



**GAS** **INDUSTRY**  
COMPANY LIMITED



## Wind and Gas – a perfect match?

New Zealand Wind Energy Conference, Hamilton

3 – 4 April 2012

Steve Bielby, Chief Executive - Gas Industry Co

## Name this early windfarm site



Gas Industry Co

2

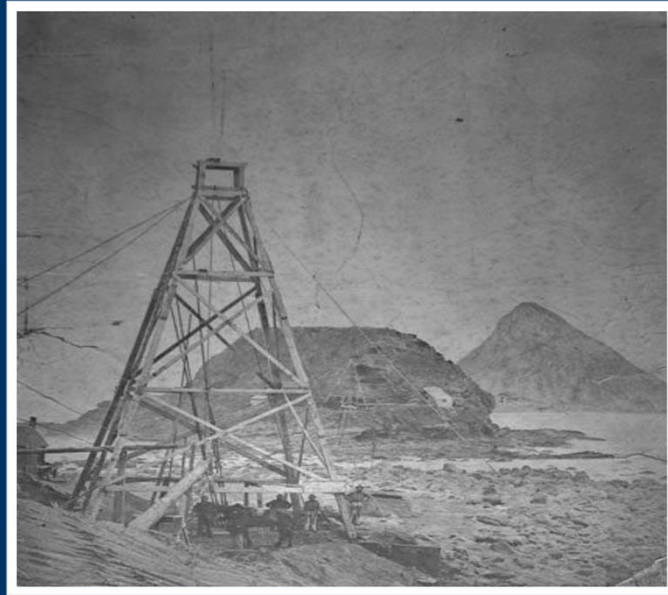
- The Energy Direct Bearing Head wind farm proposal, near the western heads of Wellington Harbour, in 1994-5 was one of New Zealand's first.
- The proposal was refused resource consents at first instance by the Wellington Regional Council and the Hutt City Council. In essence, the visual impacts from around Breaker Bay on the western side of the harbour (more than 10km away) were deemed unacceptable.
- The speaker was instructed by the Councils on appeals lodged by Energy Direct, but those did not proceed to hearing.
- More than 20 years on, the interesting question is how this proposal would fare today. Amongst other things, we now have a National Policy Statement on renewable energy, experience of wind farms and the Wellington Regional Council (a sometime supporter of wind energy in recent years) has recently come into ownership of at least part of the site.
- The plans should still be somewhere.....

## 'Understanding the respective roles for wind and gas in NZ's energy futures'

- *NZ Gas Story*
- Role for wind and gas generation

- Development of the wind energy industry will benefit from a broad understanding of different NZ energy options and futures.
- This presentation offers wind energy industry participants an external perspective from another key energy industry participant, and one that has a surprisingly close relationship.
- The presentation first updates the NZ Gas Story, then looks at the respective roles and scenarios for gas and wind generation.

## Gas/oil exploration started in 1865...



Gas Industry Co

4

- Oil and gas exploration has a long history in New Zealand.
- This 1865 well was the first in the Commonwealth.
- The location is Port Taranaki, with the Sugar Loaf Islands in the background.

## Wind generation also started early...



Source: History of Wind Power

Gas Industry Co

5

- Wind powered generators also have a long history in NZ.
- They were used on ships by the end of the 19th century, as seen on the New Zealand sailing ship "Chance" (1902)

## Modern gas story kicked off with Kapuni gasfield discovery in 1959



Gas Industry Co

6

- The modern NZ gas industry substantively started in 1959 with the discovery of what was to become our first commercial field at Kapuni.
- This was part of the era that saw other key energy developments such as the early hydro dams and Wairakei geothermal field.
- Kapuni was soon followed by the larger Maui field. Together they dominated the gas industry through to the early 2000's and saw an array of associated infrastructure and end users developed to utilise the new gas resource.

## Kupe is our newest big producing field ...



Gas Industry Co

7

- Fast forwarding again to the current day, the industry continues to develop; as exemplified by the next few slides.
- The Kupe field was opened 2 years ago. It was known about back in the 1990's but development only followed the wind-down of the Maui field.
- The Kupe field is off-shore, and the platform can just be seen from the top of the Kupe processing plant shown in this photo near Hawera.
- The processing plant alone cost around \$180million to develop.

