[80] Another key driver of exploration activity is New Zealand's exchange rate.



Source: Based on MBIE (2019a and 2017) and US EIA (2020)

Figure 10: Expenditure on oil and natural gas prospecting and exploration in New Zealand and the price of oil.[81]

Apart from the oil price, oil and natural gas exploration expenditure is generally incentivised by jurisdictions that display:

- promising geology that indicates the likely presence of oil and natural gas deposits
- relatively low exploration and extraction costs
- attractive royalty regimes and other production incentives
- good institutions and stable policy environments.

Prior to the ban in 2018, some oil and gas companies were already leaving New Zealand, or at least beginning to scale back their operations.[82] Investment in upstream oil and natural gas activities decreased around the world after 2014, following a slump in global oil prices.[83] New Zealand was particularly affected even though it has stable institutions and a reasonably attractive royalty regime. The most probable reason for the strong downturn in exploration in

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[81] Prospecting and exploration expenditure refers to annual national expenditure under prospecting permits and exploration permits.

[82] Some oil and natural gas companies left New Zealand altogether. For example, prior to the ban, Royal Dutch Shell sold all its extraction and exploration assets in New Zealand to OMV for NZ$794 million.

[83] The sharp decrease in global oil prices in 2014 was due to a significant increase in the supply of cheap US shale oil combined with relatively slow growth in global demand (Blasi, 2017).

New Zealand, apart from a low global oil price, is because of its relatively high exploration and extraction costs compared to its competitors.[84]

It is worth noting that since the introduction of the ban, the perception of New Zealand as possessing a stable policy environment has changed. For example, the Fraser Institute's Policy Perception Index, which reflects the extent of investment barriers in the oil and natural gas industries, has dropped by around 20 per cent for New Zealand since the ban's introduction.[85] Even if the ban were to be repealed, oil and gas companies would be likely to perceive New Zealand's policy environment as being uncertain for some time to come.

A fourth reason why future oil and natural gas royalties may be overestimated is that unless a major oil or natural gas field is discovered soon, efforts to explore offshore basins other than the Taranaki basin (i.e. frontier basins) could be curtailed indefinitely, irrespective of the ban.

At the moment, some exploration under existing permits is occurring in frontier basins. For example, OMV is undertaking a NZ$500 million campaign that includes an exploration well in the Great South Basin. However, OMV announced in February 2020 that the Tawhaki-1 exploration well in the Great South Basin did not find any commercial quantities of oil or natural gas.[86]

To be economic, any new field in a frontier basin probably needs to be comparable in size to Maui, the largest natural gas field in offshore Taranaki. Given the high costs of developing and operating a field in such a remote and harsh environment, anything smaller would likely be uneconomic.

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[84] Frykberg, 2018; Oram, 2018; Oram, 2019.

[85] Fraser Institute, 2018.

[86] New Zealand Herald, 2020.

Source: Geof Wilson, Flickr

Figure 11: The Maui field off the coast of Taranaki, was discovered in 1969. Natural gas deliveries from the Maui field began in 1979 and at their peak accounted for over 85 per cent of New Zealand's total natural gas production. However, natural gas production from the field has been steadily declining for more than a decade.

Aotearoa New Zealand's fields have typically been gas-prone, and it can be expected that any new large fields would also likely be gas-prone. Because there are no distribution pipelines in the South Island that could deliver natural gas to residential or commercial consumers, and because developing them would be very costly, any natural gas found in a South Island frontier basin would most likely be exported in some form.

This would require a floating liquefied natural gas terminal or the development of a new onshore petrochemical production facility. The development of such a terminal or facility could, in turn, support further exploration efforts in the basin by providing confidence to fossil fuel producers that the infrastructure and demand needed to support further investment was in place.

The economic feasibility of such a scenario depends on the global prices for liquefied natural gas and methanol, as well as the future availability of freely allocated units under the NZ ETS. Currently, the free allocation provided to Methanex supports its international competitiveness and commercial viability. The free allocation settings under the NZ ETS will be an important factor regarding the economic impact of the ban, especially in a future with higher NZ ETS prices.[87]

For example, a higher NZ ETS price may increase the availability of natural gas to EITE industries as domestic natural gas consumers who face the full NZ ETS price switch to alternative energy sources. On the other hand, a higher NZ ETS price may also reduce the international competitiveness of EITE industries if the rest of the world continues to take insufficient action on climate change.[88]

Oil and gas companies may be betting that free allocations will be provided for any new liquefied natural gas terminal or petrochemical facility in the South Island or elsewhere in New Zealand. As the law currently stands, such activities would probably be eligible for free allocation.[89] If the Government gave them EITE status then they would be entitled to receive free New Zealand units for however much liquefied natural gas or petrochemicals they chose to produce. This could have serious consequences for New Zealand's emissions.

If, on the other hand, the free allocation regime were limited to existing activities and businesses, it is less likely a new liquefied natural gas terminal or petrochemical facility would be commercially viable.

However, the chance of success in these frontier basins, which may be no more than one in eight,[90] is likely to be of far more significance to the future of fossil fuel production than the ban. If current exploration activities are unsuccessful, the ban could end up simply formalising the decline of the offshore oil and natural gas industries in under-explored parts of New Zealand.

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[87] The purpose of free allocation in the NZ ETS is to prevent emissions-intensive and trade-exposed (EITE) industries such as methanol production from moving overseas as a result of domestic climate policy to countries whose producers do not face the cost of their carbon dioxide emissions. However, in all likelihood, free allocation has been provided to some industries and businesses that did not need them or are less efficient than their overseas competitors (PCE, 2020).

