

Coversheet: Proposed changes to the Crown Minerals Act 1991

Advising agency	Ministry of Business, Innovation and Employment (MBIE)
Decision sought	Agreement to the legislative changes to be made to the Crown Minerals Act 1991 to give effect to the Government's decision not to grant new offshore petroleum exploration permits, and to offer onshore exploration permits in Taranaki for 2018, 2019 and 2020.
Proposing Ministers	Minister of Energy and Resources

Summary: Problem and Proposed Approach

Problem Definition

What problem or opportunity does this proposal seek to address? Why is Government intervention required?

The Government has stated that it is committed to acting on climate change. It has said that it wants to show global leadership by demonstrating to other countries that New Zealanders can be better off while taking action to reduce our impact on the climate. The transition to a lower emissions economy will be a broad change to New Zealand's economy. In order to achieve and clearly signal this future direction, the Government is making broad policy changes in several areas.

Within this context, on 9 April 2018, Cabinet noted [CAB-18-MIN-0162] two policy announcements relating to petroleum exploration permitting:

- the intention to limit the area available for Block Offer 2018 to onshore blocks in the Taranaki Basin; and
- that there will be no offshore blocks offered in future block offers or through an alternative process.

On 2 July 2018, Cabinet agreed further outcomes that it was seeking from the proposed amendments to the Crown Minerals Act 1991 (CMA) [CAB-18-MIN-0306.01]. These are to:

- give effect to the new offshore petroleum exploration policy while preserving the rights of existing permit holders (for either petroleum or other minerals);
- hold a block offer for onshore blocks in Taranaki for 2018, and again in 2019 and 2020;
- prohibit surface access to conservation land for certain activities, such as drilling, as they specifically relate to Taranaki Block Offer 2018, 2019, and 2020;
- ensure the onshore Taranaki block offer processes are robust and therefore unlikely to be subject to successful judicial review proceedings;
- reduce the risk that applications for offshore Petroleum Exploration Permits (PEPs) will be made outside of the onshore block offer process, which could lead to new PEPs being granted contrary to the government's new policy on the basis of the current law.

To achieve the outcomes above, Cabinet agreed on 2 July 2018 to pursue a two-part approach:

- tranche one will consider only those legislative changes considered necessary to give effect to the new offshore policy and allow onshore block offers to be run successfully;
- tranche two will embark on a wider review of the Act on a more typical timeframe, starting with an issues paper and consultation with stakeholders later in 2018.

The key objective for the proposed changes is to allow the Government to give effect to the policy outcomes agreed by Cabinet on 9 April and 2 July 2018.

All of the options considered in this document represent alternative approaches to amending the CMA to allow the Government to give effect to the policy outcomes previously agreed by Cabinet. These approaches have been developed by MBIE, with advice from s 9(2)(h) These include:

- Option A: Change the purpose of the CMA, specifically the word “promote” to something more neutral like “to provide for” and redefining how the words “for the benefit of New Zealand” are defined in the Petroleum and Minerals Programmes so that other Government objectives, outside of maximising the economic recovery of Crown owned minerals, may be considered.
- Option B: Alter the existing framework, by creating a new provision that would allow the Minister to exclude areas from permitting despite the current purpose statement (MBIE and s 9(2)(h) preferred option). This could be done by inserting a statement in the CMA to the effect that the relevant new enabling provisions apply despite section 1A. Option B is referred to as Option 1 in the accompanying Cabinet paper: *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.
- Option C: Create an indefinite moratorium, with transitional provisions to allow onshore Taranaki exploration permitting until 2020. Option C is referred to as Option 2 in the accompanying Cabinet paper *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.
- Option D: Create new regulatory power to make prohibitions or moratoria. These regulations would seek to prohibit activities authorised by the primary legislation. The Government could use this to prohibit PEPs from being granted outside onshore Taranaki for the next three years. A future Government would then be able to change this to allow either more or less permitting, without making changes to primary legislation. This legislation change would allow also a future Government to exclude further areas, in addition to what has already been stated in the recent policy announcement. Option D is referred to as Option 3 in the accompanying Cabinet paper *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.
- Option E: Create an explicit ban on permits in specific areas (Government preferred option). Option E would create an explicit ban in the legislation on new offshore PEPs and new onshore exploration permits outside Taranaki.

As the legislation stands, the Government is required to continue to offer the opportunity for companies to apply for offshore PEPs, in accordance with the purpose of the CMA. This requirement is the basis of the counter-factual, used in this impact statement.

Proposed Approach

How will Government intervention work to bring about the desired change? How is this the best option?

The option proposed by this impact analysis is to alter the existing legislative framework by creating a new provision that would allow the Minister to exclude areas from petroleum exploration permitting (Option B, described in Section 3.1).

This option would alter the current CMA framework so that the Government can give effect to the new policy as a statutory decision. The CMA would be amended to create a new power that would allow for areas to be identified and excluded from new PEPs by regulation (for example, Orders in Council). This would be accompanied by other changes to the CMA that would support and give effect to this approach.

This option provides flexibility in the legislation by providing discretion to future Governments to implement alternative policies for PEPs. The clarity in the legislation would however be reduced as a result. As outlined below, the economic impacts of the change are highly dependent on how the discretion is used by the Government in the future, however the impacts may not be as significant as the other options, particularly in the area of energy security and affordability.

Section B: Summary Impacts: Benefits and costs

Who are the main expected beneficiaries and what is the nature of the expected benefit?

The preferred option will result in the Government being able to use its discretion to implement policies around petroleum exploration permitting. This may contribute to the Government's efforts to a lower emissions economy. It will also provide certainty to the public and the petroleum sector.

Existing petroleum exploration permit holders may benefit as the only way to access exploration acreage will be within existing permitted areas (thereby increasing the value of currently permitted acreage), while for petroleum mining permit holders the value of existing gas reserves may increase as gas becomes increasingly scarce.

Where do the costs fall?

The preferred option identified by the impact analysis is Option B which would provide discretion to the Government to declare areas where new PEPs cannot be issued. The economic impact of this option is dependent on how future Governments chooses to use the discretion that would be provided over the coming decades. A reduction in exploration permits granted could result in foregone revenue to the Crown and to petroleum companies.

When modelling foregone revenue to the Crown a consistent discount rate of three per cent has been used, while a 10 per cent discount rate has been used to model foregone revenue to petroleum companies. These discount rates are used in the Minerals Programme for Petroleum 2013 when assessing alternative field development plans.¹ The three per cent

¹ Section 8.3(3) of the Minerals Programme for Petroleum 2013

rate is a proxy for the Crown's social rate of time preference, while the 10 per cent rate is a proxy for the cost of capital of a (hypothetical) large, diversified petroleum explorer and producer. In the oil and gas model used for this analysis, the impact of any exploration decisions made in 2018 will not be felt in terms of foregone production until 2027 at the earliest. This means that the impact of discounting is very significant.² In order to illustrate this impact, we have also noted below what the value of future revenues would be in non-discounted terms for the 50th percentile probability in the mid-case scenario. These undiscounted future revenues do not represent the opportunity cost to the Crown or petroleum companies of exploration decisions made in 2018 and should not be interpreted as such. It represents the undiscounted value (in 2018 dollar terms) of revenues foregone post-2027 when production is modelled to commence.

One scenario that has been considered under Option B is the Government choosing to limit petroleum exploration permitting to onshore Taranaki until 2020 (in line with Government policy), and then for future Governments to provide opportunities for companies to apply for petroleum exploration permits for the following three decades, both onshore and offshore. The modelled fiscal costs³ to the Crown of this scenario relative to the status quo range using a three per cent discount rate are a present value of minus \$44 million (real)⁴ in the P90 range⁵ of the low exploration, low oil price, high carbon price scenario, to minus \$12.0 billion (real) in the P10 range⁶ of the high exploration, high oil price, low carbon price scenario. The P50 range⁷ in the mid-exploration, mid oil price, mid carbon price scenario is minus \$1.9 billion (real).

The impact of Option B could be more significant if future Governments choose to use the discretion provided to limit or stop exploration permitting between 2021 and 2050, both onshore and offshore. No formal Cabinet decision has been made for future onshore Taranaki block offers post-2020 which is why this potential outcome has been modelled. The modelled impact of this scenario in terms of fiscal returns to the Crown foregone using a three per cent discount rate, relative to the status quo, range from a present value of minus \$1.8 billion (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$26.7 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$9.8 billion (real).

The Government has expressed a preference for Option E, which would create an explicit ban of:

- new offshore PEPs, and
- new onshore exploration permits outside Taranaki.

² One dollar in 2018 equates to 77 cents in 2027 using a three per cent discount rate, or 42 cents using a 10 per cent discount rate.

³ All figures for future fiscal return to the Crown are based on modelling. There is comfort around the broad direction of these results, but because of the number and nature of the assumptions used in the model there is relatively low certainty in any particular model output. There is a more detailed description of the limitations of the modelling in the *Key limitations or constraints on analysis* in Section 1 of this document.

⁴ All figures that represent a cost relative to the counterfactual are represented in the text and the tables as a negative number. A benefit relative to the counterfactual is represented as a positive number.

⁵ A P90, or a 90 per cent probability, estimate represents more conservative scenarios (that is a 90 per cent likelihood of an outcome occurring in a given probability distribution).

⁶ P10, or a 10 per cent probability, estimate represents more optimistic scenarios (that is a 10 per cent likelihood of an outcome occurring in a given probability distribution).

⁷ A P50, or a 50 per cent probability, estimate represents the midpoint, or central case, in a given probability distribution.

The fiscal impact to the Crown of this scenario relative to the counterfactual using a three per cent discount rate is in the range of a present value of minus \$1.2 billion (real) and minus \$23.5 billion (real), with a mid-point estimate of minus \$7.9 billion (real).

The impact on company profits of this scenario relative to the counterfactual using a 10 per cent discount rate is in the range of a present value of minus \$199 million (real) and minus \$7.3 billion (real), with a mid-point of minus \$2.1 billion (real).

The impact of discounting is significant. Future revenues to the Crown in the period 2027 to 2050 in the 50th percentile probability distribution (in 2018 real terms), relative to the counterfactual, amount to minus \$16.6 billion for the Crown and minus \$19.2 billion for petroleum companies.

The full range of potential impacts across scenarios, probability distributions, and different discount rates of Option E (the Government's preferred option) is shown in the table below.

Onshore Taranaki through to 2050 relative to counterfactual (NPV\$ million, real)

	Low exploration,		Mid exploration,		High exploration,	
	Crown total*	Company	Crown total*	Company	Crown total*	Company
10% discount rate						
90%	-228	-199	-958	-1,117	-1,627	-1,939
50%	-511	-493	-1,778	-2,074	-3,101	-3,747
10%	-1,225	-1,352	-3,489	-4,324	-5,773	-7,290
3% discount rate						
90%	-1,230		-4,298		-7,584	
50%	-2,749		-7,925		-14,385	
10%	-5,446		-12,968		-23,483	
*Crown total is the sum of royalty and taxes						
Non-discounted revenues from 2027 to 2050**						
90%	-2,775	-2,214	-8,445	-8,695	-14,855	-14,663
50%	-5,982	-6,760	-16,626	-19,223	-29,943	-33,000
10%	-11,366	-13,370	-27,347	-31,862	-46,650	-54,536

** Non-discounted revenues represent royalty and tax returns to the Crown and company profits in 2018 (real) terms arising from 2027 to 2050

Options B and E will both likely reduce the opportunities of upstream petroleum companies to invest in New Zealand acreage.

In addition, there are expected to be broader economic impacts as a result of either change, including to the national and Taranaki economies, and potentially to the economies of other regions. These impacts have not been quantified as part of this analysis. They are also likely to be highly dependent on how future Governments choose to use the discretion provided in Option B.

What are the likely risks and unintended impacts, how significant are they and how will they be minimised or mitigated?

The proposed changes under Option B may result in a decrease in the security and affordability of supply of gas (and possibly electricity), as gas resources become scarce. The discretion provided will however allow future Governments to consider these factors when making long term decisions around petroleum exploration permitting.

The transfer of production to other countries that have higher emissions footprints may result in an increase in global greenhouse gas emissions, although the timing and scale of this impact are uncertain.

There is a risk that the change will result in uncertainty amongst petroleum exploration and production companies, and gas users. This may result in investments in the sector not proceeding.

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Identify any significant incompatibility with the Government's 'Expectations for the design of regulatory systems'.

The preferred option in the impact analysis (outlined in Section 5 of this document) is compatible with the Government's 'Expectations for the design of regulatory systems' (the Expectations).

Other options outlined in this document may result in incompatibility with the Expectations. This is explained under the analysis of the options in Section 5 of this document.

Section C: Evidence certainty and quality assurance

Agency rating of evidence certainty?

The certainty of evidence differs for the different criteria used (described in section 3.2):

- Effective regulation – evidence certainty is high. assessment of impact is qualitative. Advice from ^{s 9(2)(h)} [REDACTED] has been used in the assessment.
- Broader economic and energy policy objectives:
 - Fiscal return to the Crown – Evidence is based on complex modelling, which represents the best information available on this topic. There is high certainty in the broad direction of the results, but because of the number and nature of the assumptions used in the model there is relatively low certainty in the accuracy of the figures.
 - Energy security – Analysis is qualitative only. There is relatively high certainty about the accuracy of the information.
 - Energy affordability - Analysis is qualitative only. There is relatively high certainty about the accuracy of the information.
 - Domestic and global greenhouse gas emissions – Analysis is largely qualitative only and is based on selected relevant case studies.
 - Broader economic contribution - Analysis is qualitative only. There is relatively high uncertainty about the accuracy of the information.

Quality Assurance Reviewing Agency:

Treasury

Quality Assurance Assessment:

The Treasury Regulatory Quality Team (RQT) has reviewed the Regulatory Impact Analysis prepared by the Ministry for Business, Innovation and Employment (MBIE) and considers that the information and analysis summarised in the RIA partially meets the quality assurance criteria.

Reviewer Comments and Recommendations:

Due to time limitations and analytical constraints arising from Cabinet's previous decisions, MBIE has not consulted the petroleum industry and the public on the proposals. As such, it is not possible to be confident that all potential impacts have been identified. The consultation criterion has therefore not been satisfactorily addressed.

