

ENERGY MARKET OPPORTUNITIES POST-MAUI

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Abstract

As supply from the Maui and other existing producing fields decline, petroleum explorers and developers need to address the question *Who will be the indigenous oil and gas customers post Maui?*

This paper discusses major macro- and micro-environmental trends which will influence likely market opportunities. Two sub-markets are examined. First, what trends impact on current oil and gas customers. Second, what other new customers might arise.

The macro-environment trends cover important economic, political, legislation, socio-economic and technical parameters. The micro-environment trends cover energy market structures and pricing parameters.

The energy industry in New Zealand has been talking about what will happen after production from the Maui field begins to decline for several years. I say the *energy* industry because natural gas has a very important role in the electricity as well as direct oil, gas and petrochemical markets. In end markets oil, gas and LPG are important, some would say essential, to industry, commerce, households and transport consumers.

This address focuses on the natural gas markets and the forces that will shape opportunities for gas explorers and consumers in 2009. I have chosen this date because it is the year the Maui Gas Sale and Purchase Contract terminates. While some may argue that 2009 is still 15 years away, it can equally be argued that it is some 25 years ago that Maui was discovered and since then no significant gas resource has been discovered to replace it.

Approach

The approach I have taken in understanding potential opportunities and issues in the year 2009 for petroleum explorers and consumers follows four steps. First I discuss the various macro-environment forces influencing the natural gas market. Secondly, I focus on the micro-environment or market specific factors likely to affect opportunities for natural gas explorers and consumers over the next three decades. Thirdly, I examine three forecast market demand and supply scenarios to illustrate how the various factors uncovered in the macro- and micro-environment analysis would interact. Finally I summarise three key issues which will affect whether the opportunities to gas explorers and consumers are to be realised.

Macro-environment

To begin with I will discuss the wider macro-environment context within which the natural gas market is likely to operate over the next two decades. The key trends are analysed under the following headings; economic, technology, natural environment, legislative, social and political.

Economic New Zealand's population is likely to continue to grow, largely due to increased immigration. This expanding population base will increase demand for all forms of energy.

On top of this population driven increased energy demand may come growth from an increase in GDP per head. New Zealand's massive change, from a highly regulated and closed economy in 1983 to one of the most deregulated and open in the world 10 years later, has set the stage for such economic growth and associated increase in GDP per head. This effect may be tempered, by firstly the change from primary products manufacturing to more services in the economy, and secondly, by the increasing concern for sustainable developments that I discuss under social trends.

International oil prices influence the level of petroleum exploration and search for substitutes, not only in New Zealand, but in global oil and gas markets. This analysis assumes that the relative stability in oil prices over the last few years will be maintained over the next two decades.

The last economic factor pertinent to the gas industry is the establishment of a gas supply network through most of the North Island. This "sunk cost", in economic jargon, is a significant national asset.

Technology There are four main technology trends I foresee. Three of those trends impact on supply, i.e. coal gasification, improved secondary recovery techniques and lower cost LNG technologies. What will drive the exploration and possible adoption of these technologies in New Zealand is the established gas market and distribution infrastructure that will be available to natural gas substitutes if no further gas is discovered. These are the very reasons why explorers will also wish to discover and develop gas resources by the year 2009.

Investigations into underground coal gasification have already begun at Huntly by a joint venture comprising the New Zealand Dairy Group, ECNZ and Pittsburgh-based Energy International Corporation. FCL have also indicated that the Mokau coalfield may be a candidate for coal gasification.

On the demand side technology will change the way consumers use energy. Already cogeneration is beginning

to make a mark in the industrial sector. The drive for more energy efficient technologies is driven by cost and value in the industrial markets and increasingly by the social trend for more sustainable developments in the household markets.

Natural environment New Zealand is well endowed with energy resources. There are the sustainable hydro, solar, wind and tidal resources and long-lived geothermal resources. In the short-term, there is sufficient gas, but that will have been largely exhausted by 2009. The largest known non-sustainable recoverable resource is coal with some 25 700 PJ of measured recoverable resources.

Known recoverable coal resources are one hundred times the size of known recoverable gas resources.

Should there be no further gas discoveries, by the year 2009 we would see a large increase in coal usage. Some of that usage could be coal gasification to take advantage of the gas distribution network and established markets.

Legislative The legislative trends are beginning to be "bedded down". As certainty on the rules increases, so too will explorer confidence and investment.

The proposed change in the exploration regime with no carried contributory interest, accelerated depreciation, reduced Ad Valorem Royalty and an Accounting Profits Royalty is a marked improvement for petroleum explorers over the existing regime which has been in place for the last 8 years.

The public developers and regulators have all been on a fast learning curve in implementing the sustainable development objectives of the Resource Management Act. The economy's appetite for growth and the public's social need for wise resource use appears to be workable under the RMA, or as Guy Salmon of the Maruia Society puts it "going for green growth".

The last legislative trend is the implementation of final steps in deregulating the energy industry. End use energy markets will benefit as gas and electricity networks offer open access and regional electricity line businesses become subject to public scrutiny. ECNZ's recent agreement to take a greater share of Trans Power's fixed costs will also assist cogeneration proposals in particular.

Social There are two social trends likely to affect New Zealand's energy and gas industry.

The first is an increased societal preference of sustainable developments over inefficient and exploitative developments. The hole in the ozone layer, for example, has helped to crystallise public concern that successive generations will reap what current generations sow. Underpinning this is the Resource Management Act which fosters sustainable development projects.

On the other hand rising comfort and convenience levels by consumers have tended to increase energy demands per person over the last few decades. This trend may continue as the average standard of living improves.

Political Political trends one month in the future are hard enough to pick, let alone one and a half decades into the future. Nevertheless, my predictions on political trends affecting the gas industry are as follows:

- New Zealand's relative political stability will continue over the next two decades, underpinned by stronger economic growth than over the last two decades. The change to MMP continues and perhaps strengthens the participatory democracy of New Zealand.

- The various agreements agreed at the Rio Earth Summit in June 1992 and the current aim for developed countries to stabilise greenhouse gas emissions at their 1990 level by the year 2000 will affect the gas industry as they are implemented. These are issues that the gas industry needs to understand to ensure equitable and practical solutions are promoted.
- The final political trend which the gas industry needs to be aware of is the possibility of re-regulation of the energy market if real or perceived monopoly or dominant supplier excess pricing and profiteering occur.

Macro-environmental summary Over the next 15 years economic growth will foster demand for all energy forms including natural gas. Technology advances enhance the opportunities for substitutes to continue long term gas supply and there will be improvements in the efficient use of natural gas. I am less sure of how social, political and legislative trends over the next two decades will affect the natural gas market. A key issue for petroleum explorers and natural gas consumers is how the Toronto Accord promises will be implemented.

Micro-environment

The second part of my approach examines the micro-environmental or market-specific factors.

1993 gas supply and demand

The natural gas supply and demand for the year ended June 1993 is summarised in table 1.

Table 2 compares available resources against current demand.

Recoverable reserves

Approximately 85% of New Zealand's recoverable reserves are in the Maui field. It is estimated that those reserves will be substantially depleted within 20 years, i.e. by 2013.

Table 1. 1993 Gas supply and demand.

Supply	PJ	Demand	PJ
Maui	150	Power stations	52
Kapuni	14	Petrochemical	78
McKee/Kaimiro	5	Reticulated	39
Waihapa	4	Production use	4
Ngatoro	0.2		
Total	173		173

Note: Supply excludes gas reinjected

Table 2. Recoverable reserves.

Field	Recoverable Reserves (PJ)	Field Life Remaining (years)
Maui	2300	20
Kapuni	300	10
McKee/Kaimiro	130	10
Waihapa	10	5
Ngatoro	-	-
Kupe	250	10
Total	2690	

Note: Estimates are rounded for 1994

The sum of all of the remaining known recoverable reserves, including Kupe, can only supply current gas demand levels for 3½ years. All of these known reserves are in the Taranaki/Wanganui basin, reflecting the concentration of exploration and relative success to date in that area, e.g. 72% of exploration wells in New Zealand have been in the Taranaki/Wanganui basin. Other basins where economic petroleum discoveries may occur include Northland, East Coast, Canterbury, West Coast and Murchison, Southland, Great South and Challenger Plateau basins.

It is heartening to see some large oil companies, such as Conoco and Mobil, beginning to take an interest in exploration, joining those already well-established explorers.

Power station market

ECNZ's power stations at Huntly, New Plymouth and Stratford with a combined capacity of 1773MW used 30% of natural gas production over 1993.

Table 3 illustrates how the percentage of gas-fired generation increased from 18% in 1982 to 24% in 1992. Continued investment in gas-fired power stations is evidenced by Mercury Power's proposed 100MW station and ECNZ's proposal for a new gas-fired station for Taranaki of between 200 to 400MW.

By the year 2009 electricity generators will begin to have very limited choices to replace gas if supplies are no longer available. In particular:

- Unused hydro sites will be limited and costly.
- Geothermal options are relatively small and potentially very costly.
- Oil is a very costly option.
- Coal by default will become the primary new power station fuel source. The main issue here is the cost associated with purification of exhaust gases to contain the level of emissions.

Petrochemicals market

The Petrochemicals market used 45% of natural gas production over 1993 (table 4). These consumers are large capital intensive industries with high load factor gas demands manufacturing and distributing export or import substitution commodity products. Whether they operate in New Zealand or elsewhere in the world after 2009 is highly dependent on reliable long term gas supplies and prices.

For petroleum explorers the petrochemicals manufacturers represent a very large and stable market opportunity for future gas discoveries.

Reticulated market

The reticulated gas market used 22% of gas production in 1993. Approximately 72% of reticulated gas is used in the industrial sector (table 5). The forestry and steel industries are currently very large consumers.

By 2009, given sufficient economic gas supplies, I believe the reticulated sector will expand in all areas except CNG. The major growth will be in the industrial sector where cogeneration and forestry developments will grow. Some substitution from coal to gas by the Waikato dairy industry may also occur. These large one-off developments will be supplemented by GDP growth-driven demand for energy in all industrial sectors. The commercial and household sectors are relatively small, but premium, value markets. I expect gas to increase total sales in these areas as the population grows and as GDP per head grows.

Table 3. The power station market.

Fuel	1982	1992	2009
Hydro	76%	65%	Nearing saturation
Gas	18%	24%	Preferred if price OK
Geothermal	5%	7%	Minor
Coal	1%	3%	Last resort
Oil and Others	<1%	<1%	Expensive

Table 4. The petrochemical market.

	1993 (PJ)	2009
Motonui plant	54] Closure unless further gas discovered
Waitara plant	20	
Methanex Subtotal	74	
Ammonia-Urea	4	
Petrochemicals total	78	

Table 5. The reticulated market.

	1993 (PJ)	2009
Industry	28	Expanded +Cogeneration +Forestry
Commerce	5	Expanded
Household	4	Expanded
CNG	2	Uncertain
	39	

Assuming no significant international real oil price rises over the next 15 years, I believe it to be unlikely the CNG market will ever grow to the peak of 6PJ reached in 1987.

Forecast status quo gas supply and demand

Figure 1 illustrates the decline in gas supply as existing gas resources are depleted. The exact slope of the decline is estimated, but most commentators believe the decrease in deliverability will begin within the next 10 years.

As the Minister of Energy pointed out last year at the Energy in New Zealand Beyond 2000 Seminar, this decline in existing known recoverable gas reserves is not an "energy gap". New Zealand will not run out of energy to supply this demand given potential coal gasification and LNG import substitutes to use existing distribution infrastructure or more direct coal and oil usage.

What figure 1 emphasises is that we may be headed for a more costly energy supply path if further economic recoverable gas reserves are not found in the near future.

Gas demand summary

From this market analysis (table 6) the opportunities for growth in gas demand to 2009 and beyond appear very favourable. In terms of volume sales the largest potential increases will be existing and further gas fired power stations. The second largest growth in volume sales will be for

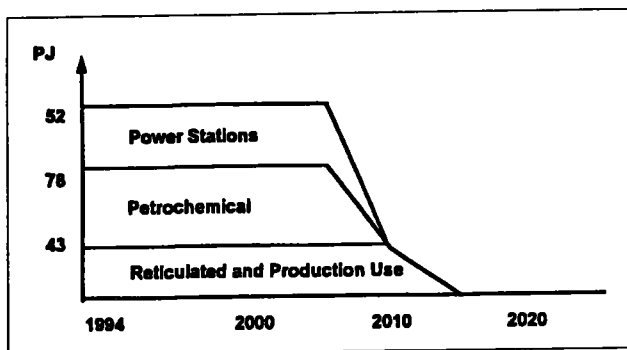


Fig. 1. Forecast status quo gas supply and demand.

cogeneration and forestry developments and possibly dairy processing. Given a more robust economy, the prospect of GDP driven industrial sector growth also looks excellent. Premium value uses by the commercial and household sectors can also be expected to expand.

Gas supply summary

From the current position of having an oversupply of gas, and hence no "immediate" demand opportunities for new gas fields for example, within 15 years we will have a large gas shortfall (figure 2).

Within 10 years consumers will begin experiencing deliverability constraints as reserves begin to taper off. This will probably affect the marginal power station and base load petrochemical sector demands first.

These deliverability and potential gas supply shortfalls are the opportunities that petroleum explorers can seek to meet. The lead times for new discoveries to come onstream are variable. In the case of the Maui field it took ten years between discovery and commissioning, four of those years were negotiating the contracts.

Scenarios

Here, I examine three representative scenarios to illustrate the combined effect of the macro- and micro-environmental factors analysed earlier.

Figure 3 illustrates the three scenarios examined. The first case assumes current levels of gas demand and supply are maintained at 173 PJ pa in a "business as usual" scenario. The second case assumes no further gas discoveries are made resulting in a "complete substitution" scenario. For the year 2009 this means only the reticulated market at approximately 40 PJ per annum is supplied. The final case assumes an "expansion" in gas demand and supply above 173 PJ in the year 2009.

Under the business as usual scenario (table 7) supply is just maintained at current levels of demand. Supply options

Table 6. Gas demand summary.

	1994 (PJ)	2009
Power Stations	52	Expanded
Petrochemicals	78	Constant
Reticulation	39	Expanded
Production Use	4	
	173	185+

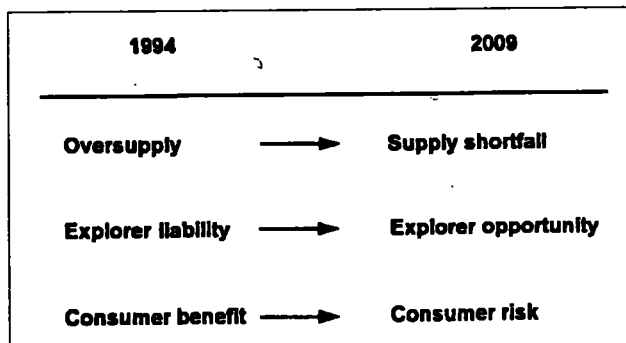


Fig. 2. Gas supply summary.

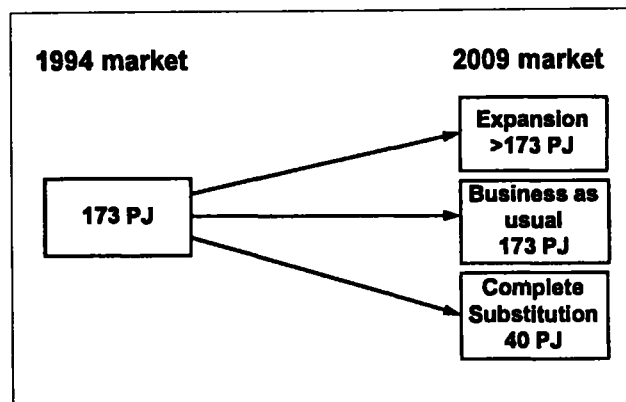


Fig. 3. Scenarios defined.

include small to medium gas discoveries or small-scale LNG imports. To put this into perspective, at least another eight Kupe-sized gas fields would be needed to maintain gas supplies at current levels for a further 10 years beyond 2009.

In this scenario potential gas demand is being constrained. More expensive coal-fired power stations would be built to meet growing electricity demands and industrial sector growth may be met from coal or by moving energy intensive developments such as forestry processing overseas. The petrochemical plants would continue on the assumption that there were sufficient gas reserves and internationally competitively priced gas feedstocks. This scenario would see continued use of the gas distribution infrastructure.

The underlying assumption for the complete substitution scenario (table 8) is that no further, or at least only minor, gas discoveries will be made by the year 2009. LNG imports are assumed to be uneconomic on their own or too small to allow economic use of the existing gas distribution infrastructure.

The impact on demand will be the closure of the export and import substituting petrochemical plants and shift in power station demand to higher priced substitutes such as coal or

Table 7. Business as usual scenario.

Demand 2009	Supply 2009
Gas fired power stations preferred over coal or gasified coal and/or	Small to medium discoveries or small scale LNG imports
Petrochemical exports still viable	

local gasified coal. There may still be some residual gas to meet premium reticulated gas demands from 2009. Progressively those reticulated consumers will convert to other energy forms, primarily imported oil, coal and electricity. Some potential end use demand such as new forestry processing industries will probably relocate overseas to use cheaper primary energy sources. The overall impact on New Zealand will be a shift towards a higher energy cost economy, higher reliance on imported energy sources (for transport fuels in particular assuming no further oil discoveries) and loss of potential investments overseas.

In the expansion scenario (table 9) gas supply is enhanced by further large discoveries or LNG imports. Demand expands in all markets, particularly power station fuels provided fuel prices are competitive with coal. Industrial expansion for cogeneration and in the forestry and dairy sectors will occur on top of a general GDP driven increase in industrial, commercial and household activity. In an optimistic expansion scenario, significant gas discoveries may lead to LNG exports. The expansion scenario is the best win/win case for New Zealand as a whole, gas consumers and petroleum explorers. The following three key issues will influence whether this win/win case will be realised.

Issues

There are excellent future demand conditions for further gas discoveries. There are two key issues which will affect whether the petroleum exploration industry will realise this opportunity over the next few decades.

Firstly, uncertainty and possible punitive policies resulting from the Toronto Accord could throttle the incentive on petroleum explorers to search for and develop further gas reserves in New Zealand. The petroleum industry along with the total energy industry needs to take an active role in ensuring that equitable and practical policies are implemented in this socially and politically hot issue.

Secondly, explorers may be too late in their search for gas and hence leave open to competing energy suppliers to meet the window of opportunity that will open as gas deliverability begins to fall. Given gas deliverability will begin to fall within the next ten years and the lead time for a major gas field development could take ten years, the time for exploration activity has started.

The opportunity is there, the challenge is now yours.

Author

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Dr Saha has a Master of Engineering degree with Distinction, a Doctor of Philosophy in Engineering from the University of Auckland and a Master of Business Administration from the Victoria University of Wellington. Dr Saha has been extensively published in several international journals and presented papers at several New Zealand and overseas conferences. He is a co-author of two books. Dr Saha has represented New Zealand in several energy and petroleum sector international conferences.

Table 8. Complete substitution scenario "Status Quo".

Demand 2009	Supply 2009
Power station demand substitutes to other fuels	No further discoveries
Premium reticulated use only in residual supply	
Petrochemicals cease	
Some demand shifts overseas	

Table 9. Expansion scenario.

Demand 2009	Supply 2009
Gas preferred power station fuel	Large discoveries
Petrochemicals expand	or LNG imports
Reticulation expands	
LNG export possible	

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