[88] Most methanol producers in other countries do not face any emissions price. Therefore, any increase in the NZ ETS price, even with free allocation, will marginally affect the international competitiveness of methanol production in New Zealand.

[89] If their emissions reach the thresholds set out in section 161C of the Climate Change Response Act.

[90] New Zealand Herald, 2020. MBIE (2018a) indicated a likely exploratory success rate of between approximately 15% (one in seven) and 10% (one in ten) for frontier basins.

The final reason why the RIA may have overestimated the fiscal costs of the ban is that there are likely to be some substitution effects from offshore to onshore exploration in Taranaki, especially if there were to be an increased interest in fracking. Recent modelling supports this view, where it has been estimated that new onshore fields are likely to be found and developed, given the tightening of gas supply from offshore fields as a result of the ban.[91] Given these potential substitution effects towards onshore exploration, one must question why onshore fields in Taranaki remain exempt from the ban.

The costs of developing an offshore field (around NZ$80 million for a single offshore exploratory well) are typically much higher than an onshore field.[92] Consequently, to recoup development costs, the minimum size for an offshore field needs to be much larger than the minimum size for an onshore field.[93]

Making an economic case for offshore exploration in the Taranaki basin is made even more difficult because the likely exploratory success rate for offshore exploration sites is approximately 20 per cent (one in five), compared to 40 per cent (two in five) for onshore exploration sites.[94] Moreover, experts suggest Maui could well be the largest offshore field discovered in the basin and that further offshore discoveries in the basin can be expected to be smaller.[95]

Natural gas production from the Maui field has been in decline for some time and 2021 is currently expected to be the last year in which natural gas is produced from the field.[96] Several other, smaller natural gas fields have since been discovered and brought into production, but none of them have matched the size of Maui. Coupled with recent temporary outages of the Pohokura gas field, supply to the market is tightening, and natural gas and electricity prices are already rising as a result.

Overall, it can be expected that the impact of the ban will fall most heavily on exploration efforts in the Taranaki basin. While there may be some substitution towards increased onshore exploration in the Taranaki region, the ban could nevertheless result in billions of dollars in foregone revenue to the Crown over three decades. However, the fiscal costs are likely to be at the lower end of the range suggested by MBIE in its RIA, for the reasons stated.

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91 Concept, 2019.

92 Funnell et al., 2015.

93 Concept, 2019.

94 MBIE, 2018a.

95 Concept, 2019; Funnell et al., 2015.

96 MBIE, 2019c.

Without access to new natural gas supply from Taranaki, the premature exit of Methanex from Taranaki would become more likely. However, a rising NZ ETS price could lead to more natural gas becoming available for methanol production as non-EITE natural gas consumers switch to low-emissions alternatives. Overall, the probability of Methanex scaling back its methanol production or prematurely exiting New Zealand altogether as a result of the ban may depend on the strength of the NZ ETS price.

If the ban were to lead to a premature exit by Methanex, it is also possible, given the nature of the New Zealand natural gas market, that existing offshore fields in the Taranaki basin (e.g. Maui) would be decommissioned earlier.

The decommissioning costs of an offshore field the size of Maui will be large and the Crown will be liable for a substantial share of them. The timing of that liability will depend to some extent on whether existing exploration permits are extended, which could result in decommissioning costs for some fields being pushed back. There is some evidence that this is already happening.[97]

Gross domestic product and employment

Beyond the fiscal costs of the ban are its wider impacts on GDP and employment. These were acknowledged but not accounted for in the RIA, which stated that: "there are expected to be broader economic impacts as a result of [the ban], including to the national and Taranaki economies, and potentially to the economies of other regions."[98]

An analysis of the impacts on GDP and employment is legitimate. The oil and natural gas industries provide important inputs for many economic activities in New Zealand, so the effects of the ban can be expected to flow on to the wider economy.

In response to the limited economy-wide analysis in the RIA, the Petroleum Exploration and Production Association of New Zealand (PEPANZ) took up the challenge. It commissioned the New Zealand Institute of Economic Research (NZIER) to assess the national and regional economic impacts of the ban using a computable general equilibrium (CGE) model.[99]

The use of a CGE model was an appropriate choice. CGE models have been widely used to analyse the direct and indirect flow-on effects of various policies, including energy and climate policies, on GDP and employment. Indeed, NZIER is among several groups that have undertaken CGE modelling to analyse the economy-wide impacts of different proposals for New Zealand's 2050 target.[100]

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[97] RNZ, 2018.

[98] MBIE, 2018a, p.5.

[99] NZIER, 2019.

[100] NZIER, 2018; Westpac NZ, 2018.

However, CGE models are often characterised as 'black boxes' with complex internal workings that make them difficult to understand. Furthermore, ongoing technological improvements, innovation benefits and knowledge spill-overs that accrue from the implementation of climate policies are difficult to capture endogenously in these models, let alone changes in consumer preferences. Importantly, these elements do not appear to have been readily captured in the model used by NZIER to assess the economy-wide impacts of the ban.[101]

Failing to appropriately consider changes in technologies over time and the innovation benefits spurred from climate policies is perhaps surprising. This is because the CGE modelling performed for the Government by NZIER to assess the economy-wide impacts of the 2050 target explicitly recognised such ongoing technological improvements by introducing a range of exogenous technological assumptions.[102]

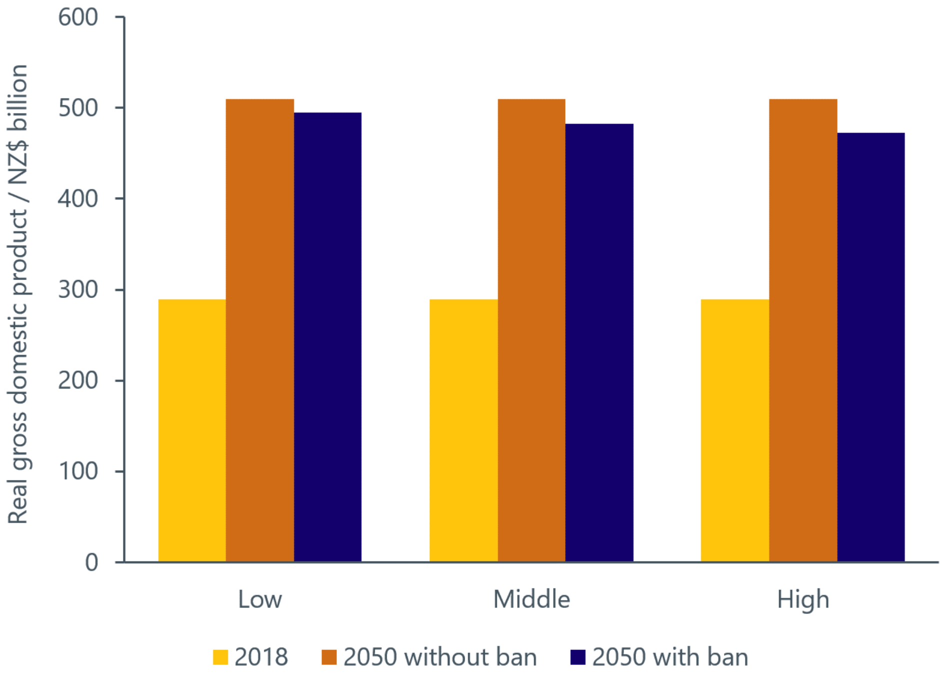
NZIER captured in its CGE model the same three scenarios as the modelling analysis undertaken by MBIE for its RIA. The problems outlined previously regarding the implausibility of the high scenario – and, to a lesser extent, the middle scenario – therefore equally apply to the results of the NZIER work.[103]

The NZIER modelling estimated that in scenarios with the ban, the impact on real GDP would be between NZ$15 billion and NZ$38 billion lower than without the ban by 2050 (Figure 12). The middle scenario was a reduction of NZ$28 billion by 2050. Of course, the New Zealand economy still grows markedly over the next three decades, with or without the ban.

[101] There is evidence that more stringent climate policies can catalyse increased innovation activity in low-emissions technologies (Calel and Dechezleprêtre, 2016).

[102] NZIER, 2018.

[103] However, NZIER did analyse a 6% discount rate in their modelling analysis.



Source: Based on NZIER (2019) and StatsNZ (2019)

Figure 12: Estimated impacts of the ban on real GDP.[104]

Importantly, the high scenario estimate is broadly similar in magnitude to the impact estimated by NZIER of New Zealand meeting its 2050 target. This underlines the high scenario's implausibility.[105] Furthermore, the CGE modelling by NZIER for the 2050 target was at the highest end of estimated NZ ETS prices.[106] For example, the NZ ETS prices modelled by NZIER for reaching the 2050 target were in the order of four-to-six times higher than other modelled NZ ETS prices. This fact implies that the economic impacts from the ban, as modelled by NZIER, are also likely to be on the very high end of possible impacts, no matter which scenario is modelled.

Nonetheless, and despite many reasons to suggest the economic impacts are overestimates, the available modelling analysis leaves little room for argument that the economic impacts of the ban are likely to be measured in billions of dollars.

[104] Real GDP in 2050 without the ban was calculated by dividing the reduction in real GDP in 2050 by the percentage reduction in real GDP in 2050.

[105] CGE modelling by NZIER (2018) estimated economy-wide impacts of NZ$48.5 billion by 2050 to reach a target that broadly approximates the emissions reduction needed to reach the 2050 target. To reach the 2050 target an NZ ETS price of NZ$580 t/$CO_2$-e by 2050 is needed, which is much higher than other modelling efforts (e.g. Westpac NZ, 2018; Productivity Commission, 2018) to reach a similar target.

[106] Winchester, 2018.

Given that the oil and natural gas industries are concentrated in Taranaki,[107] it is not surprising that NZIER's modelling indicated the greatest impacts from the ban will occur in this region. The NZIER assessment estimated that Taranaki's real GDP as a result of the ban would be between 35 and 53 per cent smaller by 2050 relative to the base scenario. By contrast, real GDP would increase slightly in regions outside of Taranaki as resources shift from Taranaki to other regions.

NZIER found that the ban would reduce employment in the oil and natural gas industries by between 33 and 40 per cent. Based on MBIE employment figures, this corresponds to direct job losses of between 1,600 and 1,900 in the oil and natural gas industries, mostly in Taranaki. There could also be further indirect job losses in supporting sectors.[108]

Given the significant impact that the ban and other climate policies will have on the Taranaki region, the Government has co-developed with Taranaki communities and stakeholders a 2050 roadmap for the region's 'just transition'.[109] As part of this transition towards clean, renewable energy and away from oil and natural gas industries, the Government has invested NZ$27 million for the development of a new national energy development centre to be located in Taranaki. The potential benefits of these investments do not figure in any of the modelling conducted so far.

Importantly, the ban coupled with a rising NZ ETS price and policies to support Taranaki's economic transition will reduce the risk that both capital and jobs will be stranded should global climate action lead to a sharp future contraction in the oil and natural gas industries over the long term. Such efforts will also assist economic diversification, especially into new low-emissions technologies.

[107] The oil and natural gas industries currently generate 30% of Taranaki's GDP.

[108] Job losses in Taranaki would be expected to result in additional government spending in the region to address the increased regional unemployment. This countervailing factor was not considered in the CGE modelling.

[109] Venture Taranaki, 2019.

Energy affordability

The ban is likely to have an impact on natural gas prices and, in turn, electricity prices. There has already been speculation that the ban has been a catalyst for increased natural gas and electricity prices.[110] However, these price rises are more likely to be the result of the Pohokura gas field outages and deliverability constraints. The impact of the ban on natural gas supply is only likely to result in materially significant reduction in supply as existing exploration and mining permits expire.

In the future, the direction of the impact on natural gas prices from the ban is far from clear because supply and demand in the New Zealand natural gas market are deeply entangled.[111] Because Methanex is currently the single largest consumer of natural gas, and a reliable buyer of it, a decision to prematurely cease operations in New Zealand would have significant impacts on the natural gas market.[112]

The impact on natural gas prices if Methanex were to prematurely exit from New Zealand in the future could go in either direction. One possibility is that a surplus of natural gas could see prices decrease.

On the other hand, it is also possible that natural gas prices could increase as a result of the increased uncertainty about continued supply and demand for natural gas in the absence of Methanex.[113] The potentially higher costs of maintaining the offshore extraction and distribution infrastructure could see these being shifted onto the remaining consumers. Furthermore, there would be a risk that natural gas producers could decide to defer investment in development of existing fields to conserve natural gas reserves.

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[110] National Party, 2019.

[111] There are many inter-connected factors that will influence future natural gas prices in New Zealand. These include the NZ ETS price and how natural gas users respond to it, the availability of natural gas from existing fields, the outcome of ongoing exploration activities under existing permits, global oil prices, and the degree to which market participants are able to anticipate any significant changes in supply or demand (such as the closure of one of Methanex's methanol production facilities). Furthermore, natural gas prices are opaque because most natural gas is traded via bilateral contracts and only a small proportion is traded via the wholesale market.

[112] Modelling by Concept (2019) has found that methanol production under a central scenario with the ban might continue to 2038.

[113] Methanex plays a role in underpinning investment in field development through the certainty of its natural gas demand and may remove risks with exploration through its specific gas supply agreements with oil and gas companies.

An increase in natural gas prices in the future has been indicated in modelling.[114] However, the impact on natural gas prices is likely to be partially subdued to 2050, as a result of petrochemicals and other major natural gas consumers reducing consumption of natural gas in the anticipation of higher prices.

If natural gas prices do increase markedly as a result of the ban, mechanisms to mitigate these higher natural gas prices on low-income households could be considered as part of a transition policy package that reaches beyond the Taranaki region. However, since natural gas for heating is more prevalent in high-income than low-income households, such policy packages may not be necessary.[115]

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[114] Concept, 2019. Modelling undertaken for the BusinessNZ Energy Council (2019) also found that the ban will increase natural gas prices over the long term. This modelling found that the percentage increase in natural gas prices with the ban could be as high as 110% between 2020 and 2060, though even without the ban prices were modelled to rise by around 60%. Whether it is realistic to project that natural gas prices could more than double in the long term depends on whether it will at some point become cheaper for natural gas consumers to import liquefied natural gas or substitute towards renewable sources of energy.

[115] MBIE, 2018b.

4 Environmental effectiveness of the ban

The ban was presented by the Government as "part of [its] plan for a 30-year transition away from a reliance on fossil fuels" and being about "taking political leadership to act on climate change and its flow-on impacts".[116] As outlined above, the ban will likely have an economic impact. That impact, in effect, represents the cost of being among those countries seeking to take global leadership on climate change by implementing supply-side climate policies. This section focuses on the likely impact of the ban on domestic and global emissions.

Other environmental impacts of oil and natural gas exploration and extraction, such as the release of drilling fluids and 'produced water' into the ocean and the potential for oil spills, are beyond the scope of this paper. The potential co-benefits of the ban are briefly summarised in Annex 2.[117]

Domestic emissions and carbon lock-in

The regulatory impact assessment (RIA) stated that the ban would result in "some reduction in domestic emissions from fugitive emissions from foregone production" and possibly "some reduction from major gas users, of which Methanex is the most material."[118]

Fugitive emissions[119] from oil and natural gas infrastructure were estimated at around 1.8 million tonnes of carbon dioxide equivalent in 2017, or approximately two per cent of New Zealand's total gross emissions.[120] Two thirds of these emissions were fugitive carbon dioxide emissions and the rest were fugitive methane emissions. By reducing future levels of exploration and extraction activity, it is likely that the ban would result in domestic emissions reductions from this source.

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[116] Woods, 2018.

[117] There may also be perceived or actual adverse environmental impacts, for example if the ban results in the relocation of exploration and mining to onshore locations that have high natural values.

[118] MBIE, 2018a, p.30.

[119] Fugitive emissions are emissions due to leaks and other unintended releases of gases from oil and natural gas infrastructure.

[120] MfE, 2019b. Recent research indicates that fugitive methane emissions from the oil and natural gas sector could be strongly underestimated in national greenhouse gas inventories (Hmiel et al., 2020).

In the electricity generation sector, the ban is likely to have little impact on domestic emissions from electricity generation if the future New Zealand Emissions Trading Scheme (NZ ETS) price is significantly higher than it is today. A rising NZ ETS price is likely to result in switching from coal- and gas-fired electricity generation to renewable energy sources, such as wind and geothermal, even in the absence of the ban.[121]

Fuel switching away from coal and natural gas in response to a rising NZ ETS price is expected to occur first for baseload electricity generation (that is, steady output over extended periods of time). This is because cost-effective substitutes are already available that can replace the role of coal- and gas-fired baseload generation.[122] At current prices, for example, new wind farms are already more economic than new combined cycle gas turbines in New Zealand even in the absence of an emissions price, and they would become more economic than existing ones at an NZ ETS price of around NZ$35 per tonne of carbon dioxide equivalent.[123]

Fewer low-emissions substitutes are currently available to replace thermal peaking plants. In the short term, thermal peaking plants are likely to continue to be needed to meet peaks in electricity demand, especially during extended dry periods when hydro generation is reduced. New Zealand's remaining natural gas reserves would probably be sufficient to supply an intermittently operated thermal peaking plant for several decades to come, albeit at a higher cost than at present, given the lower economies of scale.

In the longer term, a pumped hydro scheme, batteries or hydrogen produced from surplus renewable electricity might become viable options for providing inter-seasonal energy storage to cover winter peaks in electricity demand, particularly if combined with energy efficiency and smarter demand-side management.[124] However, these technologies are currently significantly more expensive than natural gas.[125]

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[121] In the short term, there may also be fuel switching from coal to natural gas for electricity generation as the NZ ETS price rises.

[122] The concept of 'baseload' generation becomes less relevant once high levels of intermittent renewables are added to the electricity grid. Base-cost renewables such as wind and solar (combined with energy storage and demand side management) are generally dispatched first and can displace gas-fired baseload generators.

[123] Concept, 2019.

[124] The Government's recent green paper on hydrogen highlights the potential use of hydrogen for inter-seasonal energy storage to cover winter peaks in electricity demand (MBIE, 2019e).

[125] Modelling for the Interim Climate Change Committee estimated that the wholesale electricity price would increase from the current level of around $80 per megawatt-hour to around $89 per megawatt-hour for 99 per cent renewable electricity by 2035, but would jump to $113 per megawatt-hour for 100 per cent renewable electricity in that same year (ICCC, 2019).

The impact on domestic emissions of switching away from natural gas for electricity generation depends on which fuel is used as a substitute. At current NZ ETS prices, coal is the cheapest alternative to natural gas for the Rankine units at the Huntly power station. For example, in the second half of 2018, following natural gas supply constraints and low lake storage levels, Genesis Energy ran its Rankine units to provide thermal backup generation using coal.[126] This fuel switching from natural gas to coal was not because of the ban.

Source: VirtualWolf, Flickr

Figure 13: The Huntly power station in Waikato is the largest power station in New Zealand. The station is owned by Genesis Energy and currently has four generating units – two 250 megawatt coal- and gas-fired Rankine units, a 50 megawatt gas- or diesel-fired peaking plant and a 403 megawatt combined cycle gas turbine plant.

Generating electricity using coal is more emissions-intensive than using natural gas.[127] The emissions intensity of coal-fired electricity generation at the Huntly power station is typically around 970 grams of carbon dioxide per kilowatt-hour, while the emissions intensity of its gas-fired electricity generation is typically around 400 grams of carbon dioxide per kilowatt-hour.[128]

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[126] At the end of 2018, Genesis Energy imported over 600,000 tonnes of sub-bituminous coal from Indonesia for use at Huntly (Enerlytica, 2019).

[127] Though recent research has found that liquified natural gas can be worse for the climate than coal if methane leakage rates are more than 2% or 3% (IEEFA, 2020).

[128] Genesis Energy, pers. comm, 19 March 2020.

The lower emissions intensity of natural gas relative to coal is why it is sometimes referred as a 'transition fuel'. However, as the IEA has noted, "beating coal on environmental grounds sets a low bar for natural gas, given there are lower-emissions and lower-cost alternatives to both fuels".[129] Further, in the absence of CCUS, investing in new natural gas infrastructure risks locking in future emissions and making subsequent deep decarbonisation more expensive.

Importantly, coal is unlikely to play a role in New Zealand's electricity sector for much longer, particularly as the NZ ETS price continues to rise. Genesis Energy has set a timeline of 2025 for the removal of coal from its electricity generation at the Huntly power station outside of normal market conditions, and intends to remove coal completely by 2030.[130]

The impact of the ban on domestic emissions from other uses of natural gas partly depends on the settings for free allocation under the NZ ETS.[131] For natural gas consumers that are not eligible for free allocation, such as dairy processing plants, the NZ ETS price is likely to be a stronger driver of domestic emissions trends than the ban. This is because, as with electricity generation, a rising NZ ETS price could be expected to drive fuel switching from natural gas to low-emissions sources of process heat such as electricity and biomass.[132]

By contrast, the ban could have a greater impact than the NZ ETS price for emissions-intensive and trade-exposed (EITE) activities that are currently eligible for free allocation, such as methanol and urea production.[133] This is because the NZ ETS does not currently send a strong price signal to these businesses to reduce their emissions by switching away from natural gas for their process heat needs.

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[129] IEA, 2019d, p.16.

[130] RNZ, 2019.

[131] Free allocation (also known as industrial allocation) is "the provision of free New Zealand Units (NZUs) to entities that carry out 'eligible activities' whose competitiveness is considered at risk due to costs placed on the activity by the NZ ETS. These costs create a risk of emissions leakage if these entities were exposed to the full cost of NZ ETS surrender obligations" (MfE, 2019c).

[132] The NZ ETS prices needed to drive fuel switching in the process heat sector are typically higher than those required for baseload electricity generation.

[133] Methanol and urea production are categorised as highly emissions-intensive eligible industrial activities under the NZ ETS. They are therefore entitled to a free allocation based on a level of assistance of 90% for their domestic emissions. The Government has proposed annual phase down rates from 2021 for the level of assistance for industrial allocations as part of the Climate Change Response (Emissions Trading Reform) Amendment Bill.

In the near term, one of the key factors driving methanol production volumes is resource availability from existing fields. In the medium to long term, in the absence of a major new discovery under existing exploration permits, the ban is likely to bring forward the date when methanol production becomes uneconomic in New Zealand.[134]

If free allocations were to be phased down significantly, the NZ ETS would be expected to achieve greater domestic emissions reductions at lower cost than the ban. This is because it is a price-based rather than a regulatory policy and it covers a greater share of domestic emissions than the ban. If this were to happen, the ban would have much less of an impact on domestic emissions. Conversely, if free allocations are not phased down quickly, the ban could make a greater contribution to reducing domestic emissions, especially for EITE industries that rely on an ongoing supply of domestically produced natural gas.

Source: Parliamentary Commissioner for the Environment archives

Figure 14: The Waitara Valley methanol production facility, currently owned by Methanex, was established in 1983 to convert natural gas into high-grade methanol. Methanex also owns two methanol production facilities in Motunui. Methanex's facilities in New Zealand are capable of producing up to 2.4 million tonnes of methanol per year, of which about 95 per cent is exported to the Asia-Pacific region.

[134] Concept, 2019.

If a large new offshore field in a frontier basin were discovered and free allocation continued for new activities and businesses, a fresh wave of capital investment in a floating liquefied natural gas terminal or onshore petrochemical facilities could be expected. Once committed, such investment would risk creating new sources of domestic emissions for decades to come. Indeed, with the investment committed, the incentives are such that there is a need for ongoing production, even if there is a long-term loss, since closing down could incur an even greater loss.

By limiting exploration activity, the ban could help reduce the risk of the transition to a low-emissions economy being further delayed by the discovery of a new natural gas field. However, a new field could still be discovered in onshore Taranaki or in an offshore basin under existing permits, in which case the impact of the ban on domestic emissions would likely be minimal in the short to medium term.

Finally, it was noted previously that well-designed supply-side climate policies could in theory help to avoid the 'green paradox'. This effect could occur in New Zealand due to expectations that future NZ ETS prices will be significantly higher than today's low prices.

The ban may be helping to avoid the green paradox by dampening investment in exploration and extraction even under existing permits. The ban has increased perceptions of regulatory risk, making New Zealand a less attractive destination for multinational oil and natural gas companies to invest their capital.[135]

On the other hand, the ban might even exacerbate the green paradox by incentivising increased exploration and extraction in onshore Taranaki and under existing permits outside Taranaki.[136] This is because oil and gas companies may look to increase production under existing permits given that new permits will not be issued, despite the increased regulatory risk.

If there is an incentive to increase near-term production it is likely to be stronger for natural gas than for oil because many natural gas users will be subject to a rising NZ ETS price (including EITE activities to a lesser extent if free allocation were to be phased down).[137] Whether near-term production is increased will depend to some extent on how aggressively future climate policies are expected to bite.

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[135] Fraser Institute, 2018.

[136] The extent to which producers can maximise production from existing permits depends in part on provisions under the Crown Minerals Act 1991 related to partial permitting area relinquishments and extending permit areas and durations.

[137] New Zealand's oil production, because the vast majority is exported, does not face an NZ ETS price to the same extent.

While the green paradox may occur as a result of the ban, its likelihood is small. New Zealand's natural gas market is demand-constrained in the short term (though clearly supply-constrained in the long term), which makes it risky to increase production.

Global emissions

The likely impact of the ban on global emissions is even more difficult to estimate than its impact on domestic emissions, since it depends on the actions of other countries. Any such analysis is inevitably speculative in nature.

The regulatory impact assessment (RIA) characterised the likely effectiveness of the ban on global emissions as follows:[138]

> Net impact on global emissions is uncertain but more likely to be negative than positive. Reductions in fugitive emissions from foregone production are likely to be displaced by higher-emission production of oil and gas overseas. Likewise, any reduction in output or possible future closure of high emission domestic industrial gas users such as Methanex and NZ Steel would likely result in this output being displaced by even higher emission output from overseas.

Global demand for methanol is increasing. Currently, the global methanol market is estimated to be worth over US$30 billion and is expected to grow by 2.9 per cent per year to 2025.[139] The main use of methanol is the production of industrial chemicals such as formaldehyde, acetic acid and olefins (used in plastics). It can also be directly used as a transport fuel or blended into gasoline to reduce local air pollution.[140]

Even without growth in global demand for methanol, the premature closure of one or more of Methanex's methanol production facilities in New Zealand due to the ban would result in an increase in methanol production overseas. Whether this results in higher global emissions depends on the source of that increased production.

The process heat needed for methanol production can be provided by coal, natural gas or biomass.[141] In the short term, foregone methanol production in New Zealand would most likely be replaced by increased production from existing methanol production facilities in China, some of which are coal-fired. This would be expected to result in higher emissions from process heat, all else being equal.

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[138] MBIE, 2018a.

[139] Sherry, 2019.

[140] There is also increasing interest in using methanol to replace heavier fuel oil for shipping now that new international rules limiting the sulphur content of fuel oil have come into effect (IMO, 2020).

[141] European Biofuels Technology Platform, 2011.

Beyond the short term, however, it is less clear where new methanol production capacity would come from. It would not necessarily be China, since the "economics of new coal-fired methanol [production] facilities in China are not as favourable as they once were."[142]

In recent years, the United States has become the world's largest and cheapest methanol producer due to the extensive development of shale gas resources. Therefore, foregone production in New Zealand could well be replaced by production from new methanol production facilities in the United States in future. If this were to occur, the impact on global emissions is likely to be negligible or could even slightly decrease if gas-fired methanol production facilities overseas are more efficient than those in New Zealand.[143]

If other countries take action to meet the global temperature goals of the Paris Agreement, the use of methanol as a transport fuel or blended into gasoline could decrease in the long term due to increased use of cleaner fuels such as electricity and hydrogen for transport. In this case, foregone production in New Zealand might not be replaced on a one-for-one basis. Furthermore, an increasing share of global methanol supply could be produced from biomass feedstocks or by combining carbon dioxide and hydrogen produced from renewable electricity.[144] This would result in global emissions reductions.

In the case of oil, it might be expected that any foregone production in New Zealand as a result of the ban would have no impact on global emissions, because a corresponding quantity of oil would be produced overseas. However, several oil market analyses find global oil consumption drops by around 0.5 barrels for each barrel not produced.[145]

This indicates that while some increased fossil fuel production overseas might occur, it may not be on a one-for-one basis. The extent to which global emissions are reduced will depend on how emitters respond to prices and the stringency of climate policies in other countries.

The NZ ETS does not cover emissions occurring overseas as a result of New Zealand's exports of methanol, oil and coal. The ban, however, at least has the potential to reduce emissions overseas, whereas the NZ ETS cannot.

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142 Erickson and Lazarus, 2018a, p.4.

143 While shale gas may be a slightly more emissions-intensive source of methanol production than natural gas, new methanol production facilities in United States and elsewhere are likely to be more efficient than existing facilities in New Zealand.

144 Methanol Institute, 2018.

145 Erickson and Lazarus, 2018b; Erickson et al., 2018.

By introducing the ban, New Zealand has taken a stance on supply-side climate policies with a small group of other countries – as it has done previously on fossil fuel subsidy reform.[146]

Importantly, the ban shows that New Zealand has willingly foregone rents from its fossil fuel resources, which sets an example for other countries to follow in shouldering some of the economic costs required to address climate change. It also demonstrates that New Zealand is taking steps to unravel the contradiction of taking ambitious domestic climate action while continuing to seek to profit from extracting fossil fuels and exporting them overseas. This, in turn, strengthens New Zealand's negotiating position in the international climate change negotiations.

Building a coalition of like-minded countries could have two benefits. On the one hand it could place pressure on countries with large fossil fuel reserves to consider restricting their fossil fuel production. But even before that, the emergence of such a coalition could provide a further signal to the investment community of the rising risks of capital allocation to this sector.

It is even possible that provisions related to supply-side climate policies could be included in trade agreements such as the new Agreement on Climate Change, Trade and Sustainability.[147] This could catalyse international momentum for reducing the flow of investment into fossil fuel supply, leading in turn to lower global emissions and a better chance that the global temperature goals of the Paris Agreement will be met.[148]

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[146] New Zealand has taken a leading role in advocating for reform of fossil fuel subsidies by establishing the Friends of Fossil Fuel Subsidy Reform group. The current members of the group are New Zealand, Costa Rica, Denmark, Ethiopia, Finland, Norway, Sweden, Switzerland and Uruguay (MFAT, 2020).

[147] The Agreement on Climate Change, Trade and Sustainability is a New Zealand-led initiative announced in September 2019. It aims to remove tariffs on environmental goods, establish commitments to eliminate fossil fuel subsidies and develop voluntary guidelines for eco-labelling programmes. The current members are New Zealand, Costa Rica, Fiji, Iceland and Norway (Beehive, 2019).

[148] Coalitions of like-minded countries have helped build international momentum for other supply-side environmental policies in the past. For example, Denmark was the first country to introduce a partial ban on asbestos in 1972. By 2000, 35 countries had instituted bans, and by 2013, over 60 countries had instituted bans on asbestos (Allen et al., 2017).

5 Conclusions

This note does not advocate for or against the current ban. Rather, it assembles the evidence in support of a supply-side climate policy of this nature and examines the cogency of the ban.

My conclusions as to what can and cannot be fairly claimed with respect to the ban are as follows:

Those who support the ban can legitimately claim that:

- It is a significant step to unravel the contradiction of taking ambitious action to reduce domestic emissions while continuing to seek to profit from extracting fossil fuels and exporting them overseas for as long as possible.
- The credibility of New Zealand’s negotiating position in international climate change negotiations is strengthened, and if other countries do likewise, it puts pressure on large fossil fuel producing countries to follow suit.
- It will reduce the risk that both capital and jobs will be stranded should global climate action lead to a sharp future contraction in the oil and natural gas industries.
- It will likely reduce domestic emissions through a reduction in fugitive emissions from oil and natural gas infrastructure and, if the ban leads to the premature closure of one or more of Methanex’s methanol production facilities, there may be a further reduction in domestic emissions.

Those who support the ban must however acknowledge that:

- Like the NZ ETS, it will have a small and uncertain impact on global emissions; this impact will depend on:
  - the level of ambition of climate action by other countries
  - the extent to which foregone production of oil and methanol in New Zealand is substituted by increased production overseas
  - the relative emissions intensity of international competitors.
- A price-based supply-side climate policy, such as a production or exploration tax on fossil fuels, could be a more cost-effective policy than a regulatory-based policy like the ban.

Those who oppose the ban can legitimately claim that:

- It is likely to impose costs on the economy in the billions of dollars.
- The Taranaki region will be the most significantly impacted economically by the ban as a result of foregone future offshore exploration.
- The ban is unlikely to significantly reduce domestic emissions other than reduced fugitive emissions and reduced domestic emissions from the production of methanol if Methanex were to exit prematurely.
- The NZ ETS, if made more effective (including through the phase down of free allocations), has the potential to achieve greater domestic emissions reductions than the ban, and at lower cost.

Those who oppose the ban must however acknowledge that:

- The cost to the Crown and the wider economy will not be as high as some reported estimates.
- Continued investment in oil and natural gas could expose the New Zealand economy and the Taranaki region to stranding of investment and jobs, as well as lost opportunities to diversify the economy if the world takes sufficient climate action.
- There is no firm basis for claiming that it will increase global emissions.
- Interest in offshore drilling in New Zealand's frontier basins appeared to be declining even before the ban was announced, due to the high costs and difficult nature of offshore exploration in these frontier basins.
- The NZ ETS does not account for emissions overseas as a result of New Zealand's fossil fuel exports and as such, the ban addresses sources of emissions that the NZ ETS cannot.
- Even if there is pessimism about whether countries will collectively meet the global temperature goals in the Paris Agreement, it is possible the ban will contribute to international momentum and stimulate other countries to take more ambitious climate action than they might otherwise have done.

Finally, I note that:

- Reporting of extraction-based emissions in addition to territorial emissions would provide greater transparency about New Zealand's contribution to reducing global emissions and would also help incentivise the adoption of supply-side climate policies.
- Since a significant proportion of the coal produced in New Zealand is exported and not covered by the NZ ETS, analysis could be undertaken to assess the potential for a supply-side climate policy on coal, such as a moratorium on new coal mines or a coal production tax.

Overall, the most critical factor that will determine the environmental effectiveness and likely economic impact of the ban is how other countries act on addressing climate change. If the world continues to be far from meeting global temperature goals, then the ban has few upsides. This, of course, is not unique to supply-side climate policies. A similar conclusion holds for the NZ ETS or any other unilateral climate policy New Zealand might adopt.

But if the world does move towards ambitious climate action as countries have agreed to do under the Paris Agreement, then the ban can be justified on environmental grounds, especially if it encourages other countries towards greater climate ambition on the supply-side.

If the ban is retained, it should be advocated widely by the New Zealand Government to other countries.

6 Annexes

Annex 1: Oil and natural gas permits under the Crown Minerals Act 1991

Permits for the rights to search for and extract oil and natural gas are allocated under the Crown Minerals Act 1991 (CMA).[149] There are three types of permit under the CMA: prospecting permits, exploration permits and mining permits.[150]

Prospecting permits give the holder the right to conduct reconnaissance and general investigations of an area. Allowed activities include acquisition of geological and geophysical data collection. Drilling is not allowed to be undertaken under a prospecting permit. Permits are usually granted for up to two years. A permit holder has the right to surrender a prospecting permit in exchange for an exploration permit upon approval of the Minister charged with the administration of the CMA.

Exploration permits grant the holder the right to identify petroleum deposits and evaluate the feasibility of mining any discoveries. Exploration activities can include sampling, aeromagnetic surveys, geological studies, compiling reports and seismic surveys and well drilling. Exploration permits are allocated in an annual tender called a Block Offer, which is run by New Zealand Petroleum and Minerals. Permits are issued for up to 15 years. It is possible to obtain up to two four-year extensions for appraisal purposes. A permit holder has the right to surrender an exploration permit in exchange for a mining permit if the Minister is satisfied that the holder has discovered a deposit or occurrence of a mineral to which the permit relates.

Mining permits grant the holder rights to develop a discovered petroleum field to extract and produce petroleum. Allowed activities include extraction, separation, treatment and processing of oil and natural gas. Mining permits are exclusive and are granted subsequent to an exploration permit, based on the evaluation of an appraisal programme and work programme. The size and duration of the permit depends on the extent of the discovery.

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[149] Additional permits are also required under a range of other statutes, including the Resource Management Act 1991 and the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012.

[150] These definitions are based on NZP&M (2019).

Annex 2: Non-climate environmental impacts of oil and gas exploration and extraction

Oil and gas exploration and extraction can affect the environment in several different ways. For example, exploration of oil and natural gas and their subsequent extraction where the exploration proves successful, results in rigs disposing drilling fluids and 'produced water' into the environment, which contain toxic metals, including toluene, arsenic, lead, benzene, chromium and mercury.

The disposal of drilling fluids and produced water are particularly acute for offshore exploration and extraction, where toxic chemicals associated with these substances are discharged directly into the ocean. However, there have also been examples of onshore oil drilling impacting the environment. For example, in 2010, equipment failure at an exploration drilling site in Taranaki led to oil collecting in a flare pit, which subsequently leached into a stream.[151] More drilling fluids are discharged during exploratory drilling than from extraction wells because exploratory wells are typically deeper and larger in diameter.

Continued offshore exploration and extraction also pose the risk of blowouts and oil spills.[152] While the likelihood of either of these risks is small, the damages should they materialise can be significant. For example, the BP Deepwater Horizon oil spill off the coast of Louisiana, United States, which resulted from the blowout and subsequent explosion of an offshore exploratory rig, resulted in economic and environmental damages totalling US$36.9 billion.[153]

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[151] PCE, 2014.

[152] A blowout is where an influx of pressurised oil or natural gas from the reservoir flows in an uncontrolled way from the well.

[153] Smith et al., 2011.

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