Within these limitations, however, the RIA comprehensively sets out the current state, how it is expected to develop without further intervention and under different policy scenarios, and explores how and why to what extent the policy options meet the assessment criteria. Limitations and uncertainties in the modelling, and the assumptions used to inform it, are carefully explained.

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Impact Statement: Proposed changes to the Crown Minerals Act 1991

Section 1: General information

Purpose

The Ministry of Business, Innovation and Employment (MBIE) is solely responsible for the analysis and advice set out in this Regulatory Impact Statement (RIS), except as otherwise explicitly indicated. This analysis and advice has been produced for the purpose of informing key legislative design decisions to be taken by Cabinet to give effect to the policy decisions noted by Cabinet on 9 April 2018 [CAB-18-MIN-0162]:

- the intention to limit the area available for Block Offer 2018 to onshore blocks in the Taranaki Basin; and
- that there will be no offshore blocks offered in future block offers or through an alternative process.

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Key Limitations or Constraints on Analysis

Constraints on scope:

The problem definition is the difference between the Government's stated policy intent (as outlined in section 2.1) and the legislation. Proposed options put forward in the RIS seek to allow the Government to give effect to its policy direction.

Transparency around the impacts of legislative change is the key point of a regulatory impact assessment. For this reason, MBIE has undertaken an assessment of the legal and qualitative impacts of each option against the problem definition, while also outlining what we perceive to be the broader impacts of legislative change. These broader impacts are for noting purposes only as the Government policy decision has already been made.

Limitations around modelling assumptions:

The most important piece of supplementary analysis undertaken since the Government's policy announcement on 12 April 2018 has been to update MBIE's oil and gas model. This model is primarily used to derive a future gas production profile that is then fed into the Electricity Demand and Generation Scenarios (EDGS) that forecast electricity supply and demand out to 2050 and were last published in August 2016. A description of how the oil and gas model works can be found in Chapter 7 of the Energy Modelling Technical Guide and in the Annex.⁸ Previously this model was also used in the review of petroleum royalty rates in 2012.

The oil and gas model consists of two sub-models: a simulation model and a financial model. From these models, oil and gas production profiles from future undiscovered resources are derived and can also be used to generate estimated royalty and tax revenue to the Crown, and profit for companies.

The main issue with the oil and gas model is the layers of assumptions that are required, with the sensitivities of these assumptions being not easily quantified. These include:

Simulation model

- Estimates of in place oil and gas reserves for frontier basins are required. These were last updated in 2015 by GNS Science who had a team make consensus estimates. GNS Science stated "The business of quantifying undiscovered petroleum resources is fraught with difficulty and there are numerous possibilities for error." And that the "results should be regarded as a 'first-look' yardstick only."
- Estimates of the probabilities of technical success (as opposed to commercial success). MBIE has used data available for all exploration wells drilled since 1990 to determine reasonable estimates. For some frontier basins, there is no empirical data to work from. In these situations, data from other frontier basins have been used as estimates.
- Estimates of the likelihood of finding gas versus oil. These estimates were last updated by GNS in 2015. Gas to oil ratios can have a significant bearing on the commerciality of any technical discovery.
- Estimate of number of wells drilled: For onshore and offshore Taranaki, the annual average number of wells drilled since 2006 has been used for the mid-case scenario. One less well per year has been used for the low-case scenario and one more well

⁸ Available at: <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/modelling/electricity-demand-and-generation-scenarios/documents-image-library/edgs-2016/energy-sector-modelling-technical-guide.pdf>.

drilled per year in the high-case scenario. For frontier basins, the assumption in the mid-case scenario is that one well would be drilled seven years after the permit was awarded, and then a second well 15 years from permit commencement.

Financial model

- Estimates of flowrates by frontier basis of oil/condensate, and gas out to the end of the forecast period (2050) by size scenario, are required. There are 448 flowrate forecasts required. There is wide uncertainty in the assumptions used to generate a flowrate in frontier basis.
- The cost for each basin type and size scenario of each part of the exploration process. This includes operating costs, development costs and appraisal costs which were initially provided by Mike Adams Reservoir Engineering (2014). For this model update, capital costs have been adjusted in accordance with the IHS Markit Upstream Capital Costs Index.⁹ Operating costs have been adjusted in accordance with IHS Markit's Upstream Operating Costs Index.¹⁰

The Annex provides more information on the assumptions used to create and update this model.

An external peer review of MBIE's energy modelling capability and the Oil and Gas Model was undertaken in 2018 by Research, Evaluation and Analytics by Robinson Bowmaker Paul (RBP). This peer review was undertaken before the model was updated for this exercise. The findings by RBP are outlined in the limitations described above.

While recognising the layers of assumptions and uncertainties involved, MBIE's oil and gas model is the only attempt made to quantify future oil and gas production from undiscovered resources that we are aware of.

Constraints on options:

The options considered in the RIS are focused on the methods of amending the legislation to align with the Government's policy decision to limit offshore PEPs. MBIE has sought advice from ^{s 9(2)(h)} Options have been limited to those that address the problem definition. Other options for legislative change may be considered in a planned separate review of the CMA.

Constraints on consultation and testing:

Due to decisions and the preferred approach of Cabinet, consultation was not completed with the public, agencies, or the petroleum sector on the Government's previous policy decision outlined in Section 2.1.

There has been limited consultation on the implementation options discussed in this RIS.

- Consultation with the public and the petroleum sector has not been undertaken due to the preferred approach of Cabinet and the Government, and the timing constraints resulting from this.
- Political consultation has been undertaken on the Cabinet paper and RIS.
- The following departments have been consulted on the Cabinet paper and RIS: The Treasury, the Ministry for the Environment, the Ministry for Primary Industries, the Ministry of Justice, the Department of Conservation, the Department of the Prime

⁹ Available at: <https://ihsmarkit.com/Info/cera/ihsex/index.html>.

¹⁰ Available at <https://ihsmarkit.com/Info/cera/ihsex/index.html>.

Minister and Cabinet, Te Puni Kōkiri and the Environmental Protection Authority.

Responsible Manager (signature and date):



Dr David Darby

Resource Markets Policy

Building, Resources and Markets

Ministry of Business, Innovation and Employment

30/08/2018

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Section 2: Problem definition and objectives

2.1 What is the context within which action is proposed?

Defining the counterfactual

The counterfactual is the CMA as it stands. It does not consider other changes to the CMA, or to other primary legislation. This entails the ongoing granting of offshore and onshore PEPs in accordance with the purpose of the legislation.

In terms of measuring the impact of any change, the counterfactual comprises the petroleum industry as it is today and the petroleum industry as it might look in future, based on the current legislative settings. Legislative changes will primarily impact the petroleum industry in the future, although increased future uncertainty may also have an impact on the petroleum industry today. Those directly involved in offshore petroleum exploration, such as multi-client seismic survey companies, will also be affected.

The petroleum industry today

New Zealand is a relatively small producer of oil and gas by international standards. In 2017, New Zealand produced 189 PJ of natural gas and 31,000 barrels per day of crude and condensate (which in total represented 0.03 per cent of global oil production in that year). As of 1 January 2018, reserves of crude and condensate stood at 71 million barrels, while natural gas reserves stood at 1,917 PJs.

Almost all crude and condensate is exported, while all natural gas is consumed domestically (although a significant proportion of natural gas is processed and re-exported in the form of methanol). In 2017, natural gas accounted for 37 per cent of total energy supplied for consumption in New Zealand.

In 2017 the Crown received \$183 million in royalties and Energy Resources Levies from the petroleum sector. Total royalties and Energy Resources Levies ranged from \$183 million to \$543 million per year between 2008 and 2017. Corporate tax take is unknown but likely to be in the same order of magnitude.

Determining the contribution of the petroleum sector to gross domestic product is difficult because Statistics NZ aggregates petroleum with the minerals sector data. The two sectors contributed \$3.2 billion to GDP in 2017, accounting for 1.5 per cent of the (real) national economy.¹¹ In 2013, the petroleum sector was estimated to contribute \$1.7 billion to GDP, so it is likely that the petroleum represents approximately half of the combined petroleum and mineral contribution to GDP.¹²

Based on a 2014 survey undertaken by Martin Jenkins on behalf of Venture Taranaki, the oil and gas industry directly employed 4,653 full time employees nationwide. The majority of these are in Taranaki.

Methanex is New Zealand's largest consumer of natural gas, with electricity generation and large industrial users such as Ballance Agri-Nutrients, NZ Steel, Fonterra, and Refining NZ accounting for the bulk of remaining gas demand. Residential and commercial customers accounted for 8 per cent of gas demand in 2017. The detailed contribution of the upstream petroleum sector to these businesses has never been modelled.

¹¹ The New Zealand Sectors Dashboard: https://mbienz.shinyapps.io/sector_report_prod/.

¹² Venture Taranaki, *The Wealth Beneath Our Feet*, Table 9, page 61, available at: <https://www.martinjenkins.co.nz/assets/Home/The-wealth-beneath-our-feet-next-steps.pdf>.

This assessment focuses on the supply of oil and gas in the coming decades, and does not attempt to anticipate changes to domestic or global demand.

The wider context for energy and resources

It is noted that the changes assessed in this RIS are taking place within a broad long-term economic transition, which may impact the demand for oil and gas globally and domestically (as described below in Section 2.3 under *The Government's objective to transition to a lower emissions economy.*) Specifically, the Government has made a commitment to reduce greenhouse gas emissions by 30 per cent below 2005 levels by 2030, as part of the Paris Agreement and has stated its intent to achieve net zero carbon emissions by 2050 and 100 per cent renewable electricity by 2035 (in a normal hydrological year).

In addition, other changes may occur in the global and domestic energy systems in the coming decades, including the progression of technologies that generate renewable energy, assist grid stability and electricity storage and assist in the efficient extraction of fossil fuels. These factors may impact local demand for oil and gas.

Measuring impacts within a dynamic and uncertain economic change would be challenging. The following analysis does not attempt to estimate the impact of the possible changes in the broader context.

However, the production profiles used in this analysis are considered to be appropriate due to the following:

- Almost all of the oil produced in New Zealand is exported (92 per cent in 2017). Under the International Energy Agency's New Policies Scenario, there is expected to be continued strong global demand growth for oil through to 2025. After 2025, out to 2040, rises in global oil demand slows markedly (but still rises), with continued demand growth in petrochemicals, road freight, aviation and shipping being partially offset by declining oil use for passenger cars.¹³ Demand for oil produced in New Zealand is therefore not expected to reduce before 2050. The IEA's New Policies Scenario is its central scenario and aims to provide a sense of where today's policy ambitions seem likely to take the energy sector. It incorporates not just the policies and measures that governments around the world have already put in place, but also the likely effects of announced policies, as expressed as official targets or plans.
- All gas produced in New Zealand is currently used domestically. Based on the modelling work undertaken by Concept Consulting for the Productivity Commission's Draft Lower Emissions Economy report, there is projected to be more than enough gas demand to meet modelled gas supply in the mid-case scenario used in this analysis¹⁴. The underlying assumption is that a reduction in future gas supply from existing levels will be covered through a curtailment of output by Methanex in the first instance. Methanex consumed 41 per cent of New Zealand's total gas demand in 2017.
- The production profiles described in this analysis anticipate a reduction in production, to about half of current levels. It is considered that these profiles reasonably reflect potential future demand, noting the uncertainty and dynamism in this area, and the Government objectives to transition to a lower emissions economy (described above under *The Government's objective to transition to a lower emissions economy.*)

¹³ International Energy Agency World Energy Outlook 2017, page 79; New Policies scenario.

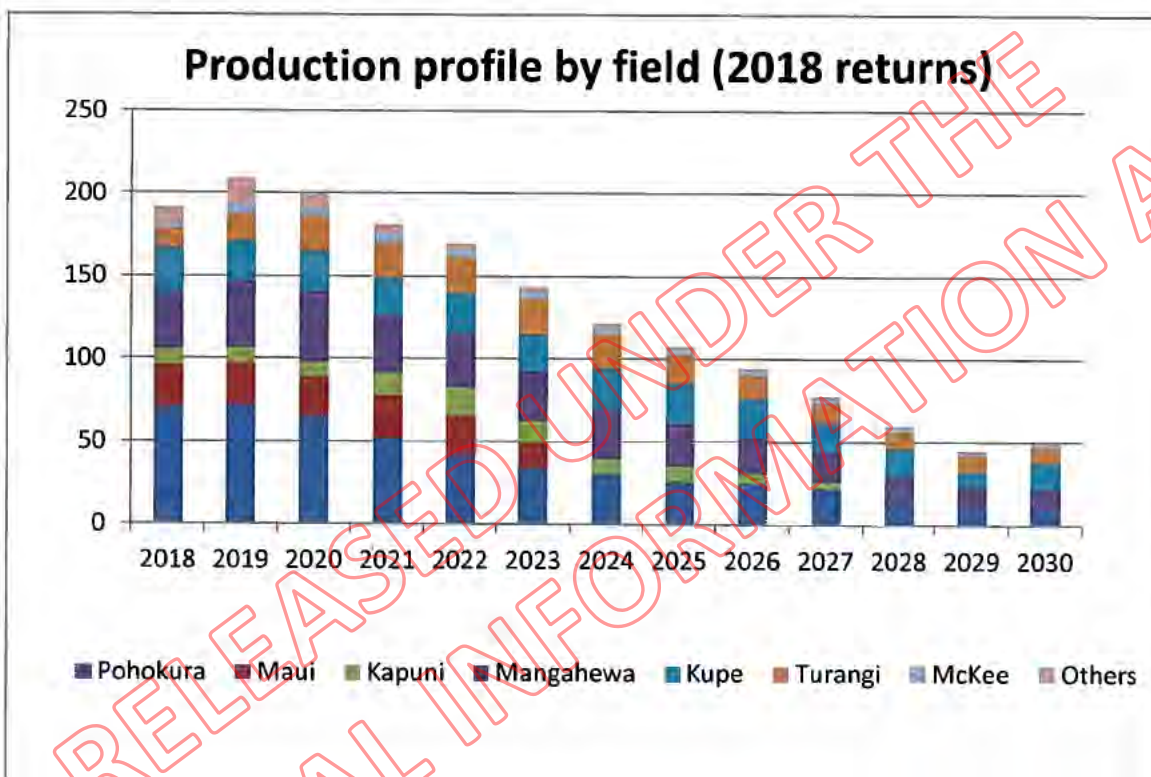
¹⁴ Concept Consulting, Motu Economic and Policy Research, & Vivid Economics. (2018). Modelling the transition to a lower net emissions New Zealand: interim results.

- Some existing contractual arrangements for gas from existing producing fields are in place. This includes an existing contract between Methanex and Nova which is due to expire in 2022. ^{s 9(2)(b)(ii)}

The future production modelled to commence from unpermitted areas from 2027 are not covered by existing contracts because the fields are undiscovered.

Outlook for upstream petroleum industry from existing producing fields

The base case estimate of natural gas production from existing producing fields predict production maintained at 2017 levels through to 2020 before heading into a continuous decline.



Gas production may be maintained at current levels for longer than indicated in the graph above following further investment at existing producing fields to bring contingent resources into the reserve category, and also if new discoveries are made from current exploration permits.

Based on 2Q 2018 data, Woodmac has modelled the present value of future royalty and taxes from major producing fields at \$3.6 billion, using a discount rate of 10 per cent.

^{s 9(2)(b)(ii)}

Outlook for upstream petroleum industry from currently permitted exploration permits

There are currently 30 active exploration permits, of which 21 are offshore and 9 are onshore. The last of these exploration permits is due to expire on 31 March 2030.

There are four committed wells (two onshore and two offshore), and a further 50 contingent wells (12 onshore and 38 offshore). Based on past experience, most of these contingent wells will not be drilled, with permit holders likely to surrender permits prior to drilling commitments based on the results of geological and geophysical interpretation. A reasonable estimate of how many of these contingent wells might be drilled would be 10 wells, of which six are onshore and four are offshore.

MBIE has not modelled potential discoveries or future output from current exploration permits.

Outlook for upstream petroleum industry from permits yet to be granted

Under the status quo, there are petroleum resources that may be brought to market from future discoveries from exploration permits that have yet to be granted. This includes both onshore and offshore exploration permits. By its nature, the quantum of future discoveries from permits that have yet to be granted is unknown. The best that can be done is to model a range of potential outcomes based on the best information we have to hand. For this MBIE's oil and gas model has been used. Constraints and limitations to the model are described in Section 1 above. A full description of the assumptions used in the model is provided in the Annex.

The model takes no account of prospectivity within existing exploration permits or the possible lack of prospectivity within past exploration permits. We consider this to be a reasonable and defensible working assumption given how unexplored or underexplored New Zealand's petroleum basins are.

Based on the outputs from the oil and gas model, first production from undiscovered and yet to be permitted fields would not occur before 2027. Three scenarios have been modelled: 1) a low exploration, low oil price, and high carbon cost scenario; 2) a mid-exploration, mid oil price, mid carbon cost scenario; and 3) a high exploration, high oil price, low carbon cost scenario. Within each scenario, there are many different possibilities in terms of how many fields are discovered, and the sizes of these fields. We run a simulation which produces many different futures, each with a different profile of oil and gas production. The results of these simulations are presented as ranges of probabilities from a 90 per cent probability through to a 10 per cent probability.

When modelling revenue to the Crown a consistent discount rate of three per cent has been used, while a 10 per cent discount rate has been used to model foregone revenue to petroleum companies. These discount rates are used in the Minerals Programme for Petroleum 2013 when assessing alternative field development plans.¹⁵ The three per cent rate is a proxy for the Crown's social rate of time preference, while the 10 per cent rate is a proxy for the cost of capital of a (hypothetical) large, diversified petroleum explorer and producer. In the oil and gas model used for this analysis, the impact of any exploration decisions made in 2018 will not be felt in terms of foregone production until 2027 at the earliest. This means that the impact of discounting is very significant.¹⁶

The potential royalty and tax payments to the Crown in the most pessimistic outlook (the P90 probability from the low exploration, low oil price, high carbon cost scenario) is a present value of \$1.9 billion (real) using a 3 per cent discount rate.

The mid (P50) estimate of the mid-case scenario is a present value of \$10.6 billion (real) using a 3 per cent discount rate.

¹⁵ Section 8.3(3) of the Minerals Programme for Petroleum 2013

¹⁶ One dollar in 2018 equates to 77 cents in 2027 using a three per cent discount rate, or 42 cents using a 10 per cent discount rate.

In the most optimistic outlook (the P10 probability from the high exploration, high oil price, low carbon cost) the present value of potential future royalty and tax payments is \$29.3 billion (real) on a 3 per cent discount rate.

The same modelling results can be used to estimate future company profits from petroleum production. The most pessimistic outlook (the P90 probability from the low exploration, low oil price, high carbon cost scenario) is a present value of \$362 million (real) using a 10 per cent discount rate.

The P50 probability of the mid-case scenario is a present value of \$3.2 billion (real) using a 10 per cent discount rate.

In the most optimistic outlook (the P10 probability from the high exploration, high oil price, low carbon cost) the present value of potential company profits is \$9.6 billion (real) using a 10 per cent discount rate.

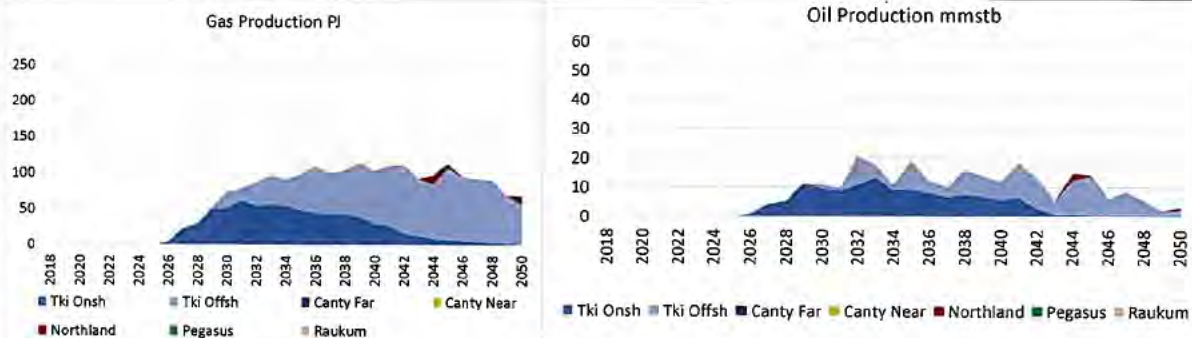
Future Crown revenues from 2027 to 2050 are modelled at \$21.1 billion from 2027 to 2050, while company returns are modelled at \$25.7 billion in the P50 probability distribution of the mid-case scenario. This represents an average Crown take over the period of \$917 million per annum. By way of comparison, royalty and Energy Resource Levy returns between 2009 and 2017 have amounted to a total of \$3.1 billion. Tax returns from petroleum are unknown but would be no more than \$3.5 billion in total over the same period¹⁷. This equates to an average annual Crown take of \$653 million¹⁸ over the last ten years. Two factors are likely to explain why projected future Crown revenues might be expected to be higher than that received over the last 10 years:

- Future royalties will be based on the current royalty rate of the higher of a 5 per cent ad valorem royalty and a 20 per cent accounting profits royalty. A significant proportion of current production is derived from fields on historic lower royalty rates (Maui, Kapuni, McKee, and Kapuni). Collectively, these fields produced 35 per cent of total gas and 24 per cent of total oil in 2017; and
- There is a forecast increase in global oil price over the forecast period from US\$41 per barrel in 2016, to US\$83 per barrel in 2025 to US\$111 per barrel in 2040 (based on the International Energy Agency's New Policies Scenario which has been used in the mid-case scenario).

The gas and oil production profiles for future undiscovered and non-permitted resources from the P50 probability of the mid-case scenario are shown below. The modelled outputs show future gas supply averaging 87 PJ per annum from 2027 to 2050, which is less than half of current gas production levels.

¹⁷ This assumes that all royalty payers are on the current royalty rate of the higher of 5 per cent ad valorem royalty and a 20 per cent accounting profits royalty. In reality, many producing fields are on lower royalty rates based on provisions provided in historic mining licences. Corporate tax rates have also changed over this period. The calculation has been undertaken on the following simplified basis – $0.28 \times ((3.1 / 0.2) - 3.1)$, where 0.28 represents the corporate tax rate, 3.1 billion represents the royalty returns over the period, and 0.2 represents accounting profits royalty.

¹⁸ Difference between \$660 million (\$6.6 billion / 10) and \$653 million are due to rounding.



Net present value of future undiscovered resources (\$ million, real)

	Low exploration, Low oil price, High carbon price		Mid exploration, Mid oil price, Mid carbon price		High exploration, High oil price, Low carbon price	
	Crown total*	Company	Crown total*	Company	Crown total*	Company
10% discount rate						
90%	423	362	1,464	1,576	2,329	2,739
50%	892	879	2,700	3,169	4,405	5,352
10%	1,813	2,035	4,812	5,926	7,644	9,616
3% discount rate						
90%	1,920		5,623		9,238	
50%	4,031		10,569		17,840	
10%	7,329		17,233		29,321	
*Crown total is the sum of royalty and taxes						
Non-discounted revenues from 2027 to 2050**						
90%	3,943	3,882	10,451	11,615	17,275	18,213
50%	8,279	9,901	21,097	25,699	35,433	41,184
10%	14,946	17,939	35,461	42,710	57,033	69,128

** Non-discounted revenues represent revenues in 2018 (real) terms arising from 2027 to 2050

Criteria against which options are assessed

All options identified seek to align the legislation with the Government's stated policy. The main criterion against which options have been assessed is the standard of effective regulation. By this we mean the extent to which options are limited to meeting the Government's stated policy (noting that a further review of the CMA will be done in due course), are resilient to change, and provide certainty to all stakeholders as to how the law will be applied in future. Ideally, the legislation should be able to be used by successive Governments, rather than being explicitly aligned with a particular Government's policy. This will provide for flexibility, clear direction and a stable regulatory system.

To the extent possible, and as required by the RIS process, the impact of each option on other outcomes (e.g. fiscal return to the Crown; energy security) has also been assessed but these have not been used when evaluating the effectiveness of each option at resolving the problem. This approach has been agreed with the RIAT team at the Treasury.

2.2 What regulatory system, or systems, are already in place?

The wider regulatory system for petroleum and minerals comprises multiple pieces of legislation, each with a different purpose, and involves a number of central and local government organisations.

Permitting of Crown owned petroleum and mineral resources is regulated through the CMA and associated petroleum and mineral regulations. The purpose of the CMA is to promote the prospecting for, exploration for, and mining of Crown owned minerals for the benefit of New Zealand.

The CMA explicitly sets out the Crown ownership of petroleum and certain minerals, allows the Crown to grant rights to locate and extract resources, sets out obligations on operators in doing so, and allows operators to make a return on any resources they find. The Crown shares in this return by charging royalties in the event of production. Before permits are granted, MBIE assesses a permit holder's technical and financial capability, their compliance history and also undertakes a preliminary, high-level assessment of a permit operator's capability and systems that are likely to be required to meet applicable health, safety and environmental legislation.

Other Acts and agencies that have a role in regulating the petroleum sector are:

- **Worksafe New Zealand** regulates workplace health and safety under the Health and Safety at Work Act 2015;
- **The Department of Conservation** is responsible for protected species under the Wildlife Act 1953 and the Marine Mammals Protection Act 1978.
- Before any prospecting, exploration and mining of Crown owned minerals can take place on public conservation land, permission is required from the **Minister of Conservation**.
- Prospecting, exploration and mining of Crown-owned minerals (including petroleum) on public land other than conservation land requires an access arrangement approved by the Minister responsible for that land.
- **The Ministry for the Environment** administers environmental legislation and regulations, including the Resource Management Act 1991 (RMA) and the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act).
- **The Ministry of Transport** administers the Maritime Transport Act 1994 and governs the legal framework for maritime safety and protection of the marine environment.
- **The Environmental Protection Authority** regulates hazardous substances under the Hazardous Substances and New Organisms (HSNO) Act 1996. It is responsible for managing the effects of specified restricted activities on the environment in the New Zealand Exclusive Economic Zone (EEZ) and Continental Shelf under the EEZ Act.
- **Maritime New Zealand** is responsible for ensuring offshore operators have plans in place to prevent oil spills and to manage the emergency response if a spill occurs.
- **Regional and District Councils** are responsible under the RMA for providing consent for petroleum and mineral activities in the onshore environment. Regional councils also have jurisdiction in the coastal marine area (out to 12 nautical miles offshore).

- Some resource consent applications may be referred to **the Environment Court** or to Boards of Inquiry for an assessment and decision.
- An operator will need to obtain an archaeological authority from **Heritage New Zealand** under the Heritage New Zealand Pouhere Taonga Act 2014 if an archaeological site may be affected by petroleum and mineral activities.

The changes discussed in this regulatory impact analysis do not affect the wider regulatory system.

2.3 What is the policy problem or opportunity?

The problem considered is that the Government is not able to give effect to its policy announcement on 12 April 2018 not to grant future offshore PEPs using the current legislation.

The Government's objective to transition to a lower emissions economy

The Government has stated that it is committed to acting on climate change. It has said that it wants to show global leadership by demonstrating to other countries that New Zealanders can be better off while taking action to reduce our impact on the climate.

The transition to a lower emissions economy will be a broad change to New Zealand's economy. In order to achieve this transition, the Government is making broad policy changes in several areas. For example, consultation on the proposed Zero Carbon Act is underway, the New Zealand Emissions Trading Scheme is being reviewed, the Productivity Commission is progressing a report on a low-emissions economy, and the Interim Climate Change Committee has been established to begin work on how New Zealand will transition to a net zero emissions economy by 2050.

The Government has committed to a reduction in greenhouse gas emissions by 30 per cent below 2005 levels by 2030, as part of the Paris Climate Agreement. It has stated its intent to achieve net zero carbon emissions by 2050 and 100 per cent renewable electricity by 2035 (in a normal hydrological year). In addition, consultation is occurring on revised emissions reduction targets, to be put in place under the proposed Zero Carbon Act. These are expected to be more stringent than the existing targets.

In setting long-term targets, the Government intends to provide time to adjust and upgrade the economy. It expects that New Zealand's economy will change over the next 30 years, and that signalling the direction of this change and taking actions early will allow the country to:

- avoid sudden, drastic economic shocks;
- gain an economic advantage as an early mover in emerging markets; and
- meet international commitments and encourage other countries to meet theirs.

Cabinet decisions made in relation to petroleum exploration

In the context of the planned transition to a lower emissions economy, the Government has considered and signalled its expectations for the ongoing role of New Zealand's petroleum sector. On 9 April 2018, Cabinet noted [CAB-18-MIN-0162] two policy announcements to be made by the Prime Minister and the Minister of Energy and Resources:

- the intention to limit the area available for Block Offer 2018 to onshore blocks in the Taranaki Basin; and
- that there will be no offshore blocks offered in future block offers or through an alternative process.

These decisions were announced on 12 April 2018 by the Prime Minister who stated that the government was "taking an important step to address climate change and create a clean, green and sustainable future for New Zealand". The announcement was aimed at providing certainty for industry and communities, to allow them to plan for a lower emissions future. The Prime Minister stated that this was part of a series of careful and considered changes that would be made over time, as part of a managed transition.

On 2 July 2018, Cabinet agreed further outcomes that it was seeking from the tranche one amendments to the CMA [CAB-18-MIN-0306.01]. These are to:

- give effect to the new offshore petroleum exploration policy while preserving the rights of existing permit holders (for either petroleum or other minerals);
- hold a block offer for onshore blocks in Taranaki for 2018, and again in 2019 and 2020;
- prohibit surface access to conservation land for certain activities, such as drilling, as they specifically relate to Taranaki Block Offer 2018, 2019, and 2020;
- ensure the onshore Taranaki block offer processes are robust and therefore unlikely to be subject to successful judicial review proceedings; and
- reduce the risk that applications for offshore PEPs will be made outside of the onshore block offer process, which could lead to new PEPs being granted contrary to the government's new policy on the basis of the current law.

Cabinet also agreed a two part approach to achieve the outcomes above:

- tranche one will consider only those legislative changes considered necessary to give effect to the new offshore policy and allow onshore block offers to be run successfully; and
- tranche two will embark on a wider review of the Act on a more typical timeframe starting with an issues paper and consultation with stakeholders later in 2018.

Cabinet noted the changes needed to give effect to the policy are likely to require the creation of a new Ministerial power under the CMA to allow the Minister to set aside or "carve out" areas of land over which PEPs cannot be granted or can only be granted subject to certain conditions; and/or new clauses in the CMA that would prevent PEPs from being granted offshore. Either option will likely require either a carve out from the purpose, or amendments to the purpose of the legislation.

Required changes to the CMA

The CMA is the legislation that governs the management of the Crown's ownership rights of certain minerals, including petroleum. It is primarily focused on economic development and is concerned with the efficient allocation of rights to explore and develop Crown-owned minerals on behalf of the Crown, in return for which the Crown requires a fair financial return.

Section 1A(1) of the CMA states that the purpose of this Act is to promote prospecting for, exploration for, and mining of Crown owned minerals for the benefit of New Zealand.

The Petroleum Programme 2013¹⁹ spells out how the words "for the benefit of New Zealand" should be interpreted.

The Minister sees "for the benefit of New Zealand" as the over-arching objective of the purpose statement and as the touchstone for interpreting the rest of the purpose statement and the provisions of the Act governing various activities and processes. The Minister considers that, within the context and mandate of the Act, "the benefit of New Zealand" is best achieved by increasing New Zealand's economic wealth through maximising the economic recovery of New Zealand's petroleum resources. [emphasis added]

Other important components of "the benefit of New Zealand", including environmental considerations, are covered in other legislation, as noted in clause 1.4. [emphasis added].

As the legislation stands, the Government is required to continue to offer the opportunity for companies to apply for offshore PEPs, in accordance with the purpose of the CMA.

The Cabinet decision on 2 July 2018 to prohibit surface access to conservation land for certain activities, such as drilling, as they specifically relate to Taranaki Block Offer 2018, 2019, and 2020, also cannot be given effect to under the current CMA. Access arrangements do not form part of the criteria on which exploration permits are granted under the CMA. By legislative design, access arrangements are dealt with subsequent to the grant of a PEP.

Inconsistencies in legislation are likely to create uncertainty for the petroleum industry and the public around the future of the industry in New Zealand and the rights of existing permit holders or companies that have invested in New Zealand.

2.4 Are there any constraints on the scope for decision making?

As discussed in section 2.1 above, policy decisions and desired outcomes have been agreed to by Cabinet. Options are designed to meet these Cabinet decisions and desired outcomes.

¹⁹ Tertiary legislation provided for under the CMA.

2.5 What do stakeholders think?

The upstream petroleum sector, major consumers of natural gas such as Methanex and Ballance Agri-Nutrients, electricity generators, the Port of Taranaki, engineering and service firms in Taranaki, and the Taranaki local government are stakeholders directly affected by the proposed changes. MBIE has not been directed to undertake consultation with these groups on the Government's final policy decision.

All of these groups have expressed concerns about the decision itself, the impact on investment certainty, future gas supply and jobs, and the ability of firms that have invested to be able fully benefit from these investments.

MBIE was not directed to engage or consult with iwi on the final policy decision. No iwi groups have formally expressed a view on the decision, either publicly or to MBIE.

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Section 3: Options identification

3.1 What options are available to address the problem?

All of the options considered in this document represent alternative approaches to amending the CMA to allow the Government to give effect to the policy outcomes previously agreed by Cabinet. These approaches have been developed by MBIE, with advice from ^{s 9(2)(h)}

The analysis considers the wider material impacts of implementing each option, relative to the counter-factual (maintaining the current legislation). As required by the regulatory impact analysis process, the impacts have been determined by assessing the potential long-term outcomes of the legislative change proposed by each option.

Five options have been proposed to address the problem definition. These have been selected as possible options because they all address the problem definition described in section 2.3.

- A. Change the purpose of the CMA;
- B. Alter the existing framework by creating a new provision that would allow the Minister to exclude areas from permitting, despite the purpose statement;
- C. Create an indefinite moratorium on new PEPs, with a transitional provision that allows onshore Taranaki block offers to be held until 2020;
- D. Create a new regulatory power to make prohibitions or moratoria; or
- E. Create an explicit ban on permits in specific areas.

All approaches would require associated legislative provisions to preserve existing rights and manage any applications currently under consideration. This will ensure that the rights of existing permit holders remain.

As outlined in the problem definition in Section 2 of this document, the policies noted by Cabinet on 9 April 2018 are not aligned with the purpose statement of the current CMA. Option A addresses this issue by changing the purpose statement. Options B, C, D and E create a carve-out that allows certain sections of the CMA to deviate from the purpose statement. This would allow the Government to give effect to its stated policy, but still results in a contradiction between these sections and the primary purpose of the legislation.

Option A – Change the purpose of the CMA

Option A allows the Government to give effect to its policy by amending the purpose statement. Key elements of the purpose statement that would need to be amended are:

- changing the word “promote” to something more neutral like “to provide for”; and
- redefining how the words “for the benefit of New Zealand” are defined in the Petroleum and Minerals Programmes so that other Government objectives, outside of maximising the economic recovery of Crown owned minerals, may be considered.

Option B – Alter the existing framework, by creating a new provision that would allow the Minister to exclude areas from permitting

Section 28A of the CMA provides for the Minister to declare areas where permits cannot be granted where doing so is necessary to better meet the purpose of the CMA. As the purpose of the CMA is to promote mineral exploration and production for the benefit of New Zealand, section 28A is intended to allow the Minister to temporarily remove certain areas from permit consideration to allow for those areas to be better explored in future. It cannot be used to safeguard or remove areas from future exploration on the basis of environmental considerations as this is excluded under the CMA and covered by other pieces of legislation.

Option B would create a provision that would allow the Minister to declare areas where new PEPs cannot be issued that could be used despite the current purpose statement. This could be done by inserting a statement in the CMA to the effect that the relevant new enabling provisions apply despite section 1A.

Note that this legislative change would allow the Government, or future Governments, to exclude further areas, in addition to what has already been stated in the recent policy announcement.

Option B is referred to as Option 1 in the accompanying Cabinet paper: *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.

Option C – Create an indefinite moratorium, with transitional provisions to allow onshore Taranaki exploration permitting until 2020

Under Option C, provisions would be written into the CMA that would prohibit the granting of any new PEPs, despite the primary purpose of the legislation. Alongside this, transitional provisions would be provided that would allow for block offers to be held until 2020 but only for onshore Taranaki.

This option assumes that no further offshore petroleum exploration will occur and onshore exploration will only occur until 2020. It would provide no discretion to the Government to change, unless further legislation changes are made.

Note that this legislation change would allow the Government to exclude further areas, in addition to what has already been stated in the recent policy announcement.

Option C is referred to as Option 2 in the accompanying Cabinet paper *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.

Option D – Create new regulatory power to make prohibitions or moratoria

Option D would amend the CMA to insert powers that enable prohibitions or moratoria to be introduced via regulations made under an Order in Council or by notice in the Gazette. These regulations would seek to prohibit activities authorised by the primary legislation.

The Government could use this to prohibit PEPs from being granted outside onshore Taranaki for the next three years. Future Governments would then be able to change this to allow either more or less permitting, without making changes to primary legislation.

If this option was implemented, it would also allow Ministers to deviate from other requirements of the primary legislation (in particular the purpose statement). It is likely that this kind of suspension of the operation of a statutory scheme in relation to PEPs would be regarded as inconsistent with the Legislation Design and Advisory Committee (LDAC) guidelines.

Note that this legislation change would allow the Government to exclude further areas, in addition to what has already been stated in the recent policy announcement.

Option D is referred to as Option 3 in the accompanying Cabinet paper *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.

Option E – Create an explicit ban on permits in specific areas (Government's preferred option)

Option E would create an explicit ban in the legislation on:

- new offshore PEPs, and
- new onshore exploration permits outside Taranaki.

This option is the Government's preferred option and is the most closely aligned with the Government's intended policy. It would explicitly give effect to the policy in the legislation, and would allow the Government to continue to grant onshore exploration permits in Taranaki.

Option E is consistent with Option 2 in the accompanying Cabinet paper *Final policy decisions for tranche one of the Crown Minerals Act 1991 review*.

3.2 What criteria, in addition to monetary costs and benefits, have been used to assess the likely impacts of the options under consideration?

All options considered in the impact analysis address the problem definition by making changes to the CMA that allow the Government to give effect to its policy regarding exploration permits. Options are assessed by compared the impacts against the counterfactual where no changes to the legislation are made, as described in section 2.1.

The assessment criteria have been divided into two tiers. The first tier is effective regulation and is the basis on which the assessment of options has been made. Noting that these legislative changes will have broader impacts, a second tier of economic and environmental impacts has been added.

Tier 1 assessment criterion: effective regulation

There are several aspects that are considered to be part of this:

- The legislation needs to meet the outcomes decided by Cabinet on 9 April 2018 and 2 July 2018. This includes the decision that only those legislative changes considered necessary to give effect to the new offshore policy and allow onshore block offers to be run successfully.
- The legislation should balance certainty with flexibility to adapt over time.

- There should be consistency between different sections of the legislation, including between the purpose, body of the CMA, secondary legislation, tertiary legislation and any associated instruments.
- Normal legislative processes should be followed, including allowing time for an appropriate level of consultation and analysis.
- Vulnerability to successful challenge during implementation should be limited.

Tier 2 assessment criterion: broader economic and environmental impacts

Impact is broken down into the following areas:

- Opportunity cost to the Crown in terms of foregone royalties and taxes.
- Opportunity cost to upstream petroleum producers in terms of foregone profits.
- Opportunity cost to national and regional economies in terms of the economic contribution of the petroleum sector that is foregone.
- Security and affordability of supply of energy – gas, electricity and other heating are considered.
- Domestic and global greenhouse gas emissions.
- Other impacts that are difficult to attribute or quantify, including investment certainty and sovereign risk and the opportunity cost of geoscience information foregone.

Note that a quantitative analysis has only been completed on the opportunity cost to the Crown in terms of foregone royalties and taxes; and foregone company profits. Analysis of other aspects of the economic contribution of the sector is qualitative only, and considers the potential impact in relation to the contribution of the sector to the economy in recent years.

3.3 What other options have been ruled out of scope, or not considered, and why?

Options that do not involve changing the primary legislation (i.e. non-regulatory options or changes to secondary legislation only) have been eliminated because they would not allow the Government to give effect to the policy. ^{s 9(2)(h)}

Section 4: Impact Analysis

Summary of marginal impacts: How does each of the options identified at section 3.1 compare with the counterfactual, under each of the criteria set out in section 3.2?

	No legislative change The law remains as it stands which would require ongoing tender of onshore and offshore acreage	Option A – Change the purpose of the CMA to allow Ministers to restrict permitting in certain areas Assume: <ul style="list-style-type: none"> The current Government chooses to restrict petroleum exploration permitting to onshore Taranaki until 2020. From 2021 to 2050, the discretion provided by this assumption will allow future Governments to implement a range of policies. The impact analysis considers two extreme scenarios, to demonstrate the potential impacts. The exact outcome will depend on how this discretion is used. 	Option B – Alter the existing framework, by creating a new provision that would allow the Minister to exclude areas from permitting Assume: <ul style="list-style-type: none"> The current Government chooses to restrict petroleum exploration permitting to onshore Taranaki, until 2020. From 2021 to 2050, the discretion provided by this assumption will allow future Governments to implement a range of policies. The impact analysis considers two extreme scenarios, to demonstrate the potential impacts. The exact outcome will depend on how this discretion is used. 	Option C – Create an indefinite moratorium on petroleum exploration permitting, with transitional provisions to allow onshore Taranaki exploration permitting until 2020 Assume: <ul style="list-style-type: none"> Petroleum exploration permitting occurs in onshore Taranaki until 2020. From 2021 to 2050, no new exploration permits are granted in New Zealand. 	Option D – Create a new regulatory power to make prohibitions Assume: <ul style="list-style-type: none"> The current Government uses the regulatory power to restrict petroleum exploration permitting to onshore Taranaki, until 2020. From 2021 to 2050, the discretion provided by this assumption will allow future Governments to implement a range of policies. The impact analysis considers two extreme scenarios, to demonstrate the potential impacts. The exact outcome will depend on how this discretion is used. 	Option E – Create an explicit ban on permits in specific areas Assume: <ul style="list-style-type: none"> The Government issues no offshore PEPs through to 2050. The Government issues no onshore PEPs outside Taranaki through to 2050.
Effective regulation – including appropriate flexibility, certainty, consistency, and normal legislative processes	0	- Changing the purpose could provide flexibility, by providing discretion to implement alternative policies in the future. The purpose statement would be aligned with the Government's objectives. A change in the purpose of legislation would be significant and would extend to minerals, prospecting permits and minerals permits. This goes beyond the Cabinet decision on 2 July 2018 that tranche one legislative changes will consider only those legislative changes considered necessary to give effect to the new offshore policy and allow onshore block offers to be run successfully. It would not be good regulatory practice to make a change of this magnitude under accelerated timeframes and without thorough consultation. It may create uncertainty as to how Ministers will choose to exercise the discretion provided under this option. This could impact investment decisions.	- It may provide flexibility, by providing discretion to implement alternative policies in the future. This option would create an exception to how the purpose statement applies which could be viewed as a contradiction within the CMA, and would result in a lack of certainty. It may create uncertainty as to how Ministers will choose to exercise the discretion provided under this option. This could impact investment decisions.	- This option would provide certainty in the legislation, by making the policy direction explicit. It would create a contradiction within the CMA, because the moratorium would not be in line with the principles in the purpose statement. In addition, it would not provide flexibility to adapt to different policies around petroleum exploration permitting.	- It may create uncertainty as to how Ministers will choose to exercise the discretion provided under this option. This could impact investment decisions. It would also result in a contradiction within the legislation, because prohibitions would not be in line with the principles in the purpose statement. It may provide flexibility, by providing discretion to implement alternative policies in the future.	- This option would provide certainty in the legislation, by making the policy direction explicit. It would however create a contradiction within the CMA, because the ban would not be in line with the principles in the purpose statement. In addition, it would not provide flexibility to adapt to different policies around petroleum exploration permitting.
Broader economic and energy policy objectives	Fiscal return to the Crown	0	-	-	-	-
		No PEPs will be granted outside onshore Taranaki from 2018 to 2020. From 2021 to 2050, two scenarios are considered that represent the extremes of what could occur, noting that the outcome of the option is uncertain and depends on how future Governments use the discretion provided: <ul style="list-style-type: none"> No petroleum exploration permitting from 2021 to 2050. All onshore and offshore areas are open for permitting from 2021 to 2050. The fiscal impact of the first scenario relative to the counterfactual is in the range of a	No PEPs will be granted outside onshore Taranaki from 2018 to 2020. From 2021 to 2050, two scenarios are considered that represent the extremes of what could occur, noting that the outcome of the option is uncertain and depends on how future Governments use the discretion provided: <ul style="list-style-type: none"> No petroleum exploration permitting from 2021 to 2050. All onshore and offshore areas are open for permitting from 2021 to 2050. The fiscal impact of the first and second scenarios relative to the counterfactual are	The fiscal impact of this scenario relative to the counterfactual is in the range of a present value of minus \$1.8 billion (real) and minus \$26.7 billion (real), with a mid-point estimate of minus \$9.8 billion (real). All values have been discounted at three percent.	No PEPs will be granted outside onshore Taranaki from 2018 to 2020. From 2021 to 2050, two scenarios are considered that represent the extremes of what could occur, noting that the outcome of the option is uncertain and depends on how future Governments use the discretion provided: <ul style="list-style-type: none"> No petroleum exploration permitting from 2021 to 2050. All onshore and offshore areas are open for permitting from 2021 to 2050. The fiscal impact of the first and second	The fiscal impact of this scenario relative to the counterfactual is in the range of a present value of minus \$1.2 billion (real) and minus \$23.5 billion (real), with a mid-point estimate of minus \$7.9 billion (real). All values have been discounted at three percent.

		<p>present value of minus \$1.8 billion (real) and minus \$26.7 billion (real), with a mid-point estimate of minus \$9.8 billion (real). All values have been discounted at three percent.</p> <p>The fiscal impact of the second scenario relative to the counterfactual is in the range of a present value of minus \$44 million (real) and minus \$12.0 billion (real), with a mid-point estimate of minus \$1.9 billion. All values have been discounted at three per cent.</p>	the same as Option A.		scenarios relative to the counterfactual are the same as for Option A.			
National and regional economic contribution	0	<p>-</p> <p>This change would provide Governments with increased discretion in the level to which it promotes the development of petroleum and minerals.</p> <p>This could result in a significant reduction in the contribution of the industry to the national and the Taranaki regional economies over the coming decades.</p> <p>The impact on company profits of the first scenario relative to the counterfactual is in the range of a present value of minus \$350 million (real) and minus \$8.1 billion (real), with a mid-point of minus \$2.8 billion (real). All values have been discounted at 10 per cent.</p> <p>The impact on company profits of the second scenario relative to the counterfactual is in the range of a present value of \$34 million (real) and minus \$5.0 billion (real), with a mid-point of minus \$544 million (real). The figure of \$34 million appears to be a quirk in the model, something that can occur in monte carlo simulations at the outer extremes. All values have been discounted at 10 per cent.</p> <p>There could also be an impact on other regions if the change results in permits not being granted in other parts of New Zealand.</p> <p>A change to the purpose of the CMA would impact the requirement for the Government to promote the development of minerals other than petroleum. This could result in a reduction in the minerals sector's contribution to the national economy.</p>	<p>-</p> <p>This change would provide Governments with increased discretion in the level to which it promotes the development of petroleum and minerals.</p> <p>This could result in a significant reduction in the contribution of the industry to the national and the Taranaki regional economies over the coming decades.</p> <p>The impact on company profits of the first and second scenarios relative to the counterfactual are the same as in Option A.</p>	--	<p>-</p> <p>This option would result in the contribution of the sector to the national and Taranaki regional economies reducing to zero over decades.</p> <p>The impact on company profits of this scenario relative to the counterfactual is in the range of a present value of minus \$350 million (real) and minus \$8.1 billion (real), with a mid-point of minus \$2.8 billion (real). All values have been discounted at 10 per cent.</p> <p>This option would also remove the potential for the sector to contribute to other regional economies in the future.</p>	<p>-</p> <p>This change would provide Governments with increased discretion in the level to which it promotes the development of petroleum and minerals.</p> <p>The impact on company profits of the first and second scenarios relative to the counterfactual are the same as for Option A.</p> <p>There could also be an impact on other regions if the change results in permits not being offered in other parts of NZ.</p>	--	<p>-</p> <p>This option would result in the contribution of the sector to the national and Taranaki regional economies reducing to low levels over decades.</p> <p>The impact on company profits of this scenario relative to the counterfactual is in the range of a present value of minus \$199 million (real) and minus \$7.3 billion (real), with a mid-point of minus \$2.1 billion (real). All values have been discounted at 10 per cent.</p> <p>This option would also remove the potential for the sector to contribute to other regional economies in the future.</p>
Energy security and affordability	0	<p>-</p> <p>Allowing petroleum permitting restrictions may increase the likelihood of energy security and affordability issues occurring in the future, because there may be less exploration and subsequent development of gas. Like electricity, New Zealand is completely disconnected from international natural gas markets.</p> <p>This option does however provide discretion to Governments, which may be used to manage the industry according to demand and to the role of petroleum in NZ's energy mix.</p>	<p>-</p> <p>Allowing petroleum permitting restrictions may increase the likelihood of energy security and affordability issues occurring in the future, because there may be less exploration and subsequent development of gas. Like electricity, New Zealand is completely disconnected from international natural gas markets.</p> <p>This option does however provide discretion to Governments, which may be used to manage the industry according to demand and to the role of petroleum in NZ's energy mix.</p>	--	<p>-</p> <p>A moratorium would likely result in the role of gas in New Zealand's energy mix reducing to zero over decades. The removal of a reliable and flexible source of energy would likely have a negative impact on both energy security and affordability.</p>	<p>-</p> <p>Allowing petroleum permitting restrictions may increase the likelihood of energy security and affordability issues occurring in the future, because there may be less exploration and subsequent development of gas. Like electricity, New Zealand is completely disconnected from international natural gas markets.</p> <p>This option does however provide discretion to Governments, which may be used to manage the industry according to demand and to the role of petroleum in NZ's energy mix.</p>	-	<p>-</p> <p>A ban on permitting outside onshore Taranaki would likely result in the role of gas in New Zealand's energy mix reducing significantly over decades. The reduction in the availability of a reliable and flexible source of energy may have a negative impact on both energy security and affordability.</p>

Domestic and global greenhouse gas emissions	0	<p>+ (domestic) - (global)</p> <p>Some reduction in domestic emissions from fugitive emissions from foregone production. There may also be some reduction from major gas users, of which Methanex is the most material, should these users have to reduce output as a result of less gas in future.</p> <p>The change will allow the Government to signal its expectation that a broader transition to a lower emissions economy will occur.</p> <p>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.</p>	<p>+ (domestic) - (global)</p> <p>Some reduction in domestic emissions from fugitive emissions from foregone production. There may also be some reduction from major gas users, of which Methanex is the most material, should these users have to reduce output as a result of less gas in future.</p> <p>The change will allow the Government to signal its expectation that a broader transition to a lower emissions economy will occur.</p> <p>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.</p>	<p>+ (domestic) - (global)</p> <p>Some reduction in domestic emissions from fugitive emissions from foregone production. There may also be some reduction from major gas users, of which Methanex is the most material, should these users have to reduce output as a result of less gas in future.</p> <p>The change will allow the Government to signal its expectation that a broader transition to a lower emissions economy will occur.</p> <p>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.</p> <p>The potential for carbon leakage is considered greater under this option than Options A and B where the Government would have discretion on whether or not to grant PEPs.</p>	<p>+ (domestic) - (global)</p> <p>Some reduction in domestic emissions from fugitive emissions from foregone production. There may also be some reduction from major gas users, of which Methanex is the most material, should these users have to reduce output as a result of less gas in future.</p> <p>The change will allow the Government to signal its expectation that a broader transition to a lower emissions economy will occur.</p> <p>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.</p>	<p>+ (domestic) - (global)</p> <p>Some reduction in domestic emissions from fugitive emissions from foregone production. There may also be some reduction from major gas users, of which Methanex is the most material, should these users have to reduce output as a result of less gas in future.</p> <p>The change will allow the Government to signal its expectation that a broader transition to a lower emissions economy will occur.</p> <p>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.</p> <p>The potential for carbon leakage is considered greater under this option than Options A and B where the Government would have discretion on whether or not to grant PEPs but slightly less than Option C which does not include the grant of any new petroleum exploration permit post 2020.</p>
Overall assessment	0					

- Key:**
- ++** much better than doing nothing/the status quo
 - +** better than doing nothing/the status quo
 - 0** about the same as doing nothing/the status quo
 - worse than doing nothing/the status quo
 - much worse than doing nothing/the status quo

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4.1 Impacts of Options, in comparison with the counterfactual

As explained above, all of the options assessed address the problem that this legislative change seeks to address, as defined in Section 2.

All options other than Option A (change the purpose statement) will create an internal tension within the CMA, by creating a requirement that does not align with the purpose statement.

All options make a trade-off between certainty and flexibility. The current legislation doesn't allow the Government to give effect to its policy around petroleum exploration permitting. To address this, the legislation can either be modified to provide sufficient discretion for different policy directions to be implemented, or can be modified to align specifically with the policy of the current Government. The former (providing discretion) is used by Options A, B and D, and results in uncertainty, because the legislation does not provide certainty around the intended approach to permitting. The latter method (aligning with the policy of the current Government) is used by Options C and E, and is does not provide flexibility. Both of these options may not provide effective regulation.

All options will result in there being no PEPs granted outside onshore Taranaki until at least 2020. This may have the following impacts:

- A reduction in the contribution of the sector to both the national and Taranaki economies over time. It will also reduce the potential for the sector to contribute to the economies of other regions.
- Increased risks around energy security and the affordability of gas (and also potentially electricity) in New Zealand over time.
- A potential reduction in domestic greenhouse gas emissions from two sources:
 - Abatement of domestic fugitive emissions²⁰ from petroleum production foregone. Fugitive emissions currently account for less than 2 per cent of New Zealand's gross emissions; and
 - Reduced production from major industrial users of natural gas, most notably Methanex. The timing of when, or even if, this might occur remain uncertain. In 2017, Methanex emitted ^{s 9(2)(b)(ii)} tonnes of CO₂ per tonne of methanol.²¹ With a production capacity of 2.4 million tonnes, Methanex has the potential to emit up to ^{s 9(2)(b)(ii)} tonnes of CO₂ equivalent per annum, which represented 2 per cent of gross emissions in New Zealand in 2016. This is the maximum amount that could be abated from Methanex ceasing operations.
- A possible increase in global emissions from two sources:
 - Abatement of domestic fugitive emissions from petroleum production processes being displaced by petroleum produced in overseas jurisdictions with higher emissions per unit of production (most likely the Middle East); and
 - Curtailment of output from high emitting domestic industrial users of natural gas (such as Methanex and NZ Steel) being displaced by higher emitting production

²⁰ Fugitive emissions are emissions of gases or vapors from pressurized equipment due to leaks and other unintended or irregular releases of gases.

²¹ [Correspondence](#) with Methanex, 20 August 2018.

from overseas jurisdictions (most likely coal based methanol in China and steel production sourced from Australia and Indonesia).²²

Options C (indefinite moratorium with transitional provisions for onshore Taranaki through to 2020) and E (permanent ban on offshore with ongoing exploration in onshore Taranaki) result in offshore exploration being permanently prohibited (unless a further change is made to the primary legislation). This is expected to have an impact on the contribution of the sector to the national economy over time, as well as to the Taranaki regional economy. It also removes the potential for the sector to contribute to other regional economies.

In addition, this may increase the risks to the country's energy security and result in increases to gas (and also possibly electricity) prices over time as a result of declines in natural gas production. In the absence of ongoing exploration, a decline in natural gas production is inevitable at some point. The extent of these risks depends on the ongoing role of gas in the country's energy mix and the uptake of alternative forms of energy.

A reduction in gas production could be expected to result in a modest reduction of domestic greenhouse gas emissions over time but, as noted, any reduction in domestic oil and gas production will simply be displaced by other, more likely higher emitting, sources overseas.

These options both result in explicit bans or moratoriums in the CMA, which will limit flexibility in exploration permitting policy. These options may have some incompatibility with the Government's 'Expectations for the design of regulatory systems'.

In particular, the Expectations state that:

The government believes that durable outcomes of real value to New Zealanders are more likely when a regulatory system:

- *is flexible enough to allow regulators to adapt their regulatory approach to the attitudes and needs of different regulated parties, and to allow those parties to adopt efficient or innovative approaches to meeting their regulatory obligations;*
- *has scope to evolve in response to changing circumstances or new information on the regulatory system's performance.*

Implementing an explicit ban or moratorium in the legislation will remove the regulator's ability to adapt their approach to the needs of different parties, for example companies who may wish to invest in offshore exploration.

Implementing an explicit ban will likely also reduce the legislation's scope to evolve in response to changing circumstances, for example potential future impacts on energy security and/or a change in Government.

Options A, B and D all increase the discretion that Ministers have to grant exploration permits. Currently, the CMA requires Ministers to promote the development of petroleum resources, for the benefit of New Zealand. Providing increased discretion will allow Ministers to exclude areas from permitting without being required to show that this is for the benefit of NZ (as currently defined).

²² Countervailing Forces: Climate targets and implications for competitiveness, leakage and innovation, available at <http://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/Countervailing%20forces%20-%20Sense%20Partners%202018%20FINAL%20report.pdf>.

The outcome of this will depend on how the legislation is used by Governments in the future. At one extreme, it could result in no further PEPs being granted beyond 2020. At the other extreme, the change from the status quo could be relatively minimal if the Government chooses to continue to offer both onshore and offshore PEPs post-2020.

Increased discretion in primary legislation may result in uncertainty as to how the Government will treat exploration permitting, which could in turn impact the ability for industry to make decisions about how and whether to invest in NZ.

Options C and E do not provide flexibility, which may result in the legislation needing to be changed to accommodate alternative policies for petroleum exploration permitting.

The key features of each of the options, in terms of impact, are:

Option A: Change the purpose of the CMA:

This option:

- would require changing the purpose statement of the CMA, which goes beyond the Cabinet decision on 2 July 2018 and is too significant to be completed as part of an accelerated legislative process;
- could have broader impacts beyond the policy position noted by Cabinet on 9 April 2018, as the purpose statement also covers minerals, as well as prospecting and mining permits, and permits for minerals (not just petroleum exploration);
- is the only option which would not create an internal contradiction within the CMA, because it would change the purpose statement as well as changing other sections as necessary to align with the new purpose statement;
- would provide increased discretion to the Government which would create uncertainty to industry as to how this discretion will be applied in future; and
- would likely have an economic impact, but the extent of this would be dependent on how the discretion in the legislation was used in the future.

The ranges of potential royalties and taxes foregone, and potential future company profits foregone, are provided below. All model results are modelled through to 2050.

In the scenario where a future Government chooses to use the discretion provided in the proposed change to the legislation to allow no offshore or onshore petroleum exploration post-2020, the modelled fiscal returns foregone relative to the status quo range from a present value of minus \$1.8 billion (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$26.7 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$9.8 billion (real). All values have been discounted at three per cent.

In terms of company profits foregone, the modelled company profits foregone relative to the status quo range from a present value of minus \$348 million (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$8.1 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$2.8 billion (real). All values have been discounted at ten per cent.

Onshore Taranaki through to 2020 and then no exploration either onshore or offshore post 2021 relative to counterfactual (NPV\$ million, real)

	Low exploration, Low oil price, High carbon price		Mid exploration, Mid oil price, Mid carbon price		High exploration, High oil price, Low carbon price	
	Crown total*	Company	Crown total*	Company	Crown total*	Company
10% discount rate						
90%	-393	-348	-1,346	-1,568	-2,120	-2,542
50%	-758	-730	-2,358	-2,752	-3,831	-4,655
10%	-1,441	-1,566	-4,044	-4,933	-6,488	-8,137
3% discount rate						
90%	-1,842		-5,344		8,777	
50%	-3,733		-9,848		-16,623	
10%	-6,516		-15,508		-26,722	
*Crown total is the sum of royalty and taxes						
Non-discounted revenues from 2027 to 2050**						
90%	-3,818	-3,698	-10,062	-11,013	-16,624	-17,279
50%	-7,861	-9,269	-20,090	-24,259	-33,732	-38,781
10%	-13,750	-16,225	-32,880	-38,997	-53,295	-63,851

** Non-discounted revenues represent revenues in 2018 (real) terms arising from 2027 to 2050

In the scenario where a future Government chooses to use the discretion provided in the proposed change to the legislation to open up both offshore or onshore petroleum exploration post-2020, the modelled fiscal costs relative to the status quo range from a present value of \$44 million (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to \$12.0 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is \$1.9 billion (real). All values have been discounted at three per cent.

In terms of company profits foregone, the modelled company profits foregone relative to the status quo in the opened up scenario range from a present value of \$34 million (real) (apparently a quirk in the model, something that can occur in monte carlo simulations at the outer extremes), in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$5.0 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$544 million (real). All values have been discounted at 10 per cent.

Onshore Taranaki through to 2020 and then exploration onshore or offshore open post 2021 relative to counterfactual (NPV\$ million, real)

Low exploration, Low oil price, High carbon price		Mid exploration, Mid oil price, Mid carbon price		High exploration, High oil price, Low carbon price	
Crown total*	Company	Crown total*	Company	Crown total*	Company

10% discount rate

90%	6	34	-62	-24	-292	-255
50%	-108	-117	-479	-544	-1,078	-1,219
10%	-533	-610	-2,530	-3,133	-3,906	-4,992

3% discount rate

90%	-44		-350		-1,339	
50%	-384		-1,887		-4,055	
10%	-1,585		-7,119		-11,950	

*Crown total is the sum of royalty and taxes

Non-discounted revenues from 2027 to 2050**

90%	-131	-428	-707	-1,154	-2,348	2,606
50%	-649	-1,006	-3,331	-4,756	-7,468	-9,794
10%	-2,665	-3,744	-10,936	-15,698	-20,400	-26,709

** Non-discounted revenues represent revenues in 2018 (real) terms arising from 2027 to 2050

Option B: Create a new provision that would allow the Minister to exclude areas from permitting:

This option:

- would have a similar impact to Option A, but this option would create a contradiction within the CMA but would not be considered to be a change that is too significant to be made under an accelerated legislative process;
- would provide increased discretion to the Government, both current and future, which would result in greater flexibility but less certainty in the legislation;
- would likely have an economic impact, but the extent of this would be dependent on how the additional discretion provided in the legislation was used in the future; and
- would have the same modelled costs to the Crown in terms of foregone royalties and taxes, and foregone profits to companies, as Option A.

Option C: Create an indefinite moratorium, with transitional provisions:

This option:

- would provide the highest level of certainty, but would provide less flexibility to implement alternative policies; and
- would have the most significant economic cost, by restricting exploration permitting to onshore Taranaki until 2020, and prohibiting all exploration permitting following this.

The modelled fiscal returns foregone relative to the status quo range from a present value of minus \$1.8 billion (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$26.7 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$9.8 billion (real). All values have been discounted at three per cent.

In terms of company profits foregone, the modelled company profits foregone relative to the status quo range from a present value of minus \$348 million (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$8.1 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$2.8 billion (real). All values have been discounted at 10 per cent.

Onshore Taranaki through to 2020 and then no exploration either onshore or offshore post 2021 relative to counterfactual (NPV\$ million, real)

	Low exploration, Low oil price, High carbon price		Mid exploration, Mid oil price, Mid carbon price		High exploration, High oil price, Low carbon price	
	Crown total*	Company	Crown total*	Company	Crown total*	Company
10% discount rate						
90%	-393	-348	-1,346	-1,568	-2,120	-2,542
50%	-758	-730	-2,358	-2,752	-3,831	-4,655
10%	-1,441	-1,566	-4,044	-4,933	-6,488	-8,137
3% discount rate						
90%	-1,842		-5,344		-8,777	
50%	-3,733		-9,848		-16,623	
10%	-6,516		15,508		-26,722	
*Crown total is the sum of royalty and taxes						
Non-discounted revenues from 2027 to 2050**						
90%	-3,818	-3,698	-10,062	11,013	-16,624	-17,279
50%	-7,861	-9,269	-20,090	-24,259	-33,732	-38,781
10%	-13,750	16,225	-32,880	-38,997	-53,295	-63,851

** Non-discounted revenues represent revenues in 2018 (real) terms arising from 2027 to 2050

Option D: Create a new regulatory power to make prohibitions:

This option:

- would provide increased discretion to the Government, both current and future;
- would have the same modelled costs to the Crown in terms of foregone royalties and taxes, and foregone profits to companies, as Options A and B; and
- would likely have an economic impact, but the extent of this would be dependent on how the discretion in the legislation was used in the future.

Option E: Create an explicit ban on permits in specific areas:

This option:

- would provide a high level of certainty;
- would have a significant impact on the economy, by permanently restricting exploration permitting to onshore Taranaki.

The modelled fiscal returns foregone relative to the status quo range from a present value of minus \$1.2 billion (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$23.5 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid

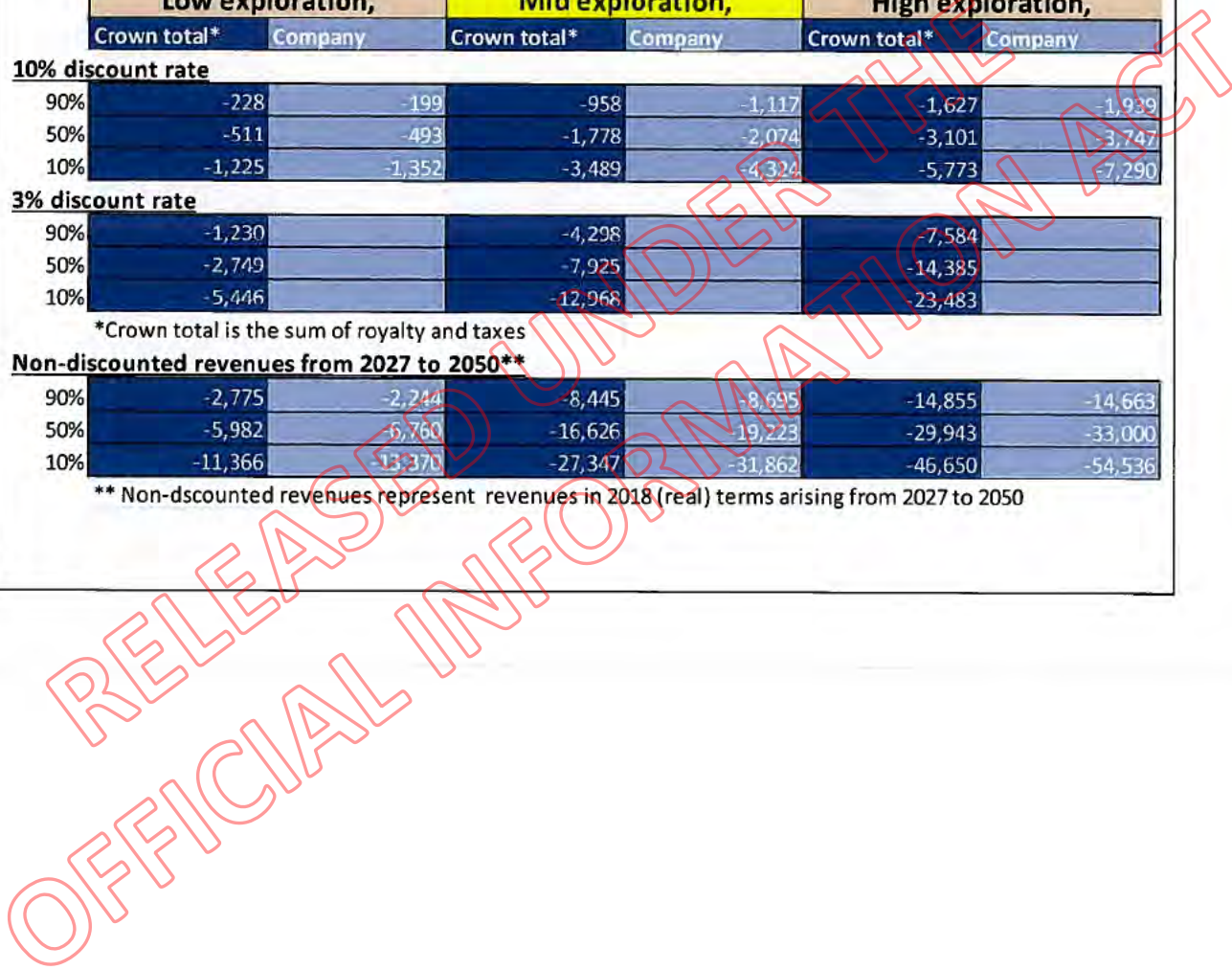
carbon price scenario is minus \$7.9 billion (real). All values have been discounted at three per cent.

In terms of company profits foregone, the modelled company profits foregone relative to the status quo range from a present value of minus \$199 million (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$7.3 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$2.1 billion (real). All values have been discounted at 10 per cent.

Onshore Taranaki through to 2050 relative to counterfactual (NPV\$ million, real)

	Low exploration,		Mid exploration,		High exploration,	
	Crown total*	Company	Crown total*	Company	Crown total*	Company
10% discount rate						
90%	-228	-199	-958	-1,117	-1,627	-1,939
50%	-511	-493	-1,778	-2,074	-3,101	-3,747
10%	-1,225	-1,352	-3,489	-4,324	-5,773	-7,290
3% discount rate						
90%	-1,230		-4,298		-7,584	
50%	-2,749		-7,925		-14,385	
10%	-5,446		-12,968		-23,483	
*Crown total is the sum of royalty and taxes						
Non-discounted revenues from 2027 to 2050**						
90%	-2,775	-2,244	-8,445	-8,695	-14,855	-14,663
50%	-5,982	-6,760	-16,626	-19,223	-29,943	-33,000
10%	-11,366	-13,370	-27,347	-31,862	-46,650	-54,536

** Non-discounted revenues represent revenues in 2018 (real) terms arising from 2027 to 2050



Section 5: Conclusions

5.1 What option, or combination of options, is likely best to address the problem, meet the policy objectives and deliver the highest net benefits?

As explained above, all of the options assessed address the problem that this legislative change seeks to address, as defined in Section 2.

Based on the analysis in Section 4, the preferred option is *Option B: Alter the existing framework by creating a new provision that would allow the Minister to exclude areas from permitting*. This addresses the problem definition, by providing sufficient discretion to the Government to implement its policies, without having unintended broader impacts. The outcome of the change would depend on future policies.

The key component of this option is to alter the current CMA framework so that the Government can give effect to the new policy as a statutory decision. The CMA would be amended to create a new power that would allow for land to be identified and excluded from new PEPs by regulation. This would be accompanied by other changes to the CMA, including provisions to preserve existing rights and manage any applications currently under consideration.

s 9(2)(h)

Option E is most closely aligned with the Government's policy, and is the Government's preferred option.

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5.2 Summary table of costs and benefits of the preferred approach (Option B - alter the existing framework, by creating a new provision that would allow the Minister to exclude areas from permitting)

Affected parties	Comment:	Impact	Evidence certainty
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Additional costs of proposed approach, compared to taking no action

<p>Regulated parties - Petroleum exploration and production companies</p>	<p>There are opportunity costs to upstream petroleum producers in terms of foregone profits from future offshore petroleum discoveries. The impact on company profits is dependent on how future Governments decide to exercise their discretion post- 2020.</p> <p>The modelled company profits foregone in a scenario of no future exploration permits being granted post 2020, relative to the status quo, range from a present value of minus \$348 million (real) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$8.1 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$2.8 billion (real). All values have been discounted at ten percent.</p> <p>The modelled company profits foregone in a scenario where the Government chooses to grant onshore and offshore PEPs post 2020, the impact relative to the counterfactual ranges from a present value of \$34 million (real) (a quirk in the model that can occur in monte carlo simulations at the extremes) in the P90 range of the low exploration, low oil price, high carbon price scenario, to minus \$5.0 billion (real) in the P10 range of the high exploration, high oil price, low carbon price scenario. The P50 range in the mid-exploration, mid oil price, mid carbon price scenario is minus \$544 million (real). All values have been discounted at ten percent.</p>	<p>Medium</p>	<p>High</p>
	<p>The proposed changes will create uncertainty for the petroleum industry,</p>	<p>Low</p>	<p>Medium</p>

	because the Government will be able to make changes to areas available for exploration permitting, without following policy and legislative processes.		
Wider Government – the Crown	<p>The proposed change is expected to result in a reduction over time in royalty and tax revenues to the Crown. There is a wide range of potential fiscal impacts depending on how future Governments decide to exercise their discretion post- 2020.</p> <p>In a scenario where there are no new PEPs granted post-2020, the modelled fiscal costs relative to the counterfactual is in the range of a present value of \$1.8 billion (real) and \$26.7 billion (real), with a mid-point estimate of \$9.8 billion (real). All values have been discounted at three per cent.</p> <p>The modelled fiscal revenue foregone in a scenario where future Governments choose to grant onshore and offshore PEPs post 2020, relative to the counterfactual, is in the range of a present value of minus \$44 million (real) and minus \$12.0 billion (real), with a mid-point estimate of minus \$1.9 billion (real). All values have been discounted at three per cent.</p>	High	High
Other parties – Taranaki public	The proposed change may reduce the economic contribution of the petroleum sector to the region.	High	Medium
Other parties – other regions	The proposed change will reduce the economic contribution of the petroleum sector to other regions, because the likelihood of the sector contributing to those regions in the future will be reduced.	Medium	Low
New Zealand public	<p>The proposed changes may result in a reduction in the petroleum sector's contribution to the New Zealand economy.</p> <p>The proposed changes may result in a decrease in the security and affordability of supply of gas and electricity in New Zealand. As gas</p>	High Medium	Medium Low

	<p>becomes increasingly scarce over time, it can be expected that gas prices will rise although the timing and scale of any price rises remain uncertain.</p> <p>In addition, it is possible that increased gas prices may flow through to an increase in electricity prices. The extent of this will depend on the continued role of gas in New Zealand's energy mix and the uptake of renewables.</p>		
Total Monetised Cost	<p>The broader economic contribution of the petroleum sector to the national economy has not been modelled.</p> <p>The potential royalty and tax revenue foregone depends on how future Governments choose to use the discretion provided in the legislation. The fiscal impact of the scenario where future Governments choose not to grant PEPs post-2020 relative to the counterfactual is in the range of a present value of \$1.8 billion (real) and \$26.7 billion (real), with a mid-point estimate of \$9.8 billion (real). All values have been discounted at three per cent.</p> <p>The modelled fiscal revenue foregone in a scenario where future Governments choose to grant onshore and offshore PEPs post-2020, relative to the counterfactual, is in the range of a present value of \$44 million (real) and \$12.0 billion (real), with a mid-point estimate of \$1.9 billion (real). All values have been discounted at three per cent.</p>	High	Medium
Non-monetised costs	<p>The change may result in a decline in the petroleum sector and its contribution to the economy and supply of resources in New Zealand.</p>	High	Medium

Expected benefits of proposed approach, compared to taking no action

Government	<p>The Government would be able to use its discretion to implement policies around petroleum exploration permitting.</p> <p>This will contribute to the Government's broader intention to signal a transition to a lower emissions economy (as</p>	Medium	Medium
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	described above in Section 2.1: <i>The Government's objective to transition to a lower emissions economy</i>)		
Regulated parties – existing permit holders	Existing permit holders may benefit as natural gas becomes increasingly scarce over time and the value of remaining gas reserves increases. These benefits may be offset by demand-side uncertainty over future gas supplies, which could result in major gas users scaling back demand over time.	Medium	Low
Total Monetised Benefit	N/A	N/A	N/A
Non-monetised benefits	The Government is provided with greater discretion to implement policies.	Medium	High

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5.3 What other impacts is this approach likely to have?

It should be noted in considering the impacts described above that foregone revenues (either to the Crown or to companies) and the broader economic impacts depend on the likelihood of future commercial petroleum discoveries. This is not a certainty but is considered likely in the period to 2050, based on previous experience and the geological prospectivity of New Zealand.

The following costs and benefits cannot be easily assigned to a specific stakeholder group.

The Government benefits by aligning the law with its policy decision

The proposed legislative changes benefit the Government by allowing it to give effect to its stated policy, which in turn supports the broader policy priority to transition to a lower emissions economy, as outlined in section 2.1.

Implementing policies that result in a decline in the petroleum sector may specifically allow the Government to:

- demonstrate global leadership in emissions reductions and efforts to tackle climate change;
- signal expectations for the future role of the petroleum sector in New Zealand's economy;
- balance resource development with emissions reductions and climate change objectives; and
- manage public concern around the environmental effects of petroleum exploration and mining, noting that these effects are currently managed under other pieces of legislation.

Foregone domestic greenhouse gas emissions that would otherwise have been emitted

The proposed changes may result in a reduction in domestic gas emissions. There is a first-order impact of fugitive greenhouse gas emissions not emitted but which otherwise would be.

In addition, there may be second-order impacts if major gas users, most notably Methanex, scale back or completely close operations in New Zealand should gas supply become scarce in future. The timing of when, or even if, this might occur remain uncertain. In 2017, Methanex's New Zealand plants emitted ^{s 9(2)(b)}_(ii) tonnes of CO₂ per tonne of methanol.²³ With a production capacity of 2.4 million tonnes, Methanex has the potential to emit up to ^{s 9(2)(b)(ii)} tonnes of CO₂ equivalent per annum, which represents 2 per cent of gross emissions in New Zealand in 2016. This is the maximum amount that could be abated from Methanex shutting down completely.

Likely increase in global greenhouse gas emissions in the short-medium term

New Zealand is able to produce some products more efficiently and with a lower greenhouse gas emissions footprint than our international trading partners. As noted in the report undertaken for the Ministry for the Environment titled *Countervailing Forces: Climate targets*

²³ Methanex, *Responsibility Care & Sustainability, 2017 Report Summary*, available at: <https://www.methanex.com/sites/default/files/microsites/Methanex-Sustainability-Report-2017.pdf>.

and implications for competitiveness, leakage and innovation (the Countervailing Forces report)²⁴ the biggest risks around carbon leakage relevant to the natural gas industry include steel and petrochemicals.

In the case of steel, the Countervailing Forces report noted that if New Zealand were to start to import more steel it is most likely to come from Australia and Indonesia – based on historical import trends – and both countries have average emissions intensity in electricity which is 5 – 6 times more emissions intensive than New Zealand.

In the case of methanol, the marginal source of global methanol supply is coal to methanol produced in China which has an emissions' intensity at least double (but typically three to four times) that of gas to methanol. All other things being equal, a decline in methanol produced in New Zealand would result in increased methanol production from China (which accounts for approximately half of global methanol demand, and two-thirds of Chinese methanol production is derived from coal).

In the case of urea, New Zealand currently imports between ^{s 9(2)(b)(ii)} and 650,000 tonnes of urea per annum primarily from the Middle East and Malaysia. When combined with emissions from shipping, these imports have a higher emissions footprint than the urea produced in New Zealand. The proposed investment ^{s 9(2)(b)(ii)} the Kapuni urea plant ^{s 9(2)(b)(ii)} tonnes per annum would have improved the CO₂ emissions profile by between 25 per cent and 30 per cent per unit of urea produced ^{s 9(2)(b)(ii)}.

. The overall impact of this investment decision ^{s 9(2)(b)(ii)} but this will likely be more than offset by continuing imports of urea from the Middle East with a higher emissions footprint.

Foregone contribution to national gross domestic product, exports, and the Taranaki economy as a result of investment uncertainty

There is some evidence to suggest that investment uncertainty created in anticipation of these legislative changes has already resulted in investments being deferred or cancelled. In the case of the Kapuni urea expansion project, this would have resulted in a modest increase to domestic greenhouse gas emissions but a likely reduction in global greenhouse gas emissions in terms of imports from the Middle East and Malaysia with a higher emissions footprint being displaced.

In addition to direct economic impacts there will also be second order impacts in terms of investment decisions that are foregone due to increased uncertainty around future gas supply. Caution needs to be applied in attributing investment decisions solely and uniquely to anticipated legislative changes to give effect to the Government's decision not to grant future offshore petroleum exploration permits. Other factors may also be at play, such as the Government's broader policy around climate change. The most notable investment decision that has at least partially been attributed to the Government announcement, was that made in July 2018 by Ballance Agri-Nutrients. Instead of investing \$1.1 billion in expanding and revamping its Kapuni urea plant, the company opted instead for a \$35 million refurbishment of existing plant. The larger investment of \$1.1 billion would have involved ^{s 9(2)(b)(ii)} the plant capacity to ^{s 9(2)(b)(ii)} tonnes of urea per annum and displaced the equivalent of ^{s 9(2)(b)(ii)} tonnes of urea per annum which is currently imported from the Middle East.

Investment uncertainty may also result in the decommissioning of upstream facilities being brought forward, if operators perceive that the opportunities in the New Zealand industry are limited, noting that the CMA requires permit holders to maximise economic recovery. The

²⁴ Available at:

<http://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/Countervailing%20forces%20-%20Sense%20Partners%202018%20FINAL%20report.pdf>.

decommissioning of midstream infrastructure that supports the existing industry may be brought forward if the sector declines. Both of these may have an impact on contributions to Crown revenue and the broader economy.

5.4 Is the preferred option compatible with the Government's 'Expectations for the design of regulatory systems'?

The preferred option is not incompatible with the Government's 'Expectations for the design of regulatory systems'.

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Section 6: Implementation and operation

6.1 How will the new arrangements work in practice?

s 9(2)(h)

There is already high awareness among stakeholders of the policy change discussed in this document, however there has not been consultation or information shared about the proposed legislative change.

MBIE is the government department responsible for administering the CMA and this regulatory role will not be affected by the proposed change. The Minister of Energy and Resources is responsible for making decisions about the allocation of permits and these decision-making powers have generally been delegated to MBIE. MBIE will therefore need to consider any exclusion made under the new provisions when making decisions about permit allocation, and the nature of existing delegations may need to be reviewed. There are not expected to be any problems around the implementation of the proposed changes.

The requirements are expected to affect decisions about new permits immediately after coming into effect. Transitional arrangements will be required to clarify and protect the rights of existing permit holders.

The change will not significantly impact other agencies. Consultation with other agencies will occur throughout the drafting process and agencies will be informed of other administrative changes.

6.2 What are the implementation risks?

The policy that this change seeks to implement has been well publicised, and it is expected that the petroleum industry are already considering this in decisions that they are making about investment in New Zealand.

Stakeholders have raised concerns about how the rights of existing permit holders and investors will be affected by the change. Transitional provisions will need to be created to manage the risk of unintended consequences in this area. The implications of the provisions will need to be clearly communicated to stakeholders.

No other implementation risks have been identified.

Section 7: Monitoring, evaluation and review

7.1 How will the impact of the new arrangements be monitored?

Given the lengthy timeframes involved from the grant of a petroleum exploration permit to the point where the first well is drilled (up to seven years), and then from drilling to production (potentially a further decade depending on the basin), the direct impact of this legislative change in terms of future oil and gas production will not be felt for many years to come (2027 at the earliest under MBIE's modelling). This complicates the monitoring and evaluation of this legislative change. Instead, MBIE will continue its existing regulatory, monitoring, and advisory role of energy markets to gauge any areas of concern.

As stewards of the Crown Mineral estate, MBIE monitors investment in the upstream petroleum sector through such areas as nominations for future block offer areas, the number of bids received in block offer rounds, exploration expenditure, the quantity of seismic lines shot, and the number of exploration wells drilled. The last three elements are regularly published each year in the *Energy in New Zealand* publication.

MBIE also has an ongoing role in monitoring energy markets and advising on matters such as energy security and energy affordability. Gas production and demand data is collected through the International Energy Agreement 1976 and the Gas (Statistics) Regulations 1997. Detailed daily production profiles by field and reserve and resource data is collected through the CMA. Gas production, demand and prices are published each quarter, reserve and resource information is published each year, while daily production profiles are not currently published at all. Short-term gas prices can be monitored on EMSTradePoint (<http://www.emstradepoint.co.nz/>).

As the largest single consumer of natural gas, Methanex plays a unique role in helping to balance gas demand and supply. The ability of Methanex to continue operating at full capacity provides a gauge on whether or not gas supply is becoming tight. The announcement on 17 July 2018 that Methanex had signed agreements that are expected to supply gas to underpin over half of its 2.4 million tonnes of annual production capacity in New Zealand for a period of 11 years through 2029^{s 9(2)(b)(ii)}

Under the production forecasts in the mid-case scenario, there is projected to be significantly less gas from new exploration than current levels. While there is a significant level of uncertainty around this production profile, it does highlight that the outlook for Methanex is highly uncertain, regardless of the Government decision not to grant future offshore PEPs. The most that can be said is that the decision not to grant future offshore PEPs will exacerbate this uncertainty and likely, all other things being equal, bring forward the point where Methanex has to reduce output.

7.2 When and how will the new arrangements be reviewed?

Cabinet agreed on 2 July 2018 that there would be a second tranche of legislative amendments to the CMA. This wider review of the CMA will be conducted on a more typical timeframe starting with an issues paper and consultation with stakeholders later in 2018. It is likely that the legislative changes settled upon as part of the tranche one amendments will be revisited as part of this second tranche of work. Specifically, this is likely to encompass any possible amendments to the purpose statement of the CMA.

There is no formal review planned for the Government decision not to grant future offshore PEPs. Any review of this decision will be directed by the Government of the day.

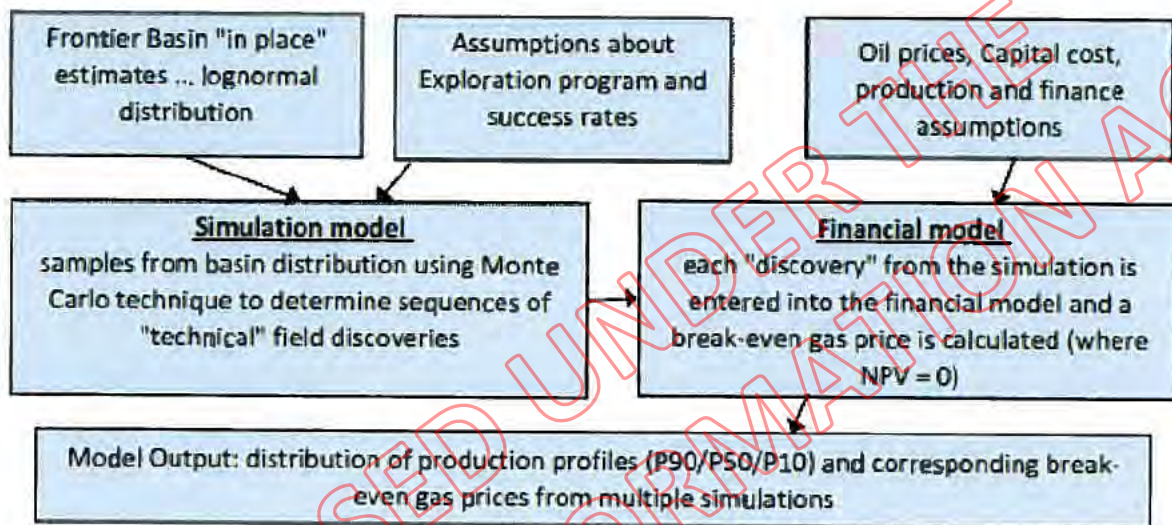
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Annex: MBIE Oil and Gas Model

A description of MBIE's oil and gas model is set out in Chapter 7 of the Energy Modelling Technical Guide.²⁵ The main purpose of this model is to generate gas supply estimates for electricity generation scenarios. It was most recently updated in 2016, with the outputs used in the Electricity Demand and Supply Generation Scenarios.

Overview of modelling process

A simulation model has been developed to assess New Zealand's potential undiscovered technical petroleum (oil and gas) resource and a financial model to calculate the commercial viability of the technical resource.



Simulation model

The first step in the modelling process is to estimate, for each frontier basin, the technical Oil Initially in Place (OIIP) and technical Gas Initially in Place (GIIP) for the entire basin. The GNS report²⁶ provides OIIP and GIIP assumptions, with the uncertainty in the estimates reflected by assuming a lognormal distribution. The table below shows the basin OIIP and GIIP estimates at the P90, P50 and P10 levels, as well as the truncated minimum and maximum values.

²⁵ Available at: <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/modelling/electricity-demand-and-generation-scenarios/documents-image-library/edgs-2016/energy-sector-modelling-technical-guide.pdf>.

²⁶ GNS Science Consultancy Report, September 2015, *Assessment of New Zealand's Undiscovered Petroleum Resource* by Delphi Panel.

Technical in place resource estimates

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB	Northland	Tki Deep	Raukum	Pegasus
Giip (tcf)									
Min	0.4	0.7	0.2	0.1	0.5	0.4	0.6	0.2	0.3
90%	0.9	1.5	0.7	0.4	1.6	1.0	1.6	0.7	1.0
50%	2.2	3.5	2.6	1.6	6.9	2.8	5.0	3.3	4.5
10%	5.3	8.1	10.1	6.8	29.4	8.0	12.3	15.9	13.5
Max	10.8	16.2	30.3	22.4	95.9	18.6	12.3	57.1	13.5
Oiip (mmbbl)									
Min	46	103	60	14	84	44	47	25	10
90%	90	238	156	53	244	125	156	81	43
50%	207	663	508	267	907	445	883	348	248
10%	475	1850	1650	1363	3375	1588	2158	1488	750
Max	934	4271	4313	5138	9852	4474	2158	4866	750

Source: GNS Science

The simulation model samples from these basin distributions using a Monte Carlo technique. The sampling process is run several hundred times, with each sample referred to as an 'iteration'. Each 'iteration' is a hypothetical future in which NZ has a certain quantity of petroleum resources.

The next step in the modelling process is to determine the likely size and number of gas and oil fields that are contained within each basin. It is assumed that the distribution of fields follows 'Zipf's law', where the second largest field is half the size of the largest field, the third largest field is one third of the largest, and so on. Once the basin size and the largest field size are known, then the remaining field sizes can be calculated. The table below shows the largest field assumptions for each basin and for each basin probability level.

Maximum field size for each probability level

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB	Northland	Tki Deep	Raukum	Pegasus
Max gas field size (tcf)									
Min	0.23	0.50	0.08	0.07	0.23	0.38	0.45	0.15	0.21
90%	0.42	0.75	0.28	0.23	0.67	0.75	1.13	0.53	0.75
50%	0.80	1.50	1.20	1.00	3.00	1.50	2.25	2.25	2.25
10%	1.50	2.75	3.30	3.00	9.00	3.00	6.00	6.00	2.25
Max	2.62	4.68	8.70	7.91	22.50	6.33	13.29	16.29	6.11
Max oil field size (mmbbl)									
Min	23	100	63	50	150	65	60	44	14
90%	38	133	125	100	225	120	120	100	31
50%	80	300	250	200	450	200	300	300	150
10%	140	600	550	600	1200	500	1000	600	200
Max	258	1137	1031	1125	2400	1000	2370	1500	900

Source: GNS Science

The next step, for each iteration, is to determine how many of these potential fields will be discovered and when they will be discovered. This requires hypothetical exploration wells to be drilled and assumptions made regarding the success of the wells. The tables below outline the success rate and exploration assumptions.

The probability of a technical success is assumed lower for frontier basins when compared to the established Taranaki region. The probability rates are based on historical well success rates in Taranaki, while those for frontier basins having been discussed and agreed on in consultation with Michael Adams Reservoir Engineering in 2009.

Probability of a technical success

Technical success rate

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB Far	Northland	Tki Deep	Raukum	Pegasus
Success rate (for finding oil or gas)	40%	20%	15%	15%	15%	15%	10%	10%	10%
Failure rate	60%	80%	85%	85%	85%	85%	90%	90%	90%
Probability of gas (if there is a success)	50%	48%	65%	65%	67%	48%	50%	50%	50%
Probability of oil	50%	52%	35%	35%	33%	52%	50%	50%	50%

Source: Michael Adams reservoir engineering

Well count

Low case

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB Far	Northland	Tki Deep	Raukum	Pegasus
2018									
2019									
2020									
2021									
2022									
2023	2								
2024	3								
2025	2	4							
2026	3								
2027	2		1		1				1
2028	3	4							
2029	2								
2030	3								
2031	2	4					1		
2032	3								
2033	2								
2034	3	4	1	1	1	1			
2035	2								1
2036	3								
2037	2	4							
2038	3						1		
2039	2							1	
2040	3	3							
2041	2								
2042	2		1	1	1	1			
2043	2	3							1
2044	2						1		
2045	2								
2046	2	3							
2047	2							1	
2048	2								
2049	2	3	1	1	1	1			
2050	2						1		1

Source: MBIE - 2018 estimates

Mid case

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB Far	Northland	Tki Deep	Raukum	Pegasus
2018									
2019									
2020									
2021									
2022									
2023	3								
2024	4								
2025	3	5							
2026	4								
2027	3		1	1	2		1		2
2028	4	5							
2029	3								
2030	4								
2031	3	5				1			
2032	4								
2033	3								
2034	4	5	1	1	2		1		
2035	3							1	2
2036	4								
2037	3	5							
2038	4								
2039	3					1			
2040	4	5	1	1	2		1		
2041	3								
2042	3								
2043	3	4						1	2
2044	3								
2045	3					1			
2046	3	4	1	1	2		1		
2047	3								
2048	3								
2049	3	4							
2050	3							1	2

Source: MBIE – 2018 estimates

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High case

	Tki Onsh	Tki Offsh	Canty Near	Canty Far	GSB Far	Northland	Tki Deep	Raukum	Pegasus
2018									
2019									
2020									
2021									
2022									
2023	4								
2024	5								
2025	4	6							
2026	5								
2027	4		2	2	3	1	2	1	4
2028	5	6							
2029	4								
2030	5								
2031	4	6							
2032	5								
2033	4								
2034	5	6	2	2	3	1	2		
2035	4							1	4
2036	5								
2037	4	6							
2038	5								
2039	4								
2040	5	6	3	3	3	2	3		
2041	4								
2042	4								
2043	4	5						2	4
2044	4								
2045	4								
2046	4	5	2	2	3	2	3		
2047	4								
2048	4								
2049	4	5							
2050	4							2	4

Source: MBIE – 2018 estimates

The model randomly selects a number between 0 and 100 when an exploration well is drilled. If the random number is less than the assumed success rate then the well is a success, otherwise it is a failure. For example, a random number of 17 in Offshore Taranaki is deemed a success. If there is a technical success, the model then selects another random number to determine whether the discovery is primarily oil or gas prone. Another random number is then generated to determine what sized field is discovered (i.e. is it the largest, fourth largest, smallest, etc)²⁷.

The random numbers are generated for each hypothetical exploration well drilled. This results in a sequence of discoveries and failures for each single model iteration. These technical successes and failures are stored for each iteration in a database, which contains the following information:

- Technical field size (tcf gas or mmbbl oil) by basin
- Discovery year
- Number of exploration well failures

Financial model method

The commercial viability of each technical discovery was assessed using the financial model. The financial model is a discounted cash flow model, which includes all the relevant income

²⁷ The model assumes that the largest field will be found before the third discovery.

and costs an oil company would expect in the course of exploring, developing, and operating an oil or gas field.

Every gas field discovered and stored in the database is fed into the financial model and a break even gas price and production profiles are calculated. The break- even gas price is the average price required in order for the project to attain a net present value (NPV) of zero. Note that gas prone fields also produce some oil condensate which is sold at a given price (refer to Financial Model assumptions in the appendices).

Every oil field was also fed into the financial model and an NPV was calculated using an exogenous oil price assumption (same price as in Reference Scenario).

Crude oil price

(Low) Sustainable Development scenario				(Mid) New Policy scenario				(High) current Policy scenario				
2016	2025	2030	2040	2016	2025	2030	2040	2016	2025	2030	2035	2040
41	72		64	41	97		136	41	83	94	103	111

Source: IEA World Energy Outlook 2017 page 52

Exchange rate – US\$/NZ\$

Low	0.56
Mid	0.66
High	0.76

Source: NZIER

Carbon price – US\$/tonne

(Low) current Policy scenario				(Mid) New Policy scenario				(High) Sustainable Development scenario				
2016	2025	2030	2040	2016	2025	2030	2040	2016	2025	2030	2035	2040
	22		40		25		48		63			140

Source: IEA World Energy Outlook, page 48 (European Union)

Long-term gas prices – NZ\$/GJ

7.23 per GJ constant.

Exploration and development cost thresholds

These were initially provided to the then Ministry of Economic Development in 2009 by Michael Adams Reservoir Engineering.²⁸ Cost estimates were updated by Michael Adams in 2015 and for this exercise were scaled using IHS Markit's Upstream Capital Cost Index²⁹ and Upstream Operating Cost Index to 1Q 2018.³⁰

²⁸ Available at: <http://www.mbie.govt.nz/info-services/sectors-industries/natural-resources/oil-and-gas/petroleum-expert-reports/michael-adams.pdf/view>.

²⁹ Available at: <https://ihsmarkit.com/Info/cera/ihsindexes/index.html>.

³⁰ Available at: <https://ihsmarkit.com/Info/cera/ihsindexes/index.html>.