



Essentials of Efficient Natural Gas Trading in New Zealand

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Introduction

Gas Industry Company New Zealand commissioned this paper to provide informed and independent analysis to;

- highlight international best practices;
- enlighten new companies who may be considering natural gas trading as a new way of contracting natural gas; and;
- evaluate the design and functionality of the proposed trading platforms of NZX and Transpower.

New Zealand now has two electronic physical natural gas trading platforms for buyers and sellers in the marketplace: NZX's New Zealand Gas Market and Transpower's emTrade. These markets will be evaluated in detail in later chapters. Electronic trading provides greater opportunities for more companies to become involved in the energy industry. As technology evolves to prove the market more efficient, companies who may have not previously thought they could participate in the industry may find new ventures to enrich their businesses, such as acting as agent for market participants by performing lower cost tasks on their behalf, such as contracts, scheduling, risk management, settlement or confirmation functions.

This paper is meant to be an overview of the designs and functionality of exchange trading in general as it is represented in the global marketplace as well as the specifics and analysis of what is being proposed in New Zealand.

1. Why Trade and the Role of Trading

1.1 Why Do Organizations Trade Gas?

Organizations trade natural gas for a variety of reasons:

- Gas retailers need to purchase gas to service their retail markets.
- Producers need to sell gas to optimize profits in exploration.
- Various industrial businesses need to purchase natural gas for such activities as dairy, meat, timber, steel, and food processing; and petroleum refining.
- Power generators need to purchase gas to fuel gas-fired power plants.

The more efficient these various companies are in managing their natural gas requirements, the more profitable they will be.

The largest percentage of natural gas traded in New Zealand is for the high heat required in power generation. This differs from North America, where the highest percentage of natural gas demand is used for industrial processing.

1.2 Trading Functions

Trading companies are those that are in the business of buying and selling a product or a commodity for a profit. These companies are in the business of capturing profitable opportunities which present themselves in any of their business activities.

International trading companies in the oil and gas and mining industries generally conduct two types of trading:

- Supply chain trading, in which traders work to meet customers' needs with available supplies.
- Proprietary trading, in which traders play the commodities markets using their first-hand knowledge of supply and demand.

Other common trading techniques that have evolved in the United States include:

Asset optimization:

Producers, storage operators and transmission providers have an obligation to their stockholders or investors to operate their assets in a way that optimizes profits, while also maintaining a high quality of safety and trust for consumers. Over the years, marketing companies have evolved to assist these companies in running their business. Some less capitalized companies have found it less costly to hire a third party for a smaller fee than it would cost to perform the same functions themselves.

Derivative market-making (financial trading):

Hedge funds and financial energy companies, such as large investment banks, perform most of the derivative trading in global markets due to the extensive capital requirements and collateral required with the new regulations being enforced by global regulators, such as Dodd Frank in the US and EMIR regulations beginning to roll out in European markets.

Arbitrage and hedging of asset portfolios:

(Arbitrage is discussed in further detail in Section 4). To hedge asset portfolios, a producer may decide to hedge his production estimates in the future by purchasing a derivative product called a swap. He will lock in the prices today for the current settled price on the market exchange in the future. Another way to hedge assets is to hire someone to do it for you, such as acting as agent for a large industrial end user by procuring supply, or for a producer by selling supply. Another opportunity of an agent is performing administrative functions for either or both parties. As an agent, trading companies can perform various necessary administrative procedures at a low cost for those companies that do not have established departments or the knowledge to perform these functions. An agent may act on behalf of another company by signing contracts on behalf of companies they represent and performing legal functions for them, such as brokering transportation on pipelines, scheduling, confirmations, and settlement functions.

1.3 Trading Strategies

Commodity trading strategies are simply the basis for why and when you will buy and sell commodities. You should have some well thought out strategies before you begin trading commodities. This does not mean watching the financial news or reading a commodity newsletter for the latest trading tips. Rather, you should have consistent strategies that will let you know under what circumstances you will buy, sell and limit your exposure to losses.

Some companies have evolved into the business of having teams of traders, not just the companies who own the asset, such as the producer or distribution companies. Their business is only trading. Traders keep the supply and demand balance in constant equilibrium by searching for profitable arbitrage opportunities where discrepancies between supply and demand exist. In general they help the market by providing efficiency, competition, and liquidity. Each day, organizations that trade are looking for areas of excess supply or high demand. If there is a region or location temporarily oversupplied they can buy from one counterparty and sell and transfer title to another counterparty, capturing a profitable spread in between. A spread is the difference between the buy and sell price.

