Forecasting New Zealand’s gas sector in 2050
(Accurate to two decimal places...)

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6 March 2019

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“But first, a history lesson”
In the 1960s and ‘70s we found oil
But, the oil we found was quite gassy

- In order to produce the oil, we also needed to produce a lot of gas
And, New Zealand is in the middle of nowhere

- With no connection to the rest of the world, how do we sell our gas?

THINK BIG!

- Methanol and synthetic fuel production
- Power generation
- Industrial process heat
- Replacement of town gas
For a long while, Maui (and Kapuni) were the only shows in town

- Little further exploration as demand was ‘full-up’ with Maui & Kapuni gas

- What exploration there was, focused on the search for oil
  
  "If we’re lucky we’ll find oil
  If we’re unlucky we won’t find anything
  If we’re really unlucky we’ll find gas"
And then, in the early 2000s...

OMG!
A re-determination of the Maui field has downgraded remaining reserves by 400 PJ!

- All of a sudden......

New Zealand was running out of gas!
Except we weren’t

During the years of tightness, petrochemical production (i.e. Methanex) significantly scaled back
Methanex has been a critical enabler of the gas market

For upstream:
- Underpinned the ongoing development of existing fields
- Provided confidence for the development of new fields

For downstream:
- Scaled back at times of scarcity, "rationing" gas for higher-value users
Why does Methanex play this critical market balancer role?

It is very large

- Res/Com: 8%
- Ind proc.: 18%
- Elec gen.: 26%
- Petrochem: 48%

It is price-sensitive

- Assumption: CO2 price = NZ$25/tCO2

Ability-to-pay = opportunity cost of producing overseas

Ability-to-pay = cost of fuel switching
Our existing fields have a fair bit of life left in them

- Although we ‘only’ have 10 years’ worth of reported reserves

- We have the same again in reported contingent resources from existing fields
But we will need to find and develop new gas much sooner than 19 years... 

...if we want to maintain current gas demand

Source: PEPANZ
The Taranaki basin has sufficient undiscovered gas to meet demand for a long while yet.

As of 1 January 2018, New Zealand’s gas sector looked fairly robust.

However…
The times, they are a-changin’

The price of CO\textsubscript{2}’s a-risin’
(while my deliverability’s a-fallin’)

Can’t get me none of them offshore exploration permits no more
What is this exploration ‘ban’?

- No new offshore exploration permits to be issued
- Existing offshore exploration permits will remain valid
- New exploration permits allowed for onshore Taranaki
What is the likely effect of the ‘ban’ on future gas developments?

- Some gas unlikely to be found
- Some developed beyond 2050

- What?
- Hardly any new offshore gas?
- But existing permits cover oodles of acreage?
- How can this be?

Source: Concept analysis of MBIE & NZIER reports

<table>
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<th>GNS estimate of potential</th>
<th>Without ban</th>
<th>With ban</th>
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<td>MBIE estimate of new-fields found and produced by 2050</td>
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Gas isn’t smeared evenly across the Taranaki basin

- GNS P50 estimate was for just 6 more fields
Offshore exploration: A technical guide

• Stake: $80-100m (cost of an exploration well)

• Chance of success: 1-in-10!*

• With these odds, you can’t keep rolling the dice forever

• MBIE numbers suggest another dozen-or-so exploration wells

* Source: GNS
So...

OMG!
Less than 200 PJ more offshore gas will be found and produced! (Probably)

• All of a sudden ..... 

New Zealand is going to run out of gas in 23(ish) years’ time!
So surely Methanex will scale back production ASAP?

Fear not fair maiden. I will scale-back my methanol production trains to enable scarce gas to be allocated to higher value users.

Years’ worth of gas reserves & resources

- Undiscovered resources (U)
- Contingent resources (C)
- Remaining reserves (P)

With Methanex: 23 (ish)

Without Methanex: 40 (ish)
Maybe not.
Methanex has already bought most of its gas for the next 10 years!

• Why would producers sell to Methanex ‘today’, when they could sell to higher-value consumers ‘tomorrow’?

• There are many reasons:
  - ‘Tomorrow’ could be 8 to 10 years away
  - Offshore producers incur high fixed operating costs
  - Postponing gas sales may also postpone oil sales
  - There is CO2-related uncertainty over future
    o gas (and oil) prices
    o regulatory framework
    o gas production costs
Increased CO2 prices will affect users’ ability-to-pay

• Every $19/tCO2 equivalent to $1/GJ on gas price

• Except for Petrochemicals which are largely insulated under the ETS

• At ≈ $70/tCO2 baseload electricity can’t afford to pay as much as methanol

• And at ≈ $100/tCO2, neither can some industrial process heat
But even at high CO2 prices, there will be a rump of high-value users for whom gas remains the most economic fuel.

- New Zealand could move from being a 200 PJ to a 40 PJ market.
- Infrequently-required peaking electricity generation likely to be highest value user.
So Methanex will probably keep sucking for a while yet. But it (probably) won’t affect high-value gas users.

- Methanex key to offshore fields producing their remaining gas
  - And giving confidence for the remaining few rolls of the offshore exploration dice
- Once existing offshore depleted, in the absence of any new offshore finds, likely that Methanex (& Ballance) exit NZ
  - Replaced by overseas petro.
- Baseload powergen will also likely exit due to CO2 price
  - Replaced by renewables
- The rump of remaining high-value consumers can be met by existing and new onshore gas.

Source: PEPANZ + Concept analysis
In the long-term, a large number of our future gas eggs are in the Kapuni basket

- Some uncertainty over contingent Kapuni as
  - It is in a new, even deeper accumulation
  - It is very high CO2 content → may require cost-effective CCS
So high-value users will (probably) still have gas.
So that’s (probably) all right then….

I smell supply security

…. or is it?

The deliverability beast cometh
What is deliverability?

• Deliverability = Peak production capability

• But deliverability just one dimension of broader need for Flexibility:
  Peak capability
  + Ability to move up and down
  + Ability to sustain output
### Why do we need flexibility?

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<th>Market</th>
<th>Demand variations</th>
<th>Supply variations</th>
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<tr>
<td>Gas</td>
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<td>Supply interruptions</td>
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<td>Electricity</td>
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<td>Renewable fluctuations</td>
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Despite declining *total* gas and coal generation, gas and coal, along with hydro, continue to do most of the heavy lifting for providing *flexibility*.
Variability in different timeframes drive the need for flexibility

- Hydro both contributes to, and causes the need for, flexibility
- Different flexibility resources are appropriate for meeting different flexibility timeframes
Overall, gas assets plus coal have provided the bulk of after-hydro flexibility

- Increased wind and solar will increase the need for flexibility
  - Particularly peak capacity

- But there are some flexibility head-winds coming...
The Maui field has been one of the biggest providers of flexibility. But it is getting old and infirm. And will eventually die.
Other existing providers of gas flexibility also likely to exit

Other offshore gas fields

Methanol interruption

Gone in 10-15 years
What’s going to (cost-effectively) keep the lights on if/when we lose some of our biggest current providers of flexibility?

Breakdown of non-hydro flexibility providers

- Gas-fired power gen interruption
- Methanex interruption
- Other field swing
- Maui swing
- Ahuroa
- Rankines on Coal
- Linepack
Even with high-priced CO2, Huntly on coal may be least-cost dry-year solution for a while yet

- Huntly is sunk capital
- Coal is a low-cost option for low capacity-factor fuel
  - Stockpile costs relatively low
  - Top-up from overseas purchases
- At very high CO2 prices, over-building renewables plus some gas flexibility (Ahuroa + some upstream gas swing) is cheapest
Keeping a small percentage of gas and coal generation should deliver greater whole-of-economy emissions reductions.

- Having 2-3% of generation from gas and coal for renewables balancing will keep electricity lower-cost.
- Lower-cost electricity facilitates transport and industrial process heat electrification – both of which dwarf emissions from peaking fossil generation.

**Concept projection of least-cost generation to meet whole-of-NZ-net-zero-by-50**

![Graph showing least-cost generation projection](image)
So, what will 2050 look like?

No more NZ petrochemical production, and a major shift to renewables, but a rump of high-value gas consumers remaining.

More volatile prices.

However, overall effect on baseload prices (electricity and gas) should be modest…

... provided changes are driven through CO2 price, allowing a small proportion of gas and coal-fired generation to provide high-value flexibility services.

Forcing 100% renewables through non-CO2 price measures would be costly, and may result in worse whole-of-economy emissions.

We will all be driving flying cars.

And the new transmission pricing methodology will be in place. (Maybe).
Thank you
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