## New Stratford Power Station points up increasing role for 'peaking plant'



Gas Industry Co

8

- Opened in April 2011, the Stratford Peaker Plant exemplifies the increasingly peaky nature of energy demand and the increasing corresponding role for gas peaking plant.
- This requires new turbine technology, which can ramp up in around 8-10 minutes and as many times as required (in contrast to older CCGT plant which can require 8 hours to ramp up and which cannot ramp up/down frequently).
- There is also a correlation to the peaky nature of wind generation, which is explored later in this presentation and elsewhere at the conference.



## New Ahuroa Gas Storage Facility seeks post-Maui supply flexibility



Gas Industry Co

9

- Associated with the Stratford Peaker Plant is the Ahuroa Gas Storage Facility.
- This seeks to provide storage flexibility lost with the wind-down of the Maui field, which could be ramped up and down easily to meet demand.
- The Ahuroa Facility utilises an old gas field and allows gas to be drawn on in a range of scenarios, including peak demand periods and significant field outages.

## The NZ Gas Story continues to develop

- Net gas production ↑
- Remaining gas reserves ↑
- Wells drilled ↑
- Petroleum mining licence expenditure ↑
- Producing fields (all Taranaki) ↑
- Gas consumers ↑
- Total transmission pipeline (km) →
- Total distribution networks ↑

Gas Industry Co

10

- Taken together, the three developments shown on the preceding slides demonstrate major new investments in gas-fired generation and other gas use, underpinned by 20-30 year business cases.
- This slide shows key gas industry trends in the period 2005 -2010. In summary, the industry continues to develop on all the chosen indicators, apart from transmission pipelines.
- The latter were built up to the mid-1980's. They are getting full, and the need to squeeze more out of the existing gas transmission system and provide for new transmission investment are a primary current focus for Gas Industry Co. This is discussed in more detail later in this presentation.
- The data supporting this table is as follows:

	2005	2010	Change
Net gas production	144	173	+20%
Remaining gas reserves (P50) (PJ) <sup>1</sup>	1,036	2,021	+95.1%
Wells drilled (5 years inc)	121	189	+56.2%
PMP/PML expenditure (5 years incl) (\$m)	1,276	5,193	+306.9%
Producing fields	13	15	+2
Gas consumers	236,986	254,900	+7.6%
Total transmission pipeline (km)	2,526	2,527	+1
Total distribution networks (km)	15,133	16,711	+1,578

Transmission pipeline and distribution network lengths taken from Gas Information Disclosure Regulations

disclosures. Other figures taken from Energy Data File.  
<sup>1</sup> 2010 reserves include Pohokura, Kupe

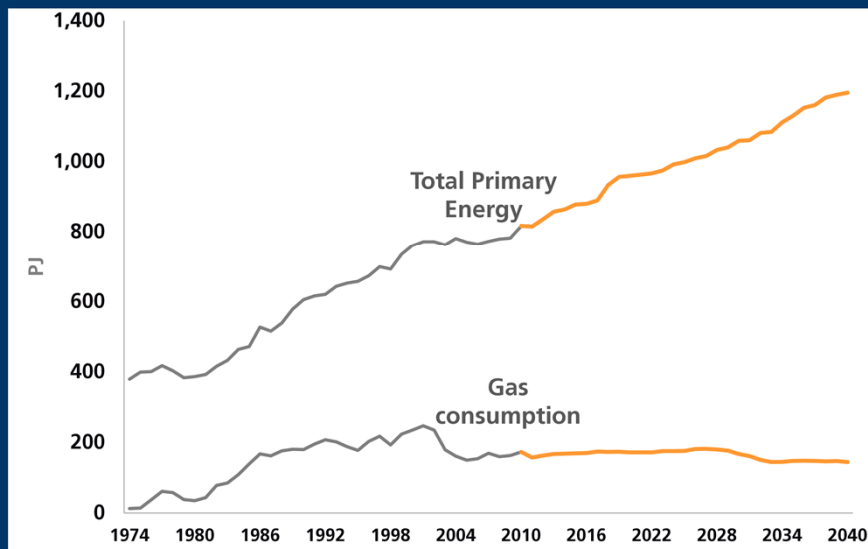
## Gas story is growing internationally

- Energy demand growth underpins global economic growth and prosperity goals
- Internationalisation of energy markets
- Carbon futures – 'golden age of gas' ??
- Sustainability - climate change drivers; 'world in 2050'
- Environmental management concerns grow
- Focus on renewables; move away from coal and question marks over nuclear



- Looking beyond NZ, gas is growing even faster and is becoming even more important to energy policies globally.
- The International Energy Agency has talked about a “golden age of gas”, including as a key option for weaning the world off its high dependence on coal.
- This raises issues of climate change and environmental management, which are beyond the scope of this presentation. But the need to address those issues is a common feature of developed economies’ energy policies.
- This is particularly where significant new developments of unconventional gas are seen as underpinning not just new energy supplies needed to meet growing global demand, but as also underpinning national economic growth and climate change response (especially in displacing the dominance of coal generation internationally).

## Base case scenario for gas is flat to 2040



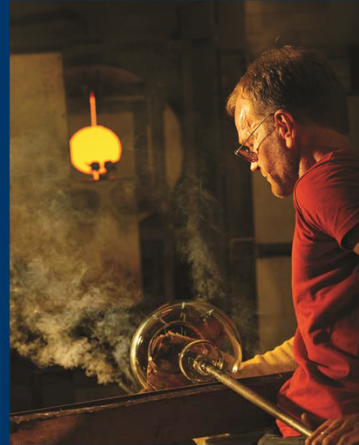
Sources: MED – NZ Energy Data File 2011, New Zealand's Energy Outlook 2011 (reference scenario)

- As globally, energy demand will continue to grow in NZ, consistent with economic growth policies.
- The MED's base case scenario envisages a similar NZ gas market size to current out to 2040.

## Key trends that will shape NZ's gas future

- Big gas or little gas?
- Conventional and unconventional?
- South Island and North Island?
- Domestic or international?
- Government's desirable long-term future:

*'Significant discoveries of oil and gas have boosted NZ's foreign earnings and domestic gas supplies'*



- Beyond that MED base case, there are a number of broad trends that will determine or characterise gas's future in NZ
- Ensuring new finds and production remain the industry priority. Explorers are looking for a new Maui field or bigger. MED scenarios also cover lesser finds that are consistent with NZ experience to date (range approx 120 to 180PJ p.a.)
- The current natural gas market is restricted to the North Island. Exploration offshore South Island raises the possibility of South Island supply/reticulation/interconnection.
- The NZ natural gas market is isolated, while globally LNG is increasingly internationalised. In NZ, scenarios include export following a significant new find or import to address any supply shortage.
- Either way, Government energy policy is aimed at significant new discoveries underpinning economic growth and domestic supply.

## 'Understanding the respective roles for wind and gas in NZ's energy futures'

- NZ Gas Story
- *Role for wind and gas generation*

- With that background review of the NZ Gas Story, this presentation turns to consider the prospective roles for wind and gas generation.

## Comparison with Australia provides context on the NZ electricity market

	Australia	New Zealand
% of electricity generation:		
Renewables	7.4	74
Coal	76.7	4.5
Wind	1.5	3.7
Gas	15	21
Gas reserves (PJ)		
• conventional	123,200	2,020
• unconventional	16,180	n/a

Sources: Australian Department of Resources Energy & Tourism *Energy in Australia 2011*  
New Zealand. MED *Energy Data File 2011*

- The Australian gas/wind experience is instructive for New Zealand.
- We have ten times the amount of renewables in Australia, while Australia has a very high reliance on coal.
- NZ's renewables are growing, with latest annual figures at 77%.
- NZ is doing well comparatively with wind, and has more gas-fired generation in place.
- The challenges facing the two countries are accordingly quite different. NZ is targeting 90% renewables, and the challenge is how to get there from 77%.
- By contrast, Australia has a much bigger challenge weaning itself off coal.
- The gas reserves figures in the final line of the chart give a pointer to where the respective national stories may head.
- Australia has enormous reserves potential, with significant further upside in the unconventional figures and significant committed investment already around that (e.g. around A\$60b committed to 3 LNG facilities in Queensland alone).
- NZ has relatively lesser reserves (even allowing for the smaller market size), emphasising again the importance of ongoing exploration.



## Electricity supply scenarios point up future role for wind and gas

- Electricity Statement of Opportunities 2010:

- **Sustainable Path**

*New Zealand embarks on a path of sustainable electricity development... Renewable generation, including hydro, wind, and geothermal, backed by thermal peakers for security of supply, are the least-cost option*

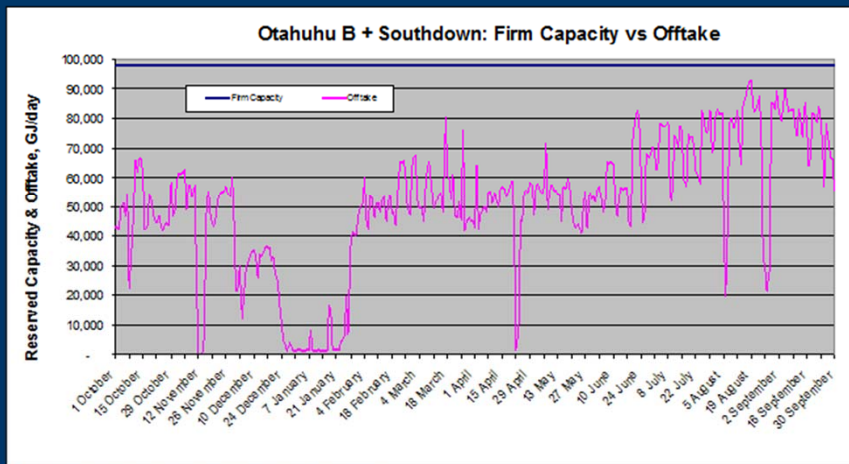
- **High Gas Discovery**

*Some existing thermal power stations are replaced by new, more efficient gas-fired plants... New CCGTs and gas-fired peakers are built to meet the country's power needs; the most cost-effective renewables are also developed*

- The most recent Statement of Opportunities (prepared by the former Electricity Commission in September 2010) provides a range of scenarios that talk to the future for wind and gas generation.
- The Sustainable Path and High Gas Discovery scenarios indicate some outer bounds.
- The Sustainable Path scenario assumes robust sustainable generation, including lots of wind. It assumes a role of gas-fired peakers for security of supply. In more detail:  
*2010 Sustainable path - New Zealand embarks on a path of sustainable electricity development and sector emissions reduction with a long-term average carbon charge of \$60/t. In addition, no new large gas discoveries are made in the future. The resultant high gas price make gas-fired baseload generation relatively uneconomic to run and forces some to be decommissioned. Renewable generation, including hydro, wind, and geothermal, backed by thermal peakers for security of supply, are the least-cost option under this scenario. Electric vehicle uptake is high, and vehicle-to-grid technology is used to manage peaks and provide ancillary services. New energy sources are brought on stream in the late 2020s and 2030s, including biomass, marine, solar, and carbon capture and storage. Demand-side2 participation becomes a more important feature of the market, driven by consumer pressure.*
- The High Gas Discovery scenario assumes major new gas discoveries, low gas prices, and correspondingly more gas-fired generation and less wind. In more detail:  
*2010 High gas discovery - Major new gas discoveries keep gas prices low over the entire time horizon. Some existing thermal power stations are replaced by new, more efficient gas-fired plants. New CCGTs and gas-fired peakers are built to meet the country's power needs; the most cost-effective renewables are also developed. The demand-side*

*remains relatively uninvolved.*

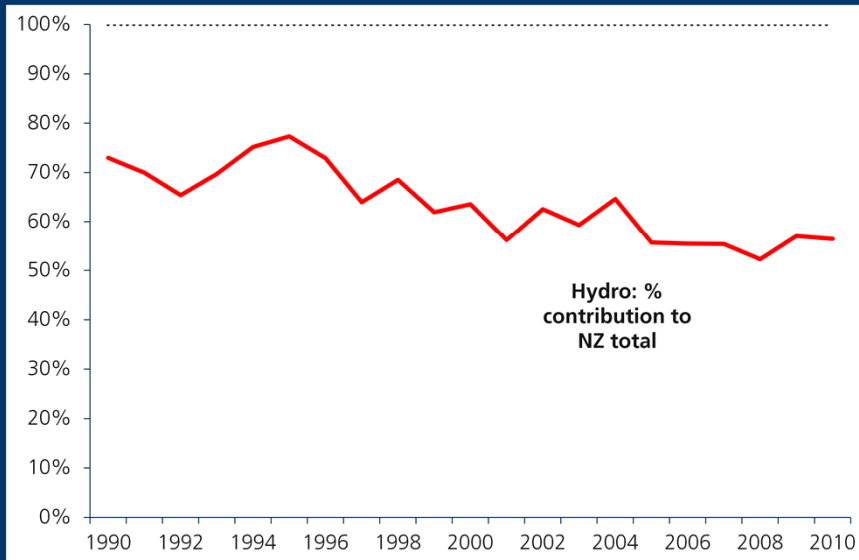
## Gas-fired power stations being used increasingly in mid-merit or peaking role



Source: Vector Limited – North Pipeline Review, October 2011

- Gas-fired generation used to be viewed as base-load, but is now moving to mid-merit or peaking roles.
- This graph is taken from a Vector report on utilisation of its transmission pipeline to Auckland. It shows that the gas-fired power stations there (Southdown and Otahuhu), which together hold around 60% of “firm” transmission capacity, did not utilise anything like their full capacity entitlements in the last gas year (to 30 September 2011).

## Hydro remains our base; but is a shrinking proportion of generation as demand grows



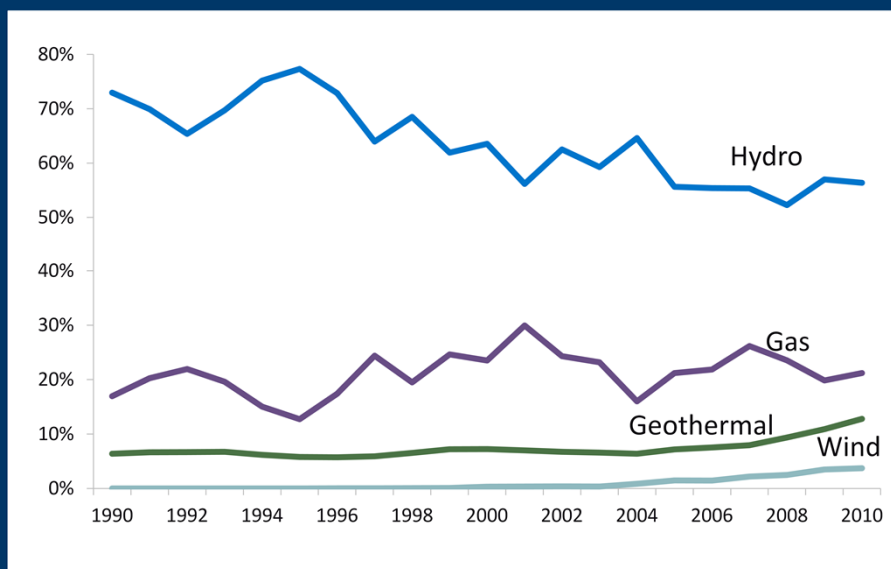
Source: MED – NZ Energy Data File 2011

Gas Industry Co

18

- The following graphs further paint the picture of the roles for gas and wind generation.
- The market continues to be built on hydro.
- The proportion of hydro supply is shrinking as demand is growing but no substantial new hydro capacity is being built (and it is unlikely that significant greenfields hydro will be built in coming years).

## Gas supports hydro; geothermal and wind increasing



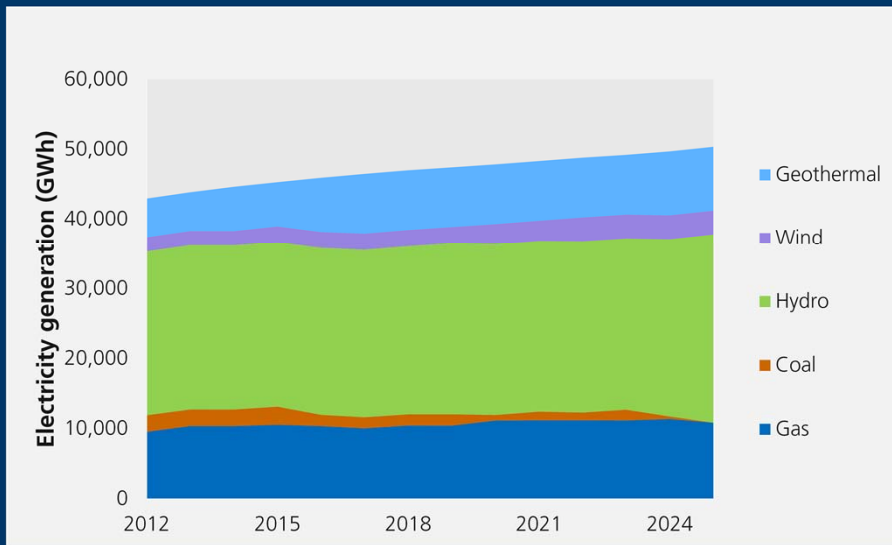
Source: MED – NZ Energy Data File 2011

Gas Industry Co

19

- This chart then overlays the proportionate contributions of gas, geothermal and wind generation to 2011.
- The corresponding shapes of the hydro and gas lines is important – they confirm that gas has backed-out hydro in dry periods; and conversely that gas drops back in wet periods.
- Geothermal and wind are trending up. Geothermal is flat baseload while wind is more variable.
- Wind's volatility is not evident from the graph, although the issue is confirmed at the conference by the extensive discussion of solutions to transmission volatility issues associated with wind generation.
- So the popular conception that “you need a MW of gas-fired generation to back out every new MW of wind generation” is not accurate, including in terms of how wind is dispatched on a daily basis. But there is a broad correlation over time, as shown above for gas and hydro.

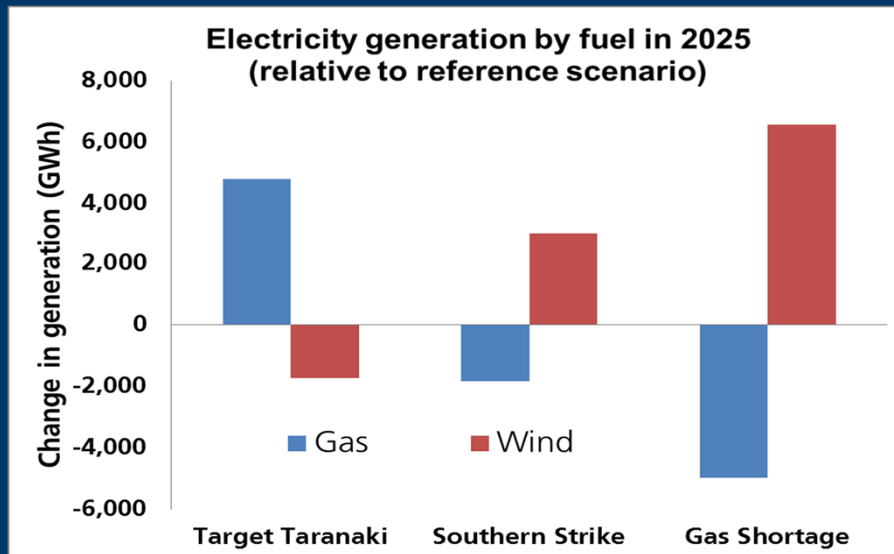
## MED reference scenario shows roles for wind and gas to 2025



Source: MED – New Zealand's Energy Outlook 2010

- The MED's Energy Outlook provides a reference scenario for generation out to 2025
- This assumes there will be significant new geothermal; more modest growth in wind and gas; hydro static; and coal dropping away.
- The reference scenario provides a base for assessment of some interesting scenarios for wind and gas in the following slides.

## How much gas we find will influence extent of wind generation development



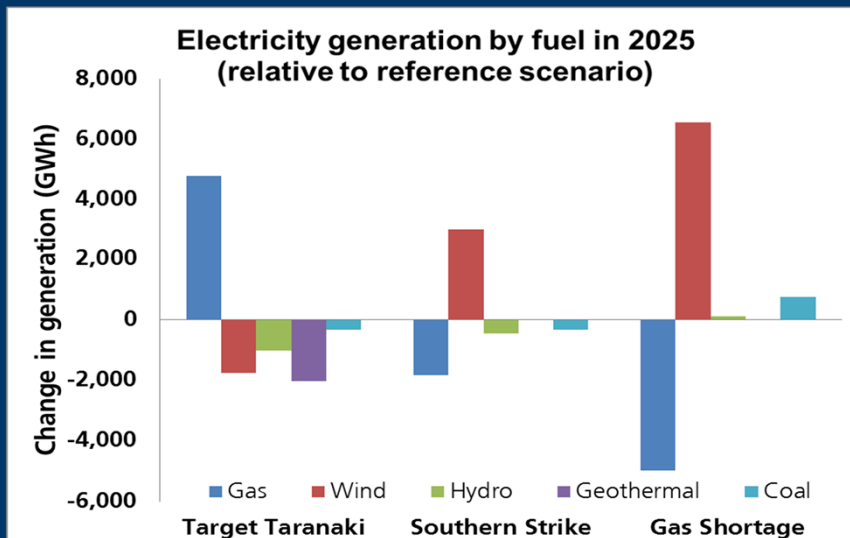
Source: MED – New Zealand's Energy Outlook 2010

Gas Industry Co

21

- The MED's Energy Outlook then includes a number of different scenarios based on how much gas we find.
- "Target Taranaki" assumes significant new finds in and around Taranaki (where all our existing production is from"
- "Gas Shortage" assumes no significant finds
- "Southern Strike" assumes a large find in one of the offshore South Island basins, but that all or most of production is exported.
- The chart shows effects of each scenario on the reference case for wind and gas generation. There is a high and inverse correlation.

## How much gas we find will influence extent of wind generation development



Gas Industry Co

22

- If we overlay the previous chart then with other key fuels (hydro, geothermal and coal), the striking thing is that there is much less correlation with those other fuels.
- In other words, the amount of gas found will not influence the amount of hydro, geothermal and coal-fired generation built anything like as much as it influences wind and gas.
- So the relationship between the futures for wind and gas-fired generation is a close one.



## *'Understanding the respective roles for wind and gas in NZ's energy futures'*

- NZ Gas Story
- Role for wind and gas generation

- The above is intended to throw some light on the future roles for wind and gas-fired generation, and the relationship between them.
- It does not suggest there is a race or a competition between wind and gas. The analysis above is in the context of different scenarios for NZ's future electricity generation, and a range of market circumstances will determine which one becomes reality. Hence, there is no "right answer", but it is important to understand the different scenarios and the drivers and desired outcomes that head us toward them.
- In particular, successive NZ Governments have had a policy goal of 90% renewable generation by 2025. The scenarios represent different paths for getting there. For example, with growing demand, all MED's Energy Outlook scenarios point to greater wind and gas-fired generation than currently.

## Gas Industry Co strategy.....



Gas Industry Co

24

- Gas Industry Co's strategy is to "optimise the contribution of gas to NZ".
- The use of "optimise" is deliberate. It is about finding the "best" role for gas, not necessarily the "biggest" although (as discussed) finding substantial new gas reserves is important to both the Government's Energy Strategy and to the gas industry.
- This presentation has focussed on use of gas for electricity generation, but gas's contribution goes much more widely into our homes and businesses.
- We expect that the wind energy industry will continue to play an important role and may well seek to "maximise" the contribution of wind energy to NZ. The WEA's recently-announced strategy to 2030 certainly heads in that direction.
- We wish the wind energy industry well in its endeavours.