As a trader, how do you determine what kind of strategy to use in your particular area of expertise to maximize your profits? The following sections describe different types of traders and examples of specialization in commodity trading strategies. Some of these strategies have evolved in other global marketplaces, such as the United States, and have not presented such opportunities in New Zealand, but it is notable since it will show examples of future ideas that could come as the market evolves over time.

- **Seasonal trading:** Commodity prices typically reach peaks or lows during certain times of the year. This is due to production cycles around the world and buying cycles of commercial users. There will be times during the year when the supplies

are at their highest and demand is at the lowest. Prices are typically lowest when supplies are at the highest. A seasonal tendency should be used as part of an overall strategy or process for selecting trades. Experience in trading a particular market for a long period of time and understanding the market characteristics really helps when using seasonal trades. Seasonal trades don't work every year and sometimes the timing is early or late in the markets for a seasonal move. In fact, a market might not show any particular bias to a seasonal tendency in many years.

- **Trading commodity spreads:** Many professional commodity traders focus on trading spreads. A spread involves the simultaneous buying of one commodity and the selling of the same or similar commodity. Using spreads often cuts down on the risk of buying a straight commodity position. A trader should be more aware of the price spread between the two contracts rather than actual prices. The price spread is the difference between the two contracts.

Example:

Trader at ABC Gas Company buys summer natural gas @ \$3.50, when the prices are lower and sells winter natural gas @ \$4.00 when demand is expected to be higher during a July trade day. There is a \$.50 spread on this trade. This is known as a bull spread. Fundamental analysis of historical pricing, weather events or temperatures, and any noted public available information on physical flows will usually show this is a typically proper trade, meaning that with all of the information available, the statement could be made that the trade made good business sense.

At any time during the year, prices may fluctuate upwards or downwards, however the actual price isn't what the trader is watching as much as the spread. The same trader sells gas in winter @ \$10.00 during a period of a volatile weather event and buys gas to cover the deal from a storage arbitrage @ \$9.50. The spread is still \$.50 even though the purchase price is much higher during the winter period.

- **Specializing in trading one commodity:** Most people have an affinity for a particular commodity. They may have had better success trading one commodity over another or their firm specializes in a particular product, such as natural gas or power. Some commodities are more volatile than others, such as gold or crude oil, where price swings can vary wildly in global markets. Liquidity is also another consideration. If a trader likes long term trading, liquidity is not a major concern. Liquidity is the availability of the product being traded at the time of demand. If there is a plentiful amount of natural gas available at a particular location, it is considered to be 'liquid', or easily traded on a given day. An 'illiquid' market is one where there is little or no demand. One good aspect of trading in one commodity is research can be done rather quickly each day if the firm trading is focused on one commodity, such as natural gas. Usually, fundamental information is readily available to trading staff each day to analyze the market conditions, review price trends and make

intelligent trade decisions. The average trader and new traders should benefit for focusing on trading one commodity. This will drastically reduce the amount of time it takes to learn how to trade and probably make a better trader. Over a period of time, you will see the pattern repeat over and over, reaffirming your confidence that you are learning the market.

2. Physical Gas Trading

2.1 OTC vs. Exchange

OTC “over the counter” markets refer to a collection of traders, brokers, and other market participants that are interested in a given commodity, security, or derivative and trade amongst themselves and not on an exchange. Trades in the OTC market are often referred to as bilateral trades between two or more counterparties. Brokers and traders will quote a given commodity or security by first quoting the highest price which buyers are currently willing to pay, called the bid, followed by the lowest price which sellers are currently willing to sell, referred to as the offer. This is called a bid-offer spread or market for that commodity or security.

Over the counter markets are getting more complex globally due to changing financial industry regulations requiring more transparency with counterparties and to ensure pricing remains competitive and fair. Regulators in the US and Europe are in the midst of the largest financial reform in the energy industry’s history as rules of **Dodd-Frank** (Wall Street Reform and Consumer Protection Act) in the US and **EMIR** (European Market Infrastructure Regulation) in Europe will require most financial transactions to be traded on exchanges.

An exchange is an electronic platform designed to provide transparency and efficiency with standardized terms for all participants to buy or sell a particular commodity. It facilitates end-to-end transactions between anonymous market participants; provides more accurate price disclosure; and can play the role of central counterparty (CCP), coordinating trading activities on the various locations offered in the platform. The primary benefit of an exchange that is also a CCP is managing the credit and physical delivery risk of its members.

The exchange has the responsibility to provide an efficient, secure, dependable platform for all participants to trade a commodity. A commodity exchange acts as a portal or a common place where traders can buy and sell commodities. Such exchanges enable seamless trading, eliminate the need for middlemen and allow the market to fix a price that is driven purely by demand and supply of the product.

2.2 How Does a Commodity Exchange Work?

Just like the stock market, a commodity exchange serves as a marketplace for buyers and sellers to engage in trading commodities directly. Trading can be done in two ways:

- Cash/spot; and/or
- Futures.

In the former method, the buyer and seller agree upon a common price of the commodity, and actual physical delivery of that commodity takes place.

The latter is different. Futures contracts do not involve spot delivery of commodities; rather, delivery is fixed for a future date at a price agreed by both the parties. People engage in this kind of trading mainly because each party gets something out of the deal. Commodity manufacturers/producers want to hedge their products against a possible future decrease in the price. On the other hand, commercial consumers want to lock in goods at a favorable price in order to avoid paying a higher price later. Individual traders wish to benefit from future movements of commodity prices.

The entire process is done electronically. The buyer submits a bid price and the future delivery date of the commodity on this exchange. The seller either agrees to pay that price by directly accepting the bid, or enters an offer price with terms that are acceptable to them. Almost all transactions take place in a similar manner, allowing the actual demand and supply to determine the price.

Any commodity exchange generally serves three main functions:

1. Defines rules and regulations of trading to carry out uniform trading practice:
 - An exchange has an obligation to put in place a standardized set of rules and regulations that participants are obliged to follow.
 - These rules and regulations should be supported by the industry regulators and follow best practices of the commodity markets.
 - The definitions should be clear and fair to all market participants.
2. Provides dispute settlement mechanism:
 - A key element of a successful exchange will be able to act as a central counterparty where all settlements are coordinated and resolved.
 - If a dispute arises between counterparties on an exchange, the central counterparty acts as a mediator for resolution, as well as taking financial responsibility to ensure all parties reach an acceptable solution.
3. Circulates price movements and market news to the participating members:
 - Exchanges track and analyze current and historical prices in commodity markets. There will generally be regular electronic postings available to the market, either via a membership or a public website.
 - Experts in the market compile fundamental data and distribute findings to members.
 - Analysts track daily market information and disseminate to members, such as industry news, new projects or new or updated regulatory information.

2.3 Who Trades

In OTC markets, as well as on exchanges, multiple industry entities trade for a variety of reasons. Producers sell natural gas to optimize exploration. Power generators and industrial businesses buy natural gas for their own use. Gas retailers buy gas to service retail markets.

In the United States, the inception of open access on gas transmission pipelines created opportunities for marketing companies, who neither produce nor consume natural gas, but who trade gas for other reasons. Such companies can trade on behalf of asset management requirements, on behalf of their own for a profit, or they could also own or invest in facilities that use natural gas. Marketing companies do not always profit on behalf of others, they sometimes become owners and operators of facilities, just like producers, retailers or end users.

New Zealand could also see a surge of new trading partners, as the US did with marketing companies in the 1980s.

2.4 Day-Ahead vs. On-the-Day

Day-ahead trading represents trading natural gas for the next day and beyond. Day-ahead and on-the-day are referred to in North America as “cash” trading either through bilateral or exchange counterparties. Most deals are done through a fixed price, but can also be done using location indexes. Index prices can be determined in a variety of ways but they are set using standards in place through the various exchanges. In the US and Canada, IntercontinentalExchange (ICE), the primary exchange platform in the US, and NGX, the primary exchange platform for Canadian trading, sets physical and financial product prices across gas, power, and natural gas liquids products (such as methane, butane, propane or natural gasoline), using set formulas established in the industry between the exchanges, industry publications, and regulatory bodies

On-the-day represents trading in the current natural gas or intraday market. Being able to trade in the same day provides solutions to such issues as balancing, production increases or decreases, and higher/lower end user demand. Having an on-the-day platform such as an exchange gives the advantage of immediate solutions, rather than depending on a bilateral trade with another counterparty that could potentially take longer to process and complete.

3. New Zealand Gas Hubs

3.1 New Zealand Supply and Distribution

In 1969, gas supplies exploded in New Zealand with the Maui field discovery. Maui gas deliveries began in 1979. At their peak, Maui accounted for 85% of total gas supply in New Zealand. Coupled with production from the Kapuni field, larger scale operations in the country began to emerge.

The 1980s saw the development of a rapid expansion of the high pressure transmission systems that allowed low pressure distribution systems to extend natural gas reach into all major populated areas of the North Island. No other significant transmission pipeline systems have been built since the construction boom in the 1980s.

Today, there are 20 fields and wells producing natural gas in New Zealand all within the Taranaki region. Pohokura and Maui fields dominate production. There are two main, high-pressure transmission pipelines owned by Vector Limited and Maui Development Limited, and together they account for 2,528 kilometers of transmission pipelines. There are currently 16,000 kilometers of distribution networks on the North Island, owned by Vector, PowerCo, Nova Gas, and Gas Net; together these distribution networks provide reticulated gas to over 250,000 consumers throughout the North Island.

Figure 1: The following table depicts the market players across producers, distribution, transmission and consumers.

| Major Fields % Net Production | McKee 1.3% | Mangahewa 2.9% | Maui 21.4% | Kupe 12.9% | Kapuni 10.1% | Ngatoro 0.4% | Kowhai 2.9% | Turangi 3.2% | Pohokura 44.6% | Rimu/ Kauri 0.3% |
|-------------------------------------|--|---------------------------------------|---|---|-------------------------|--|--|-----------------|---------------------------------|--|
| <div>↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓</div> | | | | | | | | | | |
| Producers | Todd Taranaki | | Shell 83.75% | Origin Energy 50% | Shell 50% | Greymouth Petroleum 100% | | | Shell 48% | Origin Energy 100% |
| | | | OMV 10% | Genesis Energy 31% | Todd Energy 50% | | | | Todd Energy 26% | |
| | Todd Energy 6.25% | NZOG 15% | | | OMV 26% | | | | | |
| | | | | Mitsui E&P 4% | | | | | | |
| | Operator: Todd Energy | | Operator: Shell Todd | Operator: Origin | Operator: Shell Todd | Operator: Greymouth | | | Operator: Shell | Operator: Origin |
| | | | | | | | | | | |
| Wholesalers | Vector | | | Todd Energy | | Contact Energy | | | Greymouth Petroleum | |
| | | | | | | | | | | |
| Transmitters | Vector | | | | | Maui Development | | | | |
| | | | | | | | | | | |
| Distributors | Vector | | | Powerco | | GasNet (part of Wanganui Gas | | | Nova (part of Todd Energy) | |
| | | | | | | | | | | |
| Retailers | Genesis Energy | Energy Online (Part of Genesis) | Nova Energy (part of Todd Energy) | Bay of Plenty Energy (part of Todd Energy) | Contact Energy | Energy Direct NZ (part of Wanganui Gas | | Greymouth | OnGas (part of Vector) | Mercury Energy (part of Mighty River Power) |
| | | | | | | | | | | |
| Consumers | Electricity generators: Contact Energy Genesis Power Mighty River Power | | | Direct supply large consumers, including: Methanex (methanol) Ballance Agri-Nutrients (ammonia/urea) New Zealand Steel Carter Holt Harvey Degussa Peroxide Fonterra Refining NZ Tasman Pulp and Paper | | | Reticulated consumers: Other industrial Commercial Community amenities Residential Transport (as CNG) | | | |

Source: New Zealand Gas Story

Figure 2: Vector and Maui Pipeline



Source: New Zealand Gas Story

3.2 Transmission Market Developments

There have been a number of substantial changes over the last decade in the transmission market. Arrangements have evolved from long term contracts based on supply from the Maui field to varied and more short term supply arrangements from multiple fields. Pipeline services such as access, supplier demand connections, balancing, and critical contingency management have become more sophisticated.

Historically, Maui and Vector pipelines were operated as a single system, using Maui as the balancing gas source. Pipeline balancing was a relatively simple administrative task, due to the availability of Maui gas and the tolerances allowed on the Maui pipeline. In the last decade, a number of developments have occurred in the gas market that have increased the cost and the complexity of balancing. Under legacy gas contracts, balancing was “free”¹, but with the expiration of those contracts in 2009, interconnecting parties and shippers became responsible for the imbalances they created.

In 2009, Maui Development Limited (MDL) created the Balancing Gas Exchange (BGX), an online platform that displays pipeline balance conditions and enables parties on Maui’s system to buy or sell balancing gas, as well and buy or sell gas to MDL. BGX rules allow parties to arrange puts, where MDL sells and counterparty buys balancing gas; or calls, where MDL buys and counterparty sells balancing gas. Participants must have a Balancing Gas Master Agreement in place and be a valid counterparty on the Maui Pipeline.

Current State:

- Imbalance Limit Overrun Notices (ILONs) are issued for any Accumulated Excess Operational Imbalance (AEOI)
- Parties then have until end of tomorrow (D+1) to rectify their AEOI.
- If they fail to do so, they are then cashed out under the current section 12 of the Maui Pipeline Operating Code (MPOC) at the positive or negative mismatch prices (currently set by BGX)

Future State:

- Back-to back balancing
- ILONs are written out of the MPOC
- Cash outs occur only on days where the Balancing Agent takes a balancing action
- If the Balancing Agent takