

# Scope for Pioneering Marine Gas Hydrate Development in New Zealand\*

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## Abstract

New Zealand is one of several Pacific margin nations with substantial resources of gas hydrate identified from geophysical reconnaissance and being characterised through continuing research. There is no immediate prospect of development of marine gas hydrate resources for energy and/or other uses, due to the absence of any proven technology for extraction of hydrocarbon gas at commercially meaningful rates. In general, the most advanced programmes directed at surmounting technical and other obstacles to marine gas hydrate development are being undertaken by large state-controlled enterprises within the jurisdictions of high-growth energy-short Asian economies. In contrast, New Zealand has a relatively small population and economy, within a large mainly marine jurisdiction which is relatively remote from major energy markets. New Zealand has a natural gas market consuming about 200 billion cubic feet (or petajoules; close to 5 billion cubic metres) per year. Almost half is used in petrochemicals (methanol, mainly exported, and urea, primarily for agricultural fertiliser), with about one quarter used directly by other industry and in commercial and residential premises. The balance is used for electricity generation, mainly to meet periodic peak demand in a system dominated by renewable generation (hydroelectricity, geothermal, wind and solar). Natural gas is supplied from onshore and offshore fields in the Taranaki Basin, western North Island. The natural gas industry with its extensive mid-stream infrastructure developed in response to discovery of those fields from 1959 (onshore) and 1969 (offshore, Maui Field). Ultimate reserves in all discovered and developed fields are currently estimated to total up to about 9 trillion cubic feet, of which only about 2 trillion cubic feet remain to be produced – equating to 10 years of current consumption. A shortfall in deliverability could eventuate within 3-5 years.

Gas hydrate resources fall within the definition of petroleum, which in New Zealand is governed by the Crown Minerals Act 1991. This statute (and its predecessor the Petroleum Act 1937) vests rights to petroleum in the Crown (the state), and provides for issuance of exclusive permits for exploration, and subsequent development and production (“mining”) of any discovery demonstrated to be commercial. A decade ago, research results had amply shown the large scale of New Zealand’s marine hydrate resources, and government explicitly recognised its potential as an eventual “backstop” to conventional natural gas, exploration for which was also given encouragement under an “Action Plan” in 2009. This plan included “undertaking further work to realise the potential of New Zealand’s gas hydrate endowment”. From 2012, New Zealand has run annual Block Offers for petroleum exploration, and in 2015 for the first time, provision was made for applications for conditional gas hydrate exploration permits – the first country in the world to do so other than in mandating activities by state enterprises. The

conditionality recognised the immaturity of technology and of many regulatory aspects, and any gas hydrate permits could not overlap permits for conventional petroleum; nevertheless, applications were received from a start-up company, bidding a substantial work programme. However, while considerable further research has refined the understanding and documentation of New Zealand's principal gas hydrate resources, the possibility of their eventual commercial development has failed to gain much traction. Community attitudes to the petroleum industry were impacted by the Macondo disaster in the US in 2010, and in respect of carbon-based energy resources generally, at much the same time by the Pike River coal mine disaster in New Zealand. Climate change is considered very seriously in New Zealand, and the Paris Agreement was followed by a change of government to a coalition including the Green Party, in 2017. The present government has set aside the Energy Action Plan of its predecessor, and banned the issuance of any new offshore petroleum exploration permits, ostensibly to accelerate achievement of a new zero carbon economy. New Zealand's marine gas hydrate resource endowment remains a subject of multi-faceted research, but unless a future government implements a further major policy change, the likelihood that these resources would be developed is remote. Any opportunity for pioneering technological and regulatory arrangements here is foreclosed for the time being.

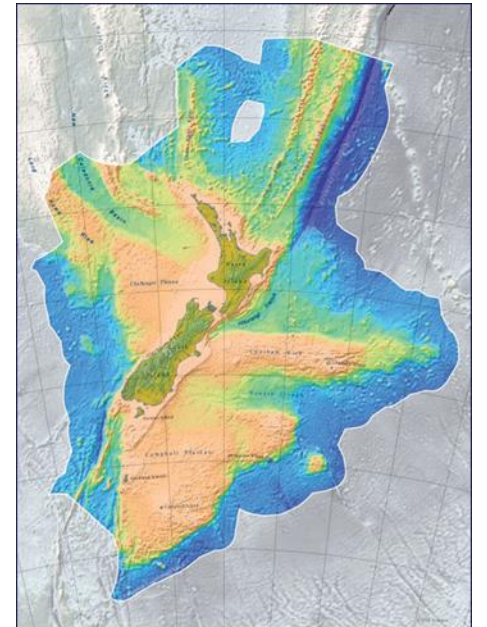
# SCOPE FOR PIONEERING MARINE GAS HYDRATE DEVELOPMENT IN NEW ZEALAND

**Mac Beggs**

*AAPG Asia Pacific Region*

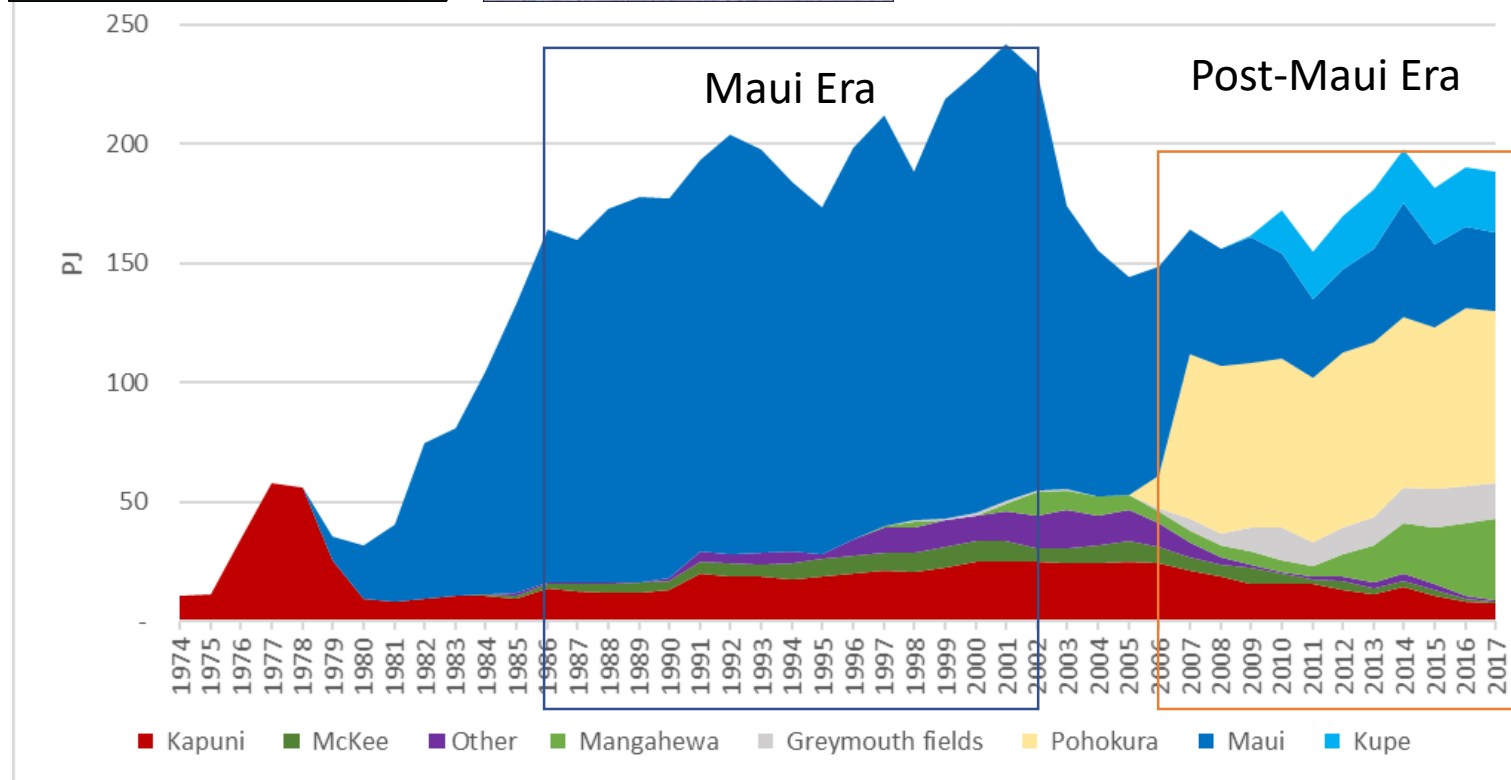
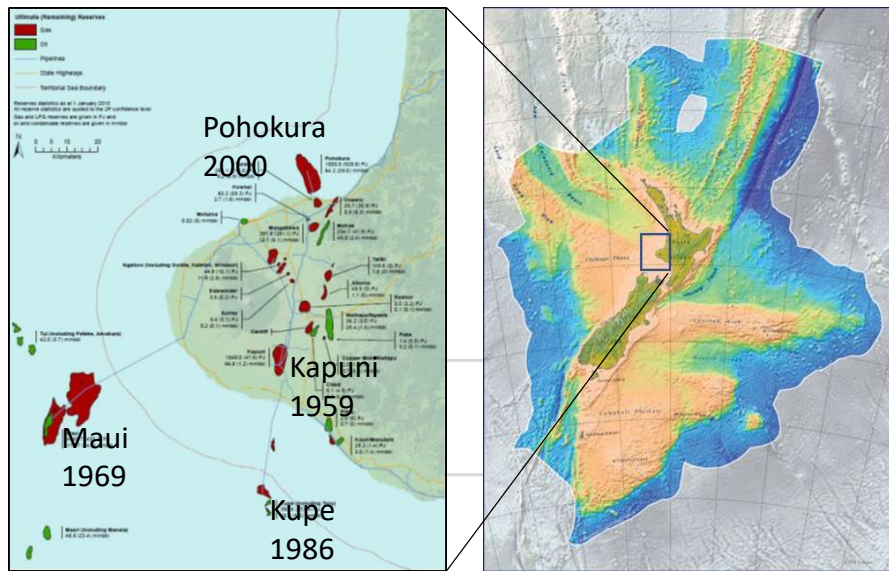
*Geoscience Technology Workshop, Auckland*

*April 17, 2019*



# Outline

- Introduction and historical perspective
- Natural gas in New Zealand's energy system
- Political / legal / regulatory framework for resource development
- 2015 Block Offer –private sector gas hydrate exploration almost born
- Current outlook for energy demand in New Zealand, and scope for eventual marine gas hydrate contribution
- Summary and closing points



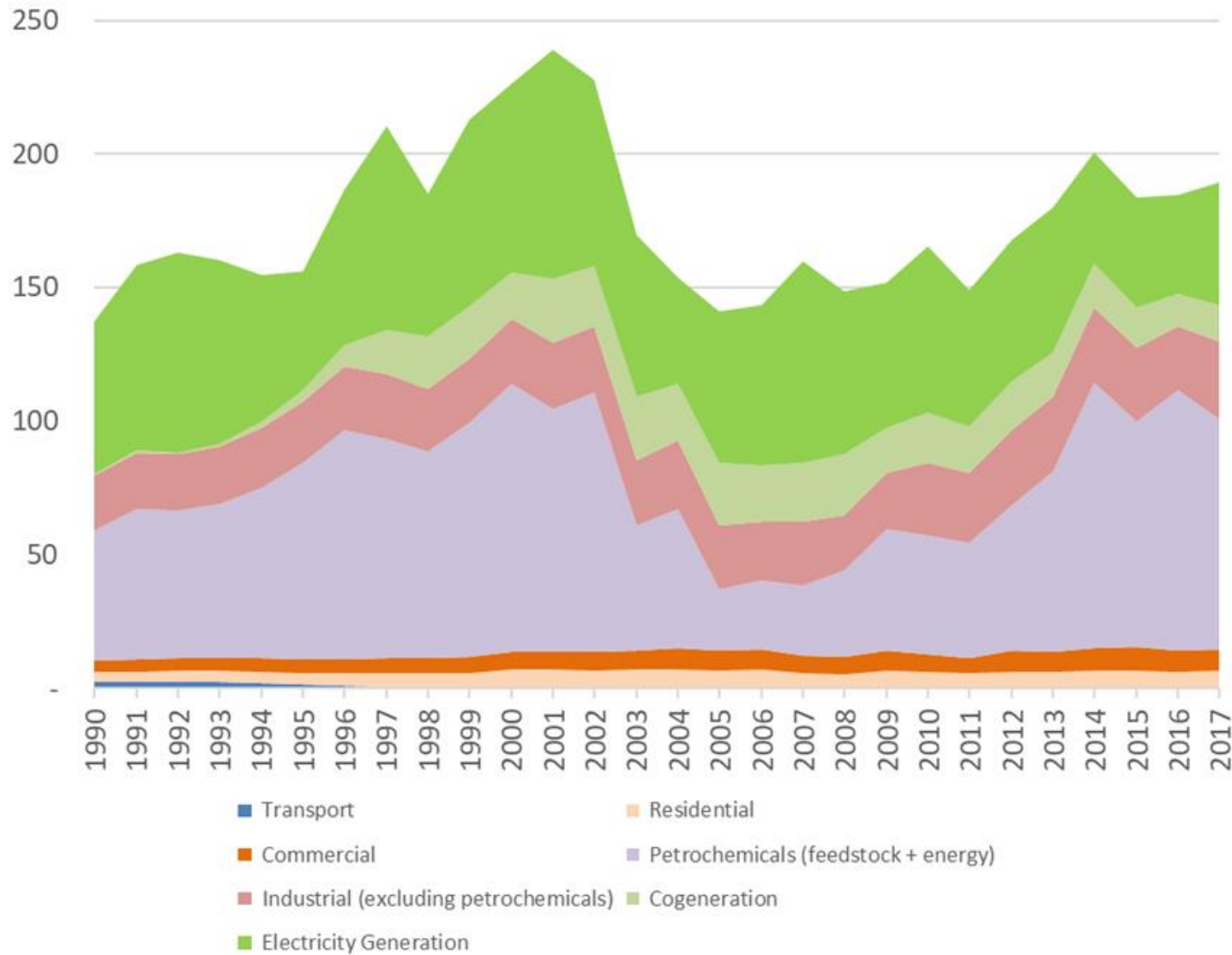
**Maui Era:** limited investment, mainly associated with onshore oil fields, since cheap Maui field gas exceeded demand.

*Transition: 3-4 years of sharply curtailed aggregate production, price discovery, multiple development business cases. 39% contraction in volume between 2000 peak and 2005 trough.*

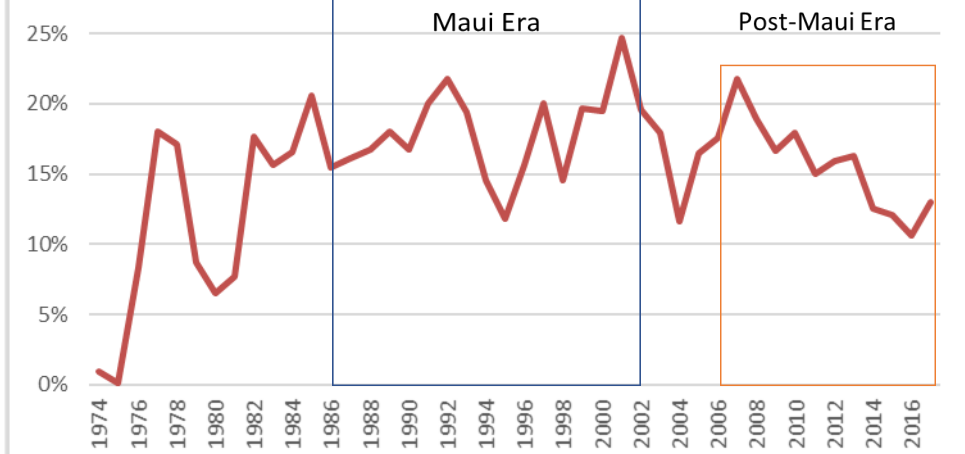
**Post-Maui Era:** New offshore fields developed; infill development in old fields; development of lower quality onshore fields. No material exploration success in spite of favourable stimuli.

*This era begins to close between 2019 and 2027 – when existing reserves (including contingent resources) fall short of demand capacity.*

Consumption of natural gas in New Zealand (PJ/year)



Proportion of New Zealand electricity generated from gas



**Maui Era:** high use of gas when hydroelectric output was curtailed by droughts.

*Transition: severe squeeze, recourse to coal, new geothermal and wind.*

**Post-Maui Era:** impact of zero emissions policies

# **A Roadmap for the Commercial Development of New Zealand's Gas Hydrate Resources**

Mac Beggs  
Ray Wood  
Stuart Henrys  
Vaughan Stagpoole

**GNS Science Report 2008/06**  
**February 2008**



## **ABSTRACT**

Offshore gas hydrates represent a significant medium- to long-term opportunity for New Zealand. Research to date has begun to delineate the distribution and characteristics of deposits, and has established and leveraged essential international linkages. Commercial development at two levels of energy output (10 and 200 PJ/yr) are considered in the context of the New Zealand energy sector. Preliminary economic evaluation of a 10 PJ/yr scale development is envisaged within a 15-20 year time frame, concurrent and parallel with leading international efforts in both methane gas hydrate and CO<sub>2</sub> storage developments.



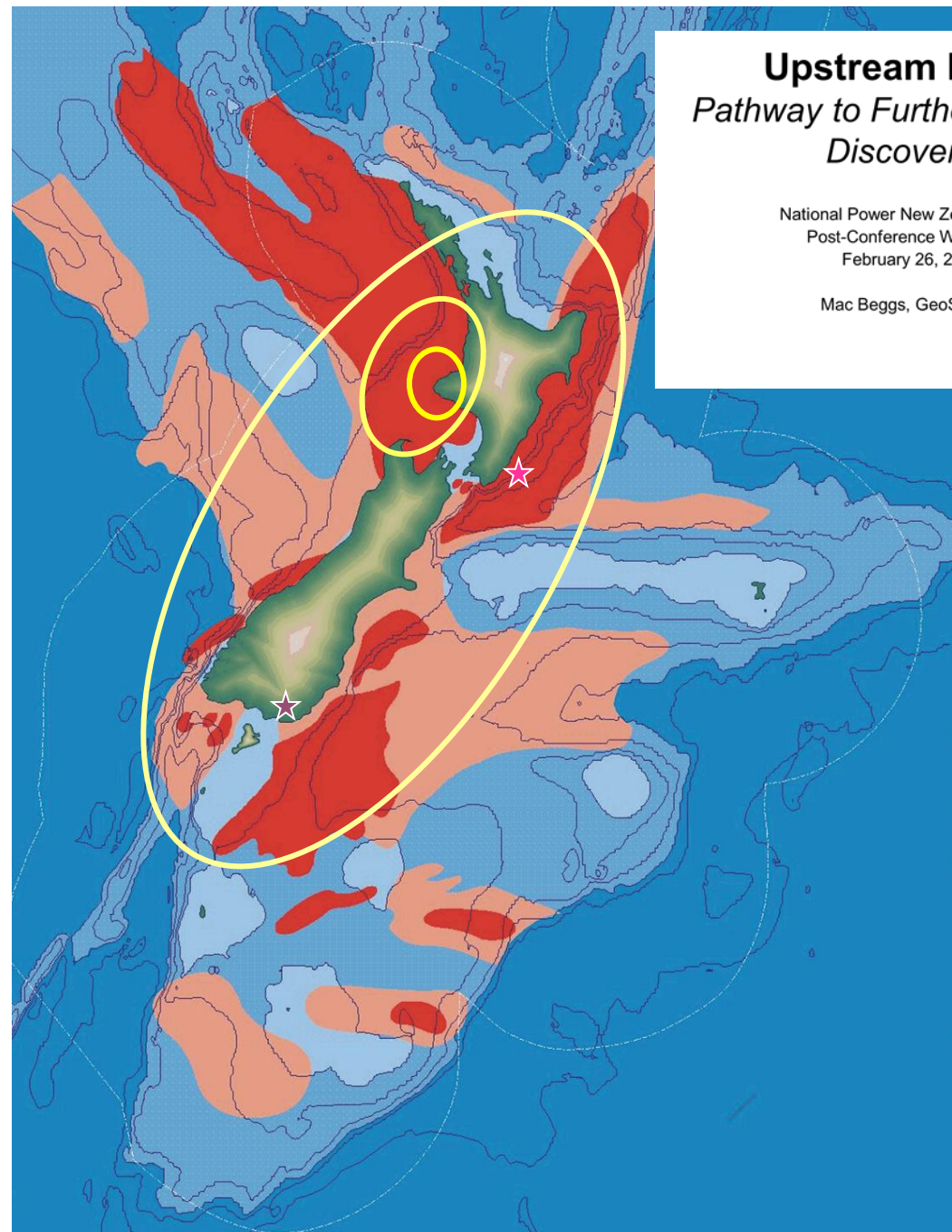
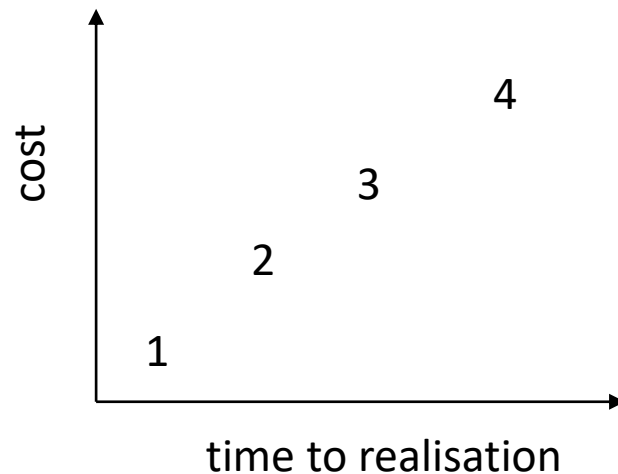


“It would be of considerable national benefit to be in the vanguard of development rather than allowing a delay of several more years while international technology development matures and is then adapted to New Zealand circumstances. There is no reason that ancillary benefits to gas hydrate development couldn't include the formation of a new industry in New Zealand, based on partnerships between innovative New Zealand companies and overseas firms with complementary skills.”

“To optimise the development of New Zealand's gas hydrate resources, and potentially establish global leadership in associated technology, we suggest that a controlled allocation process be implemented in close alignment with the next stage of publicly funded research.”

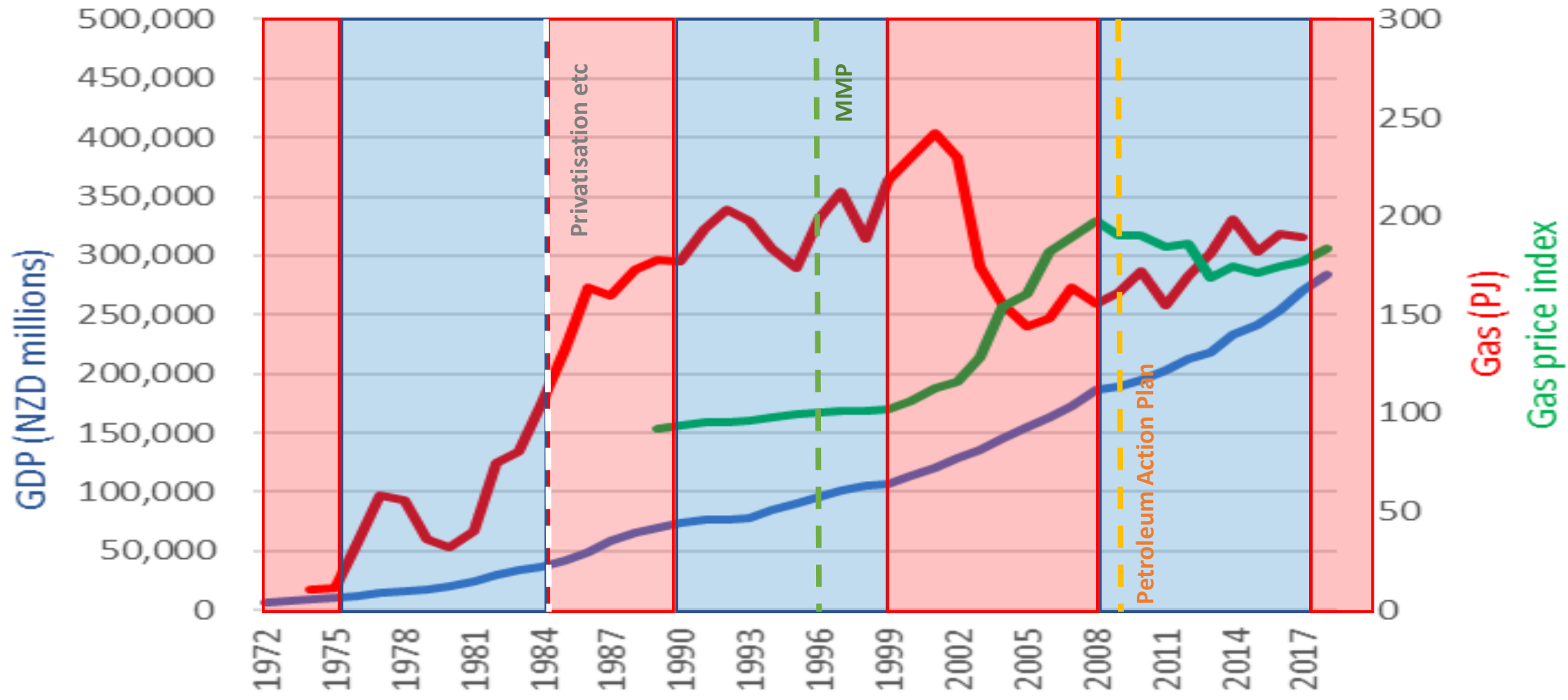


1. Extensions to existing producing fields and near-field exploration, Taranaki Basin
2. Offshore NW North Island exploration
3. Offshore frontiers
4. Unconventional indigenous resources, eg.
  - a. Gas hydrate ★
  - b. Lignite ★
5. Imported fuels



# Political/legal/regulatory framework for resource development in New Zealand (1)

- “Westminster System” – Parliament within British constitutional monarchy
- Single house, ~120 members
  - 50% of seats represent electorates
    - ~7 reserved for maori electorate
  - 50% by party lists
  - Prime Minister and Cabinet from party (or coalition of parties) with the most seats in Parliament
  - 3 yearly elections (unless called prior)



# Political/legal/regulatory framework for resource development in New Zealand (2)

- 1980's reforms
  - Resource Management Act 1991
    - To manage effects of development on the environment
  - Crown Minerals Act 1991
    - Preserved most aspects of the predecessor Petroleum Act 1937 – notably, government (“Crown”) ownership of mineral rights to petroleum
    - Provides for allocation of permits to commercial ventures, mainly by work programme bidding
- 2009 “Action Plan for Petroleum”
  - 2013 Amendments to the Crown Minerals Act
- 2018 Petroleum Exploration Ban

# 2009 Petroleum Action Plan

"The development of our resources needs to be driven by the private sector. Billions of dollars are required. None of this investment is owed to New Zealand by right. The petroleum business is capital intensive and risky.

"Businesses will only invest if they see a reasonable prospect of an economic return. We are in competition for this investment with other countries.

"To succeed, we need to ensure New Zealand is a highly attractive global destination for petroleum exploration and production investment,"

- (then) Minister of Energy and Resources Gerry Brownlee

# 2009 Petroleum Action Plan

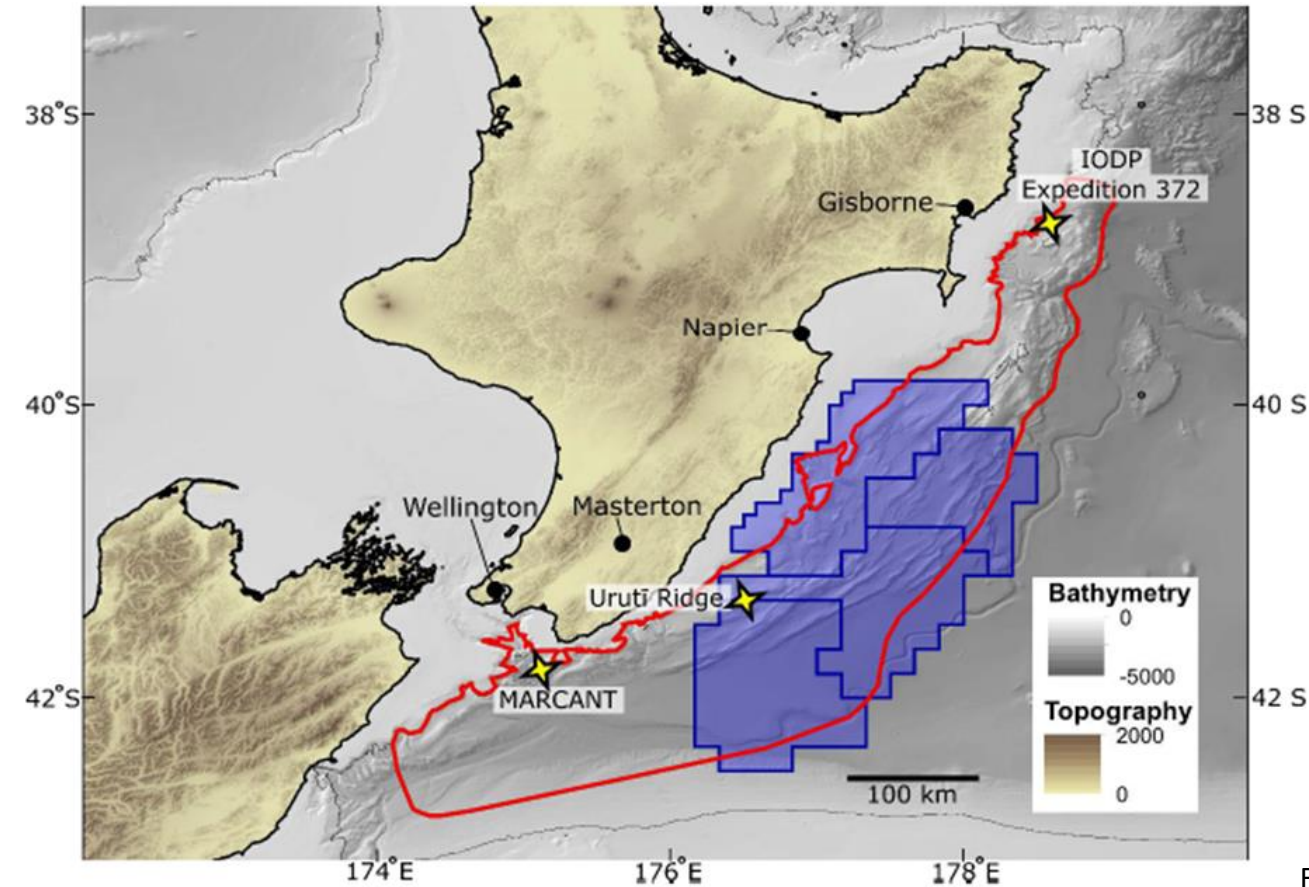
The action plan included:

- Explicitly positioning the Government both domestically and internationally as highly supportive of the development of our petroleum resources
- Evaluating future investment in improving the knowledge of New Zealand's petroleum resources so that it is well targeted for maximising investor interest in exploration
- Conducting a short, focused review of the Crown's capability and resourcing to manage our petroleum estate
- Improving the quality of information provided by industry participants on the Crown's petroleum resources
- Making necessary adjustments to New Zealand's regulatory, royalty and taxation arrangements for petroleum
- Amending the legislative framework of the petroleum sector to ensure it is sufficient to meet the objectives of the Government's petroleum strategy
- **Undertaking further work to realise the potential of New Zealand's gas hydrates endowment.**



# East Coast gas hydrate province (red polygon)

Yellow stars = Key study sites for current research. Blue regions = active 'conventional' petroleum exploration permits (granted 2014) in the region.



- 2013 reforms set up for issuance of gas hydrate exploration permits.
- First formal Block Offer in 2015 – Pegasus Basin
- Conventional permits do not confer rights to develop hydrate – and vice versa; but *“exploration permits for gas hydrates may overlap exploration permits for conventional petroleum resources, and vice versa”*
- A company was established to pursue gas hydrate exploration permits through the 2015 Block Offer
- Their applications were unsuccessful.

Founders of Hydrate Resource Corporation:  
Garth Johnston, Drew Cadenhead







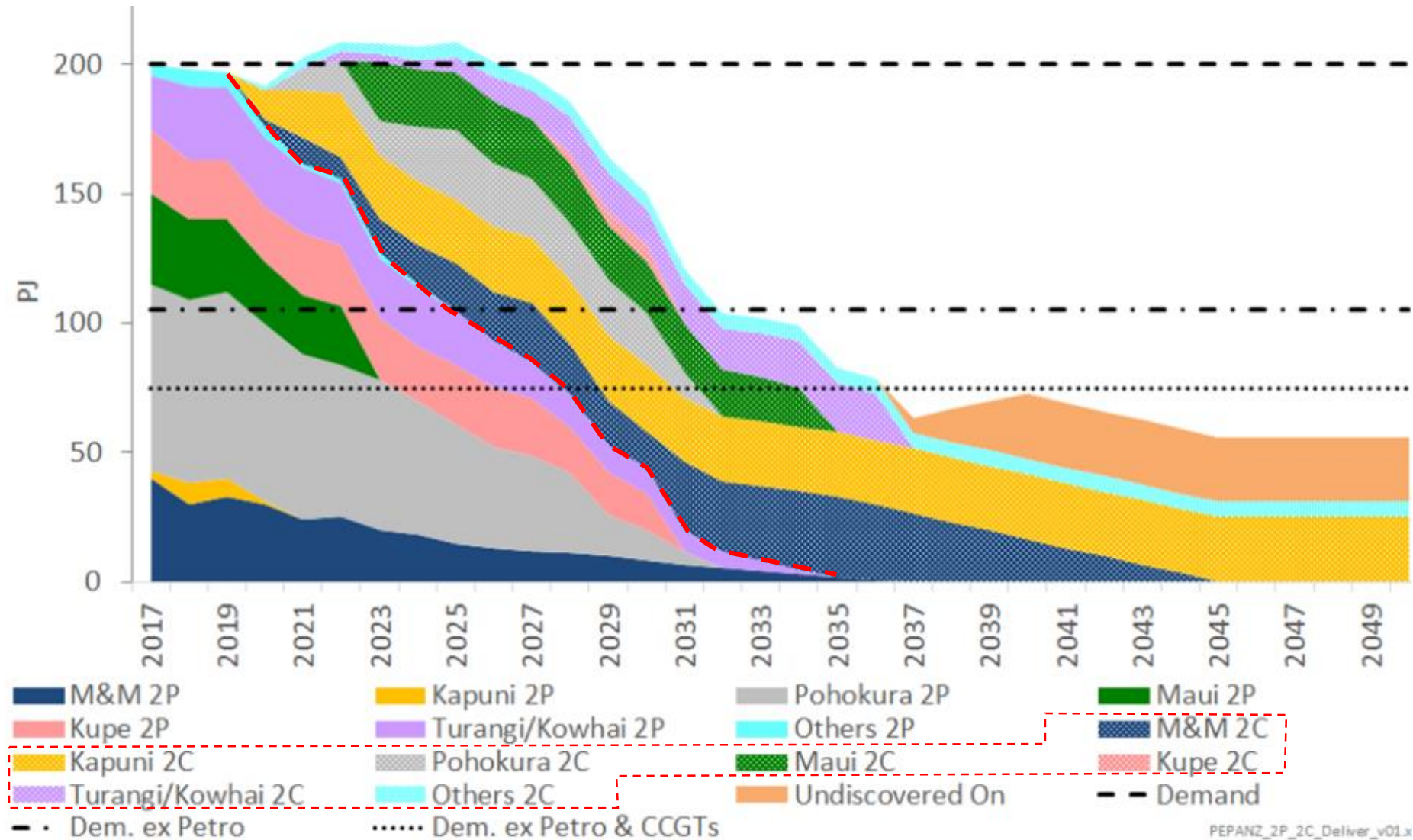
INVITATION FOR BIDS



- 1.8 Work programmes for P(H)EPs in the Offshore Pegasus/ East Coast release areas may target gas hydrate, but may not explore for conventional petroleum.
- 1.9 Globally, gas hydrates are a commercially unproven resource. Before granting a P(H)EP, the Minister will need to be satisfied that the work proposed under the work programme is likely to identify gas hydrate systems and evaluate the feasibility of mining particular gas hydrate deposits or occurrences. As part of this requirement, a bid for a P(H)EP must propose a work programme, described in appropriate detail, with sufficient research and development and/or other activities to develop and implement technical solutions to safely and efficiently process these resources on a commercial scale.
- 1.6 Where Competed Bids are targeting different resources (conventional petroleum or gas hydrates), the Bids will be ranked including taking into account the Minister's view of the potential of the proposed work programmes to make a petroleum discovery (refer to clause 7.11 of the Petroleum Programme) in a timely manner.

# Recent forecast for New Zealand's natural gas market accounting for current policy settings.

*Concept Consulting presentation, 2019 Downstream Energy Conference.*



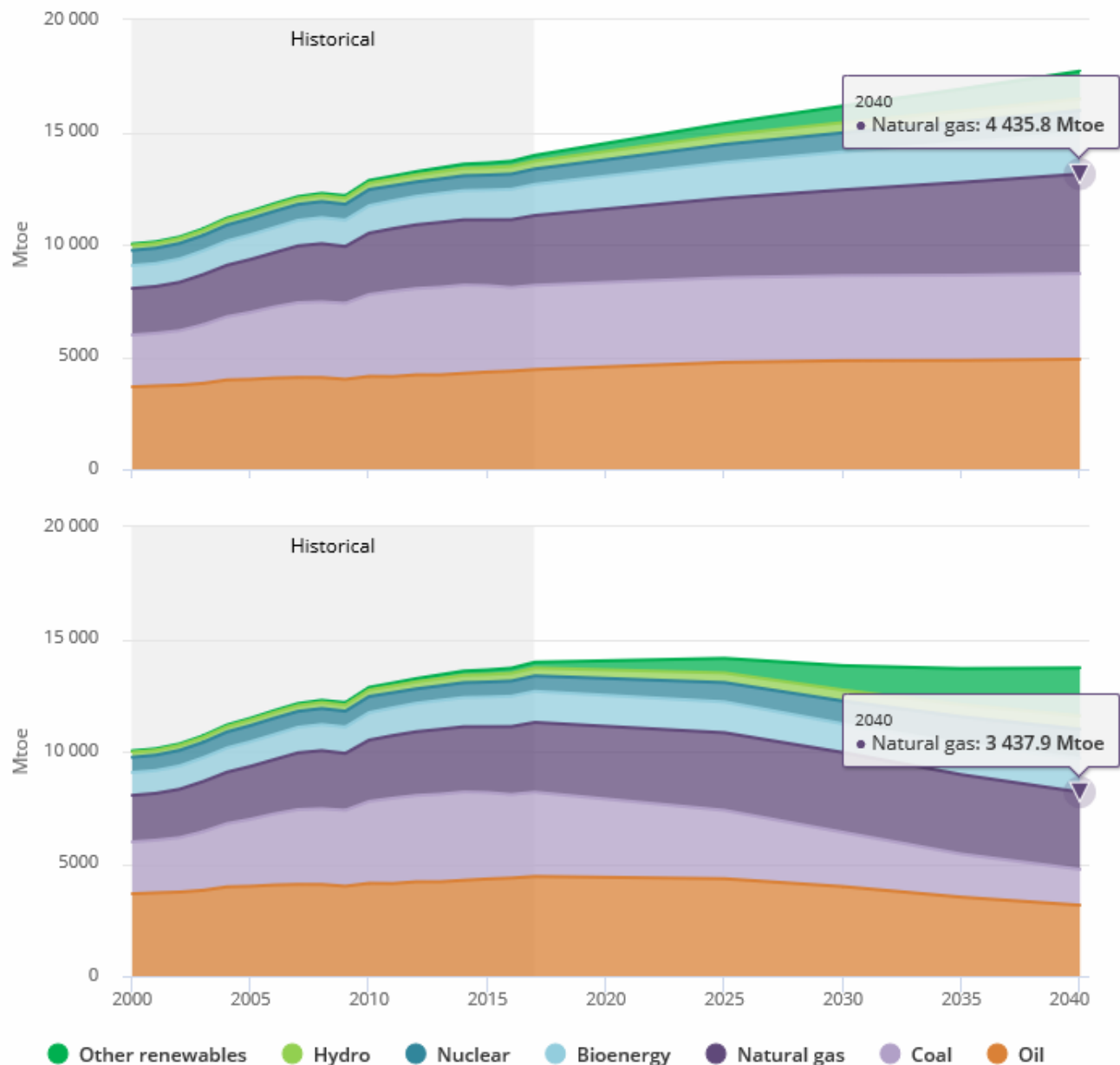
# IEA World Energy Outlook 2018

## New Policies Scenario (NPS)

Incorporates existing energy policies as well as an assessment of the results likely to stem from the implementation of announced policy intentions.

## Sustainable Development Scenario (SDS)

Outlines an integrated approach to achieving internationally agreed objectives on climate change, air quality and universal access to modern energy.



# Summary and closing points

- New Zealand juxtaposes a large marine gas hydrate resource, an enabling legal/regulatory framework, and shortening conventional natural gas stock upon which significant industries and the electric power grid depend
- From 2009, New Zealand set up and then missed its first opportunity to host pioneering marine gas hydrate development
  - Mainly, due to continuing absence of viable development / production technology
  - Current political settings foreclose another opportunity
- Reputable agencies forecast that oil and natural gas will supply over 50% of global energy demand for decades to come – will hydrate-derived gas need to be part of that?

*“It is the petroleum geologist that is going to help supply the oil and natural gas that ... will represent 51% of [global] energy demand in 2050.”*

-David Curtiss, AAPG Director, March 2019 *Explorer*

