Dear Select Committee

Submission of Sean Rush Law and Policy Limited on the Crown Minerals Amendment Bill 2024 – 1 October 2024

Sean Rush Law and Policy Limited is a law firm dedicated to energy, climate change and public policy. I would like to make an oral submission. Due to time limitations, please excuse formatting errors.

I have 30 years' experience around the world as a petroleum industry lawyer and have seen the benefits of a well regulated offshore oil producing province.

I also have a Masters in Climate Change Science and Policy and am a member of the Intergovernmental Panel on Climate Change, contributing to the 2021 Sixth Assessment Report – the Physical Science – the only NZ based lawyer to do so. I continue to undertake research into the physical science but with a recent focus on the political signal. I am coming to the conclusion that this 'political' signal influences the anthropogenic narrative far more than the observed changes to our climate.

The delicate balance between affordable, reliable energy and the stability of a climate system, that is inherently unstable, is an area in which I am uniquely qualified to opine on.

The recent rhetoric from the opponents of this legislation suggests there's no prospectivity to be had; we won't find gas for ten years etc – all highly speculative and true, as it was in 2018, but the interest from overseas investors was still bringing in an estimated $42 million to local economies.

Right now, a new well is being drilling in Taranaki that will deliver gas to New Zealand if successful. Already a new participant visited the Taranaki fields from Canada last week as part of a due diligence exercise. I have UK clients, cash rich because their UK projects have been deferred, now looking for investment opportunities with NZ an option. Others in New Zealand are watching carefully the passage of this legislation due to prospective areas they wish to explore.

This submission is in three stages:

1. A reminder about why the global petroleum industry was excited to be exploring in New Zealand;
2. Some brief ideas on how the legislative processes may be improved;
3. A few words on climate change.

1. Estimating future revenues from yet to be discovered fields

MBIE RIS - 2018

Ignoring the most recent RIS that seems unduly pessimistic (and given the petroleum expertise at MBIE has largely gone, then it's possibly not a good starting point), the industry's direct contribution to the Treasury is perhaps better reflected in the *Regulatory Impact Statement: Proposed Changes to the Crown Minerals Amendment Act 1991*, prepared by the Ministry of Business, Innovation and Employment ("**MBIE**") in 2018.

They note that the *"fiscal impact to the Crown of this scenario relative to the counter factual using a 3% discount rate is in the range of a present value of -$1.2B (real) and -$23.5B (real)."*

The estimates of undiscovered reserves upon which MBIE's conclusions were based were derived from the government's adviser, GNS in their report "*Potential undiscovered oil and gas resources of New Zealand*" which was presented in two phases, an initial 5-page report dated 20 February 2009 followed by a subsequent 11-page report dated 23 April 2009 (the "**GNS Report**").[1] It speaks volumes that the decision to ban exploration was made without updating and reinforcing this advice.

GNS present their conclusions in the following tables showing an estimated 'P50' undiscovered resource of ~6.3 billion barrels of oil, ~1.1 billion barrels of condensate and ~40 trillion cubic feet of gas - equivalent to 7 Maui's: 7 Taranaki – like regions dotted around New Zealand.

Table 1. Estimates of oil-in-place resource.

Basin	Oil (MMbbl)						Condensate
	P99	P90	P50	P10	P01	Mean	P50
Onshore Taranaki	29	63	158	400	852	202	48
Offshore Taranaki	106	238	638	1713	3831	840	106
Deepwater Taranaki	69	263	1343	6875	26023	2679	224
Northland	58	144	441	1350	3364	624	125
GSB	165	400	1183	3500	8473	1643	239
Canterbury	124	275	732	1950	4333	960	80
East Coast	100	190	418	920	1750	500	103
Pegasus	8	50	461	4250	25994	1474	82
Raukumara	48	150	612	2500	7870	1040	77
Reinga	25	100	561	3150	12855	1199	116

Table 2. Estimates of gas-in-place resource.

Basin	Gas (bcf)					
	P99	P90	P50	P10	P01	Mean
Onshore Taranaki	344	688	1606	3750	7488	1974
Offshore Taranaki	860	1625	3549	7750	14651	4232
Deepwater Taranaki	763	2125	7469	26250	73142	11500
Northland	387	1125	4159	15375	44642	6614
GSB	542	1813	7965	35000	117002	14230
Canterbury	164	575	2681	12500	43854	4995
East Coast	303	900	3421	13000	38607	5538
Pegasus	125	500	2739	15000	60008	5745
Raukumara	131	500	2582	13333	50840	5183
Reinga	197	750	3873	20000	76260	7774

[1] Available at https://www.mbie.govt.nz/info-services/sectors-industries/natural-resources/oil-and-gas/petroleum-expert-reports/GNS-science.pdf/view last visited 11 October 2018.

Clearly the work done by GNS is robust, within its limitations, and has been used for *"energy and macro-economic policy making"*. It demonstrates significant, nation changing, prospectivity that could have an immensely positive impact on ordinary New Zealanders all around the country.

This potential needs to be unlocked.

Other Crown Commissioned Reports

The MBIE analysis from 2018 should not come as any surprise. Other Crown commissioned reports were sourced by the John Key Government from internal and external sources and were archived together on the New Zealand Petroleum & Minerals website, but are no longer available. The reports were sought to understand the industry's value proposition and provide advice as to optimising the legislation in order that it might most benefit New Zealand. The process, starting in 2009, culminated in the adoption of the annual Block Offer process in 2012 and the data was reviewed by multi-nationals and their experts before attending the sell-out 2012 petroleum conference.

The enabling legislation included: Amendments to the Crown Minerals Act 1991 that were consulted on throughout 2012; the Exclusive Economic Zone Act in 2012; changes to health and safety laws and the adoption of a supporting Petroleum Programme in 2013 – in all, a well thought through, thoroughly researched integrated package of measures to stimulate interest in maximising the economic recovery of Crown minerals for the benefit of New Zealand – whilst there is room for improvement, in my opinion having worked in numerous jurisdictions around the world, this is a package for which New Zealand can be proud.

For example:

1. Stuart McDouall's *Stepping Up"* report (2009) makes for insightful reading. At the time the Tui field had just come onstream and provided very useful data. They stated:

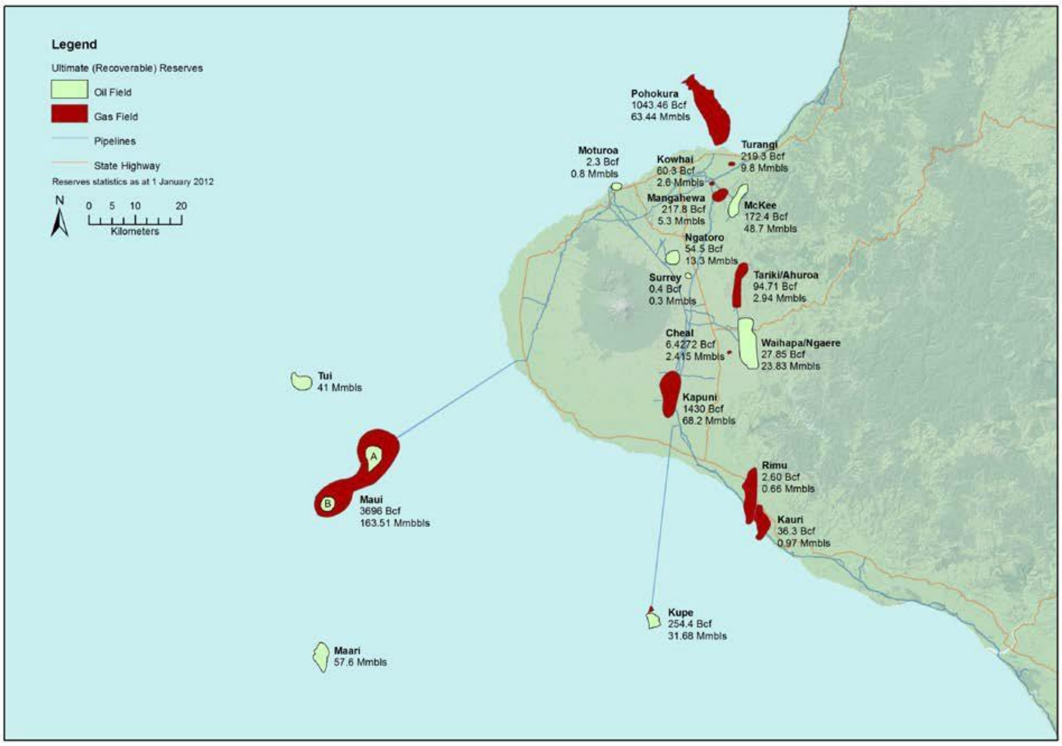
"In respect of oil and gas, Tui again provides a useful baseline. At current oil prices, Tui's total whole-of-life 2P field revenue is likely to exceed $4.0 billion in nominal terms. Of that, McDouall Stuart projects that $2.75 billion (70%) will be paid out to suppliers, employees and shareholders, with the balance, $1.25 billion, paid to government as royalties and taxes.

A national, say, 20 billion boe estimate is equivalent to 400 Tui fields. Applying Tui's economics to the estimated national oil and gas endowment at current prices implies more than $1.5 trillion in gross revenue, two-thirds of which would be paid out as production costs and dividends. Total government take of around $1 trillion, would approximate 16 years of core annual government spending at current levels."* [* the GNS estimate equals ~14.5 billion BOE].

2. MBIE's Economic Development Group's "Occasional Paper 10/07, August 2012[2] contained the following information on pages 3 to 5 that demonstrates the profound and positive effect the oil and gas industry has had on the Taranaki economy:

[2] Formerly available at https://www.mbie.govt.nz/info-services/sectors-industries/natural-resources/oil-and-gas/petroleum-expert- reports/pdf-document-library/Economic%20contribution%20and%20potential%20of%20NZs%20oil%20and%20gas%20industry.pdf

Figure 1: Oil and gas fields in Taranaki



Source: Ministry of Business, Innovation and Employment

Figure 2: Average labour productivity by region (2011)

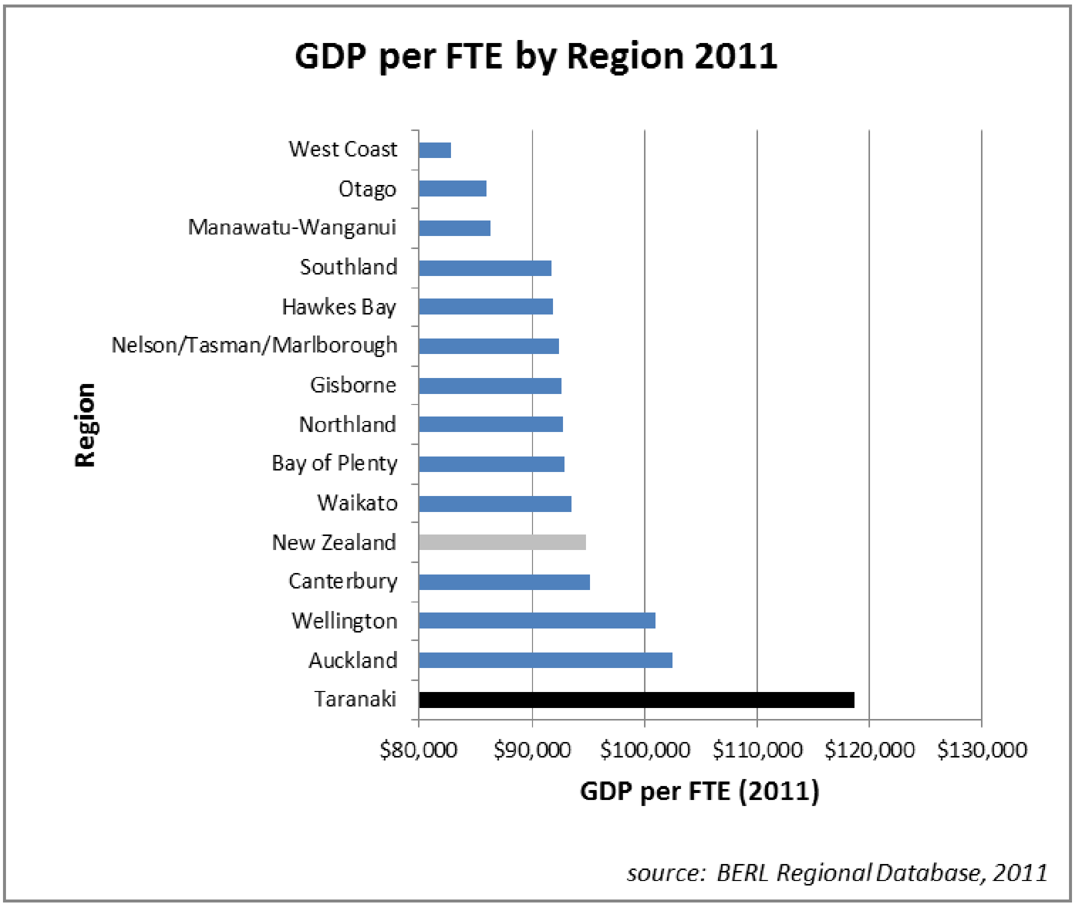

GDP per FTE by Region 2011
Region
West Coast
Otago
Manawatu-Wanganui
Southland
Hawkes Bay
Nelson/Tasman/Marlborough
Gisborne
Northland
Bay of Plenty
Waikato
New Zealand
Canterbury
Wellington
Auckland
Taranaki
$80,000
$90,000
$100,000
$110,000
$120,000
$130,000
GDP per FTE (2011)
source: BERL Regional Database, 2011

Figure 3: Output per person by region (2011)

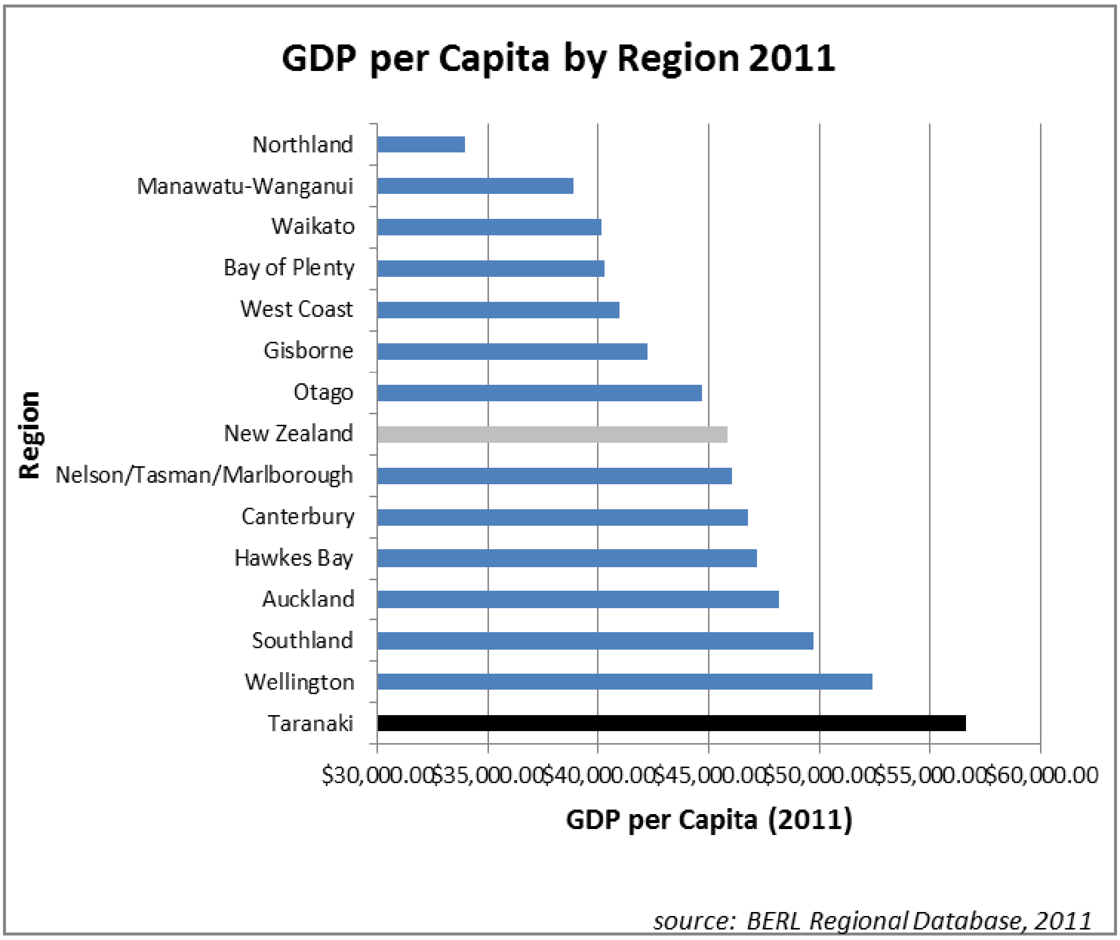


Figure 4 below shows the contribution of different sectors to the Taranaki economy in 2011. The mining sector, which includes oil and gas activities, was directly responsible for 23 percent of regional gross domestic product (GDP) in 2011.

Figure 4: Sector contributions to Taranaki GDP

Real GDP in 2011 $m for Taranaki	2008	2009	2010	2011
New Zealand	195,432	192,484	191,211	194,277
Taranaki Region	5,970	5,911	6,020	6,035
Mining	1,492	1,382	1,467	1,384
Manufacturing	983	901	869	922
Rental, Hiring & Real Estate Services	657	697	766	709
Agriculture, Forestry & Fishing	342	350	353	360
Health Care & Social Assistance	304	310	317	319
Retail Trade	306	305	307	313
Construction	320	315	283	289
Wholesale Trade	254	246	236	232
Transport, Postal and Warehousing	206	206	203	231
Professional, Scientific & Technical Services	155	175	185	181

Information Media & Telecommunications	127	135	135	168
Electricity, Gas, Water & Waste Services	107	147	157	168
Public Administration & Safety	165	171	159	165
Financial & Insurance Services	137	155	150	151
Education & Training	137	139	147	151
Administrative & Support Services	115	107	115	125
Accommodation & Food Services	69	70	69	68
Art & Recreational Services	51	57	58	53
Other Services	43	43	45	46

Source: BERL, Statistics New Zealand

The successes in Taranaki also had positive effects on the broader macroeconomy. In 2009, the petroleum and minerals sectors contributed 2.3 percent of GDP – oil and gas production accounted for 1.5 percent.

The oil and gas industry also generates around $400 million in annual royalty and around $300 million in annual company tax revenue for the government.

Oil was New Zealand's fourth-largest merchandise export, despite the fact that production is limited to a relatively small number of fields and only one petroleum basin (Statistics New Zealand, 2011).

Figure 5: The value of oil exports in comparison to other commodities

	12 months ended June, millions of dollars		
Commodity	**2009**	**2010**	**2011**
1. Milk powder, butter and cheese	8,970	8,840	11,335
2. Meat and edible offal	5,526	5,058	5,398
3. Logs, wood and wood articles	2,330	2,638	3,200
4. Crude oil	1,964	2,126	1,990
5. Mechanical machinery and equipment	1,842	1,647	1,733

Source: Statistics New Zealand

3. NZIER's *"Value of oil and gas exploration: Hypothetical scenarios",* NZIER report to the Ministry of Economic Development, March 2012[11] sought what the impact a single major oil and gas development may have on the New Zealand economy. It concluded:

"We use a computable general equilibrium model to estimate the impact on the New Zealand economy of a P50 oil and gas development scenario.

- *The development would generate an additional $1.5 billion of export revenue in an average year of production.*
- *Gross domestic product rises by 1.2%, on average, for the duration of the field's production.*

- *The impact of the export revenues is dampened by the fact that the profits go to the owners, who are likely to be offshore. After tax and royalty payments – which account for about 42% of the gross profit -- 90% of the remainder go offshore, so a better measure of returns to NZ is gross national disposable income. It rises by 0.77%: even after offshore payments, the New Zealand economy is considerably better off.*

- *Royalties are $320m per average year of production. These are assumed to be used to reduce national debt, which increases disposable incomes.*

- *Households also benefit through slightly higher real wages. Aggregate employment at a national level is assumed to be fixed, but there is strong growth in employment in the oil and gas industry and supporting supply and investment sectors. That reflects the higher effective productivity of labour in those industries following a major find."*

4. Woodward Partners report for the Ministry of Economic Development, *Valuation of the Crown's Royalty Streams from Petroleum Reserves* found:

   a. Low Case: $1,613 million - using a low valuation case that assumes a rate of exploration no greater than current, and an oil price path dropping from today's US$70 per barrel to US$55 per barrel in 2035.

   b. Mid Case: $5,545 million - The Mid valuation case assumes a rate of exploration no greater than recent levels, and an oil price path rising smoothly from today's US$70 per barrel to US$125 per barrel in 2035. They note that "*Even the P90 valuation is greater than the total valuation of the producing fields ($3,321 million vs $3,191 million)."*

   c. High Case: $10,269 million - The High valuation case assumes the rate of exploration activity accelerates by approximately 50% over the next 10 years, and an oil price path rising from today's US$70 per barrel towards US$120 to US$200 per barrel in 2035.

In conclusion under any modelling scenario, including that provided by MBIE, future exploration has considerable value to the nation.

2. COMMENTS ON THE PROPOSED LEGISLATION

I have advised the NZ, Australian and UK governments on the regulatory settings applying to petroleum regimes and have worked in most regions.

1. To attract international investors, a stable regulatory environment will be necessary:

   a. I suggest the Government engage with coastal iwi and local body interests to ensure they receive a portion of royalty attributable to their rohe / territory.

   b. Government should seek out the national oil companies of our major trading partners, particularly those with whom we have investor treaty agreements with. The appetite for Chinese, Indian, Indonesian national companies as well as Australian and British firms will not have diminished.

c. Serious consideration should be given to the formation of a National Energy Company to manage the transition generally, including the exploration and production of fossil fuels and their use as back-up to renewables.

2. The focus on decommissioning is appropriate. I tend to take the lead from the UK for offshore matters – flexible security arrangements there means that the hierarchy of security follows the following:

   a. Value of reserves firstly offset the estimated decommissioning costs;
   b. Any delta is then made up from one or a mix of a letter of credit, cash in a fund or a parent guarantee.
   c. The security is not required to be posted until the field is off plateau.
   d. There is ongoing trailing liability but there is guidance as how that would be distributed amongst prior owners – based on who derived the benefit.
   e. The trailing liability is to a permit holder and its group.

The regime where post decommissioning liability is perpetual and must be funded is unheard of anywhere in the world, to my knowledge.

3. The only really big decommissioning liability applies to the Maui field. The government should give serious thought about taking over Maui in exchange for a cheque equating to the decommissioning liability, repurpose the platform (LNG mooring?), (army training?) and build some hospitals.

3. CLIMATE CHANGE

In the time available, this will be quite rushed but:

Observations do not show a catastrophic signal

1. Climate change is not an existential threat – that is humanity is not in peril , we are not all going to die. Professor Dave Frame said as much in lectures to students in 2019 and there is no sign of such sentiment in AR6 wg1. That is pure political narrative generated by a combination of the latest adherents to Malthusian economic theory, and Marxist abhorrence of the concentration of capital, best represented by oil companies, who, they say exploit resources and workers for their own personal profit at the expense of the proletariat (working class) and environment.

2. The ‘political’ signal of catastrophe, that is the noise from activists and politicians, is not panning out in the observations of global climate change. Most people know this – they can spot a politically motivated narrative, the politics of fear, all designed to get us to change our lifestyles. But when you actually look at the IPCC reports, we see not much going on (see Table 12.12 below from IPCC AR6, working group 1).

In the table below you can see a list of “climate impact drivers”, with the first column showing changes by coloured box with a white box for no change. Most boxes are white – including areas of climate that is occupying the time and effort of local councils around NZ – sea level rise. What is clear is that indicators underpinned by the thermal response (i.e. warming) and those by elevated CO2, are affected. But not weather systems, not even sea level rise.

Consequently, the political fingerprint for dramatic and economy harming climate policy can be detected right here.

Table 12.12 | Emergence of CIDs in different time periods, as assessed in this section. The colour corresponds to the confidence of the region with the highest confidence: white cells indicate where evidence is lacking or the signal is not present, leading to overall *low confidence* of an emerging signal.

Climatic Impact-driver Type	Climatic Impact-driver Category	Already Emerged in Historical Period	Emerging by 2050 at Least for RCP8.5/SSP5-8.5	Emerging Between 2050 and 2100 for at Least RC8.5/SSP5-8.5
Heat and Cold	Mean air temperature	1		
	Extreme heat	2	3	
	Cold spell	4	5	
	Frost			
Wet and Dry	Mean precipitation		6 7	
	River flood			
	Heavy precipitation and pluvial flood			8
	Landslide			
	Aridity			
	Hydrological drought			
	Agricultural and ecological drought			
	Fire weather			
Wind	Mean wind speed			
	Severe wind storm			
	Tropical cyclone			
	Sand and dust storm			
Snow and Ice	Snow, glacier and ice sheet		9	10
	Permafrost			
	Lake, river and sea ice	11		
	Heavy snowfall and ice storm			
	Hail			
	Snow avalanche			
Coastal	Relative sea level		12	
	Coastal flood			
	Coastal erosion			
Open Ocean	Mean ocean temperature			
	Marine heatwave			
	Ocean acidity			
	Ocean salinity	13		
	Dissolved oxygen	14		
Other	Air pollution weather			
	Atmospheric CO_2 at surface			
	Radiation at surface			

1. *High confidence* except over a few regions (CNA and NWS) where there is *low agreement* across observation datasets.
2. *High confidence* in tropical regions where observations allow trend estimation and in most regions in the mid-latitudes, *medium confidence* elsewhere.
3. *High confidence* in all land regions.
4. Emergence in Australia, Africa and most of Northern South America where observations allow trend estimation.
5. Emergence in other regions.
6. Increase in most northern mid-latitudes, Siberia, Arctic regions by mid-century, others later in the century.
7. Decrease in the Mediterranean area, Southern Africa, South-west Australia.
8. Northern Europe, Northern Asia and East Asia under RCP8.5 and not in low-end scenarios.
9. Europe, Eastern and Western North America (snow).
10. Arctic (snow).
11. Arctic sea ice only.
12. Everywhere except WAN under RCP8.5.
13. With varying area fraction depending on basin.
14. Pacific and Southern oceans then many other regions by 2050.

High confidence of decrease	Medium confidence of decrease	Low confidence in direction of change	Medium confidence of increase	High confidence of increase

Table 12.12 in AR6 WGI. The coloured boxes show the climate changes that have emerged from climate noise to date. Only a few very benign climate changes have been observed. Most, including flooding, sea level rise, drought, and cyclones, have not.

As the legend shows, orange means a decrease and blue means an increase, a white box means no change is detected above the noise level. The tropical cyclone box is white, likewise the boxes for wind speed, drought, flooding, precipitation, wildfires, landslides, ocean acidity, and sea level rise are white, meaning *no* significant change is detected.

An increase in incidents of extreme heat is detected, but the footnote limits this to some tropical and mid-latitude regions, so even an increase in extreme heat events is not apparent globally. There is a decrease in cold spells and an increase in mean air temperature in most regions. Likewise, there is a decrease in permafrost, in lake and river ice, and an increase in mean ocean temperature.

Whilst these changes are important, they are in line with the type of greenhouse warming theory tells us to expect, more greenhouse gases equals some warming – the so-called 'anthropogenic global warming'. But these changes are a long way from catastrophic climate change, some warming is even benign – like less frost days and longer growing seasons. But we never hear about these benign changes because the political narrative dominates.

For example – if we compare the main text of AR6 written by scientists about Cyclones and Extreme Weather and compare it with what is hammered out by politicians and bureaucrats for the Summary for Policymakers, the 'political' signal again, dominates:

From AR6 WGI, Chapter 11, (written by scientists), on page 1583-1585.

"… there is ***low confidence* in observed long-term (40 years or more) trends in TC [tropical cyclone] intensity, frequency, and duration, and any observed trends in phenomena such as tornadoes and hail**; … it is ***likely*** that the **global frequency of TCs will either decrease or remain essentially unchanged**, … there is *low confidence* in projections of small-scale phenomena such as tornadoes and hail storms; and there is ***medium confidence* that there will be a reduced frequency** and a poleward shift of mid-latitude cyclones due to future anthropogenic climate change."

From the AR6 WGI Summary for Policymakers (written by politicians), on page 8

"Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. **Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5**."

The top quote above describes the scientific findings. They have low confidence that any trend exists in tropical cyclone intensity, frequency, or duration over the past 40 years. They also expect the global frequency of cyclones to decrease or remain the same in the future, although they believe the most intense storms will increase in *some* places, but not globally. They have medium confidence that there will be a *reduced frequency* of mid-latitude cyclones due to anthropogenic climate change.

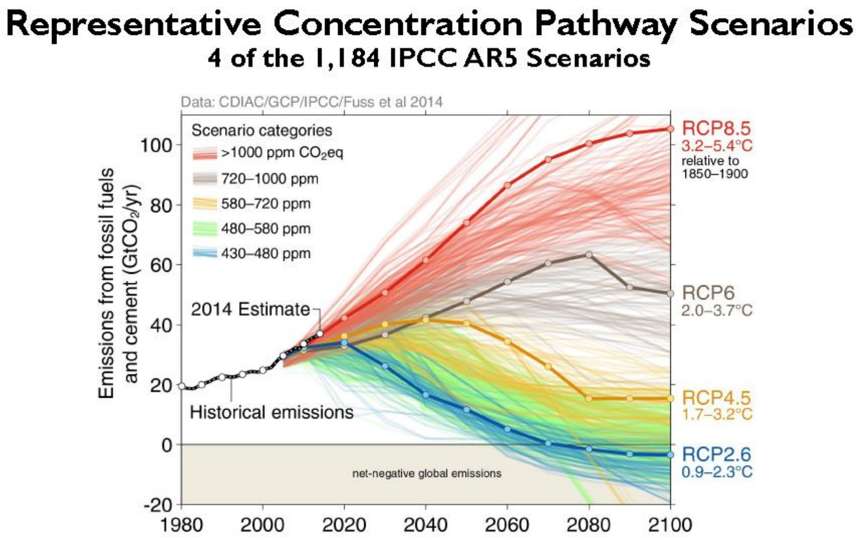
However, the *Summary for Policymakers*, where the politicians and bureaucrats get to provide input to share with their colleagues, tells a different story. They say evidence of observed changes in extreme weather, and the attribution of these changes to human influence, has "strengthened" since AR5.

For a non-technical politician, reading that would suggest that the IPCC is continuing to make progress connecting human activities with extreme weather. But the truth is that better satellite coverage provide more comprehensive observations and systematic attribution modelling has improved, meaning both have 'strengthened' but neither connects extreme weather to human activities.

The IPCC reports are full of excellent science but the wrong message can be easily sent to the non-expert by language that is, on the one hand, defensible, but on the other sends a different message – the bureaucrats are masters at this.

Goodbye to the High End Scenarios

In the early 2010s, the IPCC introduced a new set of scenarios called Representative Concentration Pathways (RCPs). The 4 scenarios were derived from 1,184 scenarios. Each RCP represents a different level of greenhouse gas concentration and associated climate impacts, ranging from very low (RCP2.6) to very high (RCP8.5) emissions. Below from Figure 8 in MfE's "A guide to local climate change risk assessments"



Evolution to Shared Socioeconomic Pathways (SSPs)

The IPCC's Sixth Assessment Report (AR6) restated the RCPs as 'SSPs' - the Shared Socioeconomic Pathways (SSPs). These pathways describe different trajectories of societal development, including factors like GDP, fossil fuel use, population, technology.

Back in 2021, the IPCC Working Group 1 in its Sixth Assessment Report ("AR6") stated in respect to the high emission scenarios:

> *"The high-end scenarios RCP8.5 or SSP5-8.5 have recently been argued to be implausible to unfold (e.g., Hausfather and Peters, 2020; see Chapter 3 of the AR6 WGIII).* [IPCC AR6 WG1 Section 4.2.2]

The Hausfather and Peters (2020) paper, cited by the IPCC, had a sub-heading entitled:

> "**Stop using the worst-case scenario for climate warming as the most likely outcome — more-realistic baselines make for better policy**." (emphasis added)

Several other prominent scientific groups have since published similar conclusions that are set out in Annex 1. NZ's Professor Dave Frame described RCP 8.5 as a scenario 'no one believes.' My own supervisor at Canterbury University, Professor Adrian McDonald agrees. Reasons given include the impossibility that coal use will increase by a figure exceeding reserves.

In 2024 the climate modelling community (Meinshausen et al 2024), published the latest IPCC thinking. The paper involves 41 co-authors from the IPCC climate modelling community, including NZ'er Greg Bodeka.

The high-end scenarios were consigned to "The Emissions World Avoided" or "TEWA" stating the need to: "separate high forcing pathways for scientific purposes from the more policy-oriented framing pathway categories."

Reflecting this evolution, MfE's chart (above) has since been reinterpreted as below:

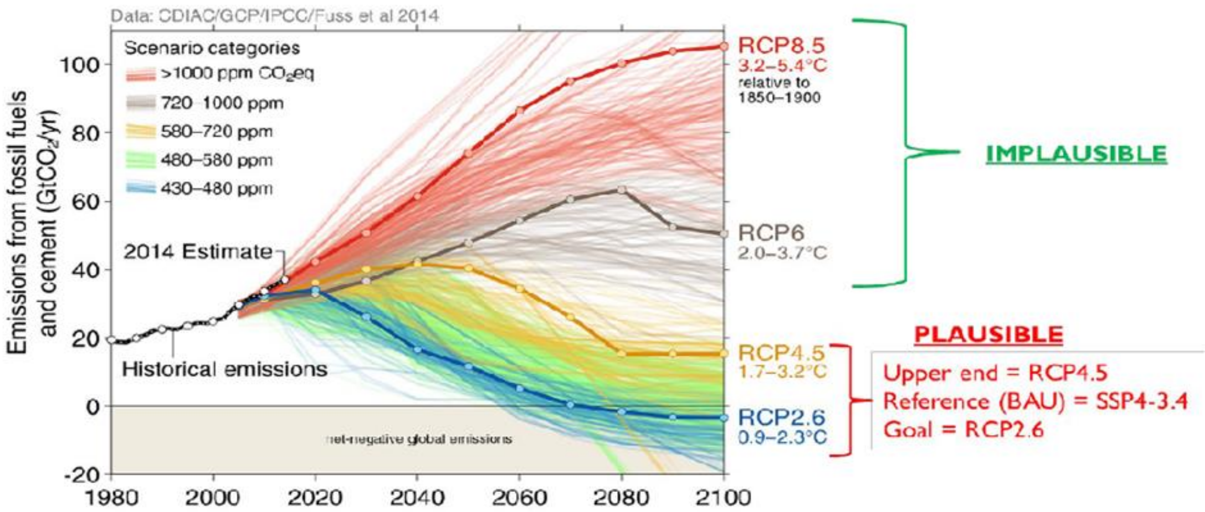


Fig 1 from Fuss et al 2014 as adjusted by R. Pielke jr to reflect Meinshausen et al 2024

Conclusion: Good policy should avoid the "TEWA" (implausible) models. See Annex 1 for further back-up.

4. CONCLUSION

In conclusion, the world needs energy – both the renewable kind that we generate, but also the stuff that can be shifted to regions that do not have the same bountiful natural resources as NZ. Banning oil and gas exploration in 2018 was an act of economic vandalism, promoted by those whose agenda's are not necessarily for the environment, and with other more nefarious intentions.

I have suggested some tweaks to the proposed regime but believe that a state-owned entity should be steering the transition, coordinating the State-Owned Entities that are able to play a role, and providing some confidence for overseas investors.

Finally, climate change is important, but it is not an existential threat – climate scientists know this, but activist politicians and bureaucrats don't want to let go of their main scare tactic.

In fact the high end climate scenarios have now been consigned to what the IPCC calls 'TEWA' - The Emissions World Avoided, and are regarded as more implausible as every year goes by. This is good news but some institutions don't want to let go of these high ends because they tell the scary stories that get media coverage and taxpayer dollars – but it's true.

Yours sincerely

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Annex 1 – List of Scientific Papers and supporting comments

1. IPCC Working Group 1 in its Sixth Assessment Report ("AR6") stated in respect to high emission scenarios:

   a. *"… However, the likelihood of high emission scenarios such as ... SSP5-8.5 is considered low in light of recent developments in the energy sector ..."* [IPCC AR6 WG1 Section 1.6.1.4]

   b. *"The high-end scenarios RCP8.5 or SSP5-8.5 have recently been argued to be implausible to unfold (e.g., Hausfather and Peters, 2020; see Chapter 3 of the AR6 WGIII).* [IPCC AR6 WG1 Section 4.2.2]

2. The Hausfather and Peters (2020) paper, cited by the IPCC, is entitled: "Emissions – the 'business as usual' story is misleading". Its sub-heading says, conclusively:

   "**Stop using the worst-case scenario for climate warming as the most likely outcome — more-realistic baselines make for better policy**." (emphasis added)

   I set out some relevant extracts:

   a. "RCP8.5 was intended to explore an unlikely high-risk future. But it has been widely used by some experts, policymakers and the media as something else entirely: as a likely 'business as usual' outcome."

   b. "Happily — and that's a word we climatologists rarely get to use — the world imagined in RCP8.5 is one that, in our view, becomes increasingly implausible with every passing year."

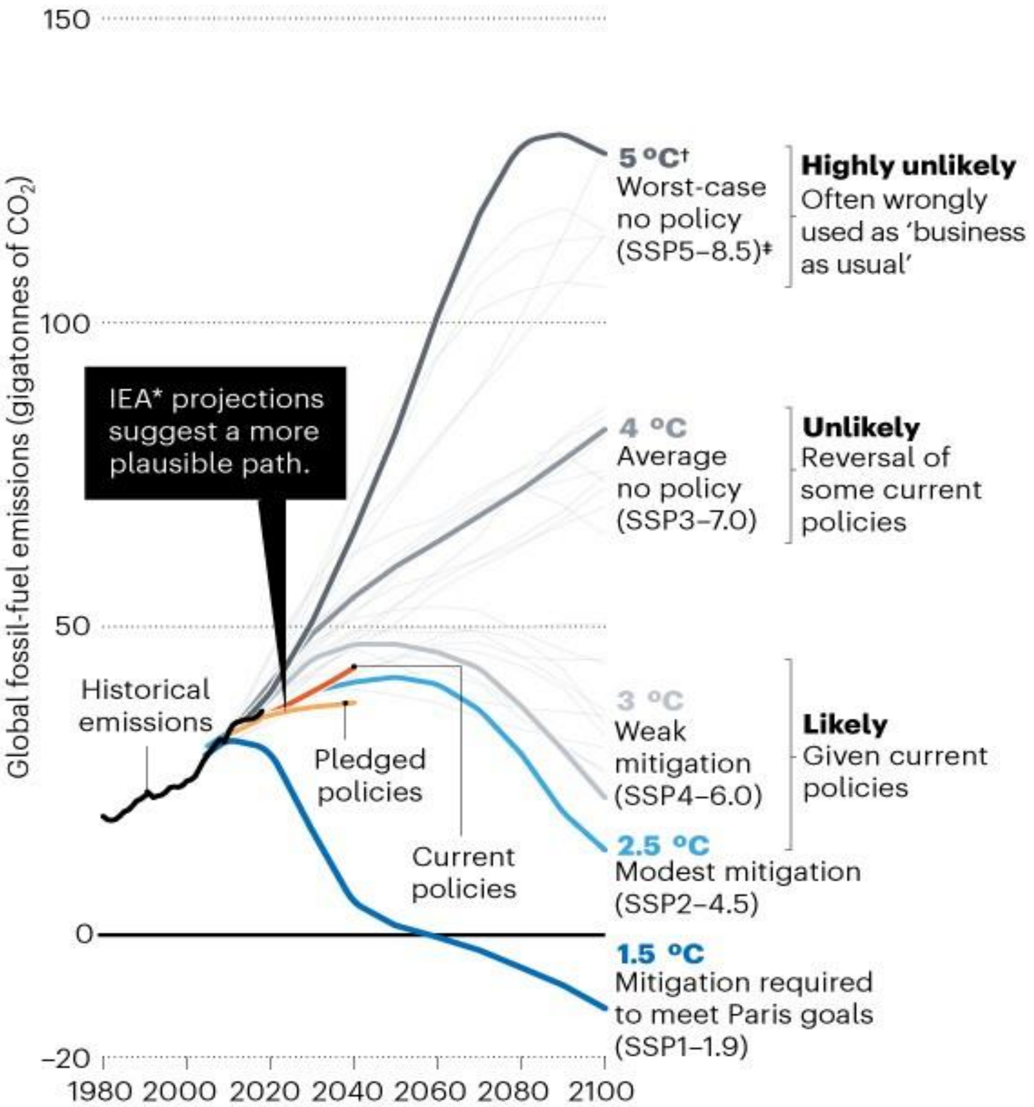
   c. "Emission pathways to get to RCP8.5 generally require an unprecedented fivefold increase in coal use by the end of the century, an amount larger than some estimates of recoverable coal reserves. It is thought that global coal use peaked in 2013, and although increases are still possible, many energy forecasts expect it to flatline over the next few decades. Furthermore, the falling cost of clean energy sources is a trend that is unlikely to reverse, even in the absence of new climate policies."

   d. "we suggest that climate-impact studies using models developed for AR6 should include scenarios that reflect more-plausible outcomes, such as SSP2-4.5, SSP4-6.0 and SSP3-7.0 (see 'Possible futures'). When RCP8.5 or its successor SSP5-8.5 are deployed, they should be clearly labelled as unlikely worst cases rather than as business as usual."

   e. They include the below "Possible Futures" diagram with references showing how the high end scenarios are now deemed "highly unlikely' and "unlikely."

POSSIBLE FUTURES

The Intergovernmental Panel on Climate Change (IPCC) uses scenarios called pathways to explore possible changes in future energy use, greenhouse-gas emissions and temperature. These depend on which policies are enacted, where and when. In the upcoming IPCC Sixth Assessment Report, the new pathways (SSPs) must not be misused as previous pathways (RCPs) were. Business-as-usual emissions are unlikely to result in the worst-case scenario. More-plausible trajectories make better baselines for the huge policy push needed to keep global temperature rise below 1.5 °C.



*The International Energy Agency (IEA) maps out different energy-policy and investment choices. Estimated emissions are shown for its Current Policies Scenario and for its Stated Policies Scenario (includes countries' current policy pledges and targets). To be comparable with scenarios for the Shared Socioeconomic Pathways (SSPs), IEA scenarios were modified to include constant non-fossil-fuel emissions from industry in 2018.
†Approximate global mean temperature rise by 2100 relative to pre-industrial levels.
‡SSP5–8.5 replaces Representative Concentration Pathway (RCP) 8.5.

Sources: Historical data: Global Carbon Budget (2019); SSP data: ref. 19/J. Rogelj *et al. Nature Clim. Change 8*, 325–332 (2018)/SSP Database (v2); IEA data: Ref. 7

3. Hausfather and Peters are not alone in declaring RCP8.5/SSP5-8.5 'implausible.' Others come to similar conclusions:
    a. Pielke and Ritchie (2021),

    "The original basis for the scenarios supporting RCP8.5 are extreme: they project a future that is characterized by high population, little technological advancement, extremely high carbon dioxide emissions and apocalyptic levels of climate change."

    "The influence of this implausible scenario on public and policy discussion of climate change is pervasive and consequential."

    b. Burgess et al (2021)

    "Our analysis supports the conclusions drawn by previous studies (Hausfather and Peters 2020, Pielke and Ritchie 2020) that high-emission AR5 (RCP8.5) and high-emission AR6 (i.e. SSP3-7.0 and SSP5-8.5) baselines should not be utilized as reference scenarios in climate research."

    c. Huard et al (2022): "the high-emission scenario SSP5-8.5 becomes unlikely as we reach the second half of the century.

4. IPCC Professor Dave Frame, at Canterbury University, was reported by Newsroom saying in regard to Auckland planning decisions based on RCP 8.5:

    "If they build in a safety margin that's actually contingent on a scenario that nobody really believes, then it's bad policy practice. **And I also think it opens the door to legal challenge**." (emphasis added).

5. Meinshausen et al 2024, - resulted from the IPCC Expert Workshop held in Bangkok, April 2023. The paper involves 41 co-authors from the IPCC climate modelling community and addresses the next generation of framing pathways for use in IPCC AR7.

    The coauthors similarly ruled out the plausibility of the high-end scenarios. Their Table 1 (below) shows that the high-end scenarios (red circle) are now consigned to "The Emissions World Avoided" with the more likely scenarios based on current trends circled green.

    The authors state that the higher end warming pathway category could be mistaken as a 'business as-usual' scenario and they consider it would be beneficial to separate high forcing pathways for scientific purposes, from the more policy-oriented framing pathway categories.

Table 1 - Overview of suggested pathway categories to inform the design of specific representative emission pathways for Earth system model runs. Categories of emission pathways identified in the IPCC AR6 WGIII (compare Table SPM.1) and selected WGI core SSP-RCP scenarios are provided for comparison. For each category, we provide an indicative 'priority' suggestion, recognizing that there are limited resources to run a large set of scenarios across all ESMs.

Category to be represented	Key characteristics of the representative pathway	Advantages	Potential drawbacks	Closest category (and selected pathways) in IPCC AR6[a]
High emissions: "TEWA" - The emission world avoided	• High end emissions • Departing from historical emissions in the past, i.e., 2015. • Three main options are SSP5-8.5, SSP3-7.0 or a new pathway that retrospectively reflects 'no-further climate action' (NFA) starting in, e.g., 1992, 2010 or 2015, each with their respective advantages and challenges (aerosols, comparability to CMIP6 and possibly CMIP5, representativeness of previous reference scenarios, etc.) • Lower priority	• Allows depiction of the world that could have unfolded without climate policies. • Allows to learn about high tail warming possibilities of lower scenarios. • Allows direct comparison of new generation of ESMs with previous ones, if a CMIP6 high end pathway is repeated (SSP5-8.5 or SSP3-7.0). • High signal-to-noise for projected changes in climate	• Could be mistaken as a reference case pathway. • Could lead to the false impression that the difference with this avoided scenario is the exclusive result of successful climate policies, and therefore that we have already achieved the biggest part of the challenge and what is left requires a smaller effort in comparison.	AR6 WGIII category C7-C8 SSP3-7.0 or SSP5-8.5 or RCP8.5.
"Medium" or "No further action (NFA)"	• A medium-high category that approximately reflects the median of "current policies as of 2023" or "current trends" estimates. • Approximately flat global GHG emissions from 2025 towards the end of century. • Approximately resulting in a 2.5-3.0°C world by the end of the	• An approximate depiction of future emissions in the absence of further climate policy action and assuming continuation of "current trends" as of the early 2020s. • Reflective of 2°C crossing up to approximately 2.5-3°C warming by 2100.	• The longer-term evolution of emissions under current policies is highly uncertain. Together with the DASMT this category spans the range of future policy outcomes (as of 2023)	AR6 WGIII category C6 SSP2-4.5, RCP4.5.

6. One author is Greg Bodeker, a Kiwi modeller living in Alexandra. His comment to me when I sought his thoughts on the MfE's use of SSP5-8.5 were:

   *"Hmm, I don't think that's good advice. Well, you could conduct that stress test as a **very** extreme test, but to what end? It certainly should not be used to guide investment in adaptation actions. That would likely result in unnecessarily high adaptation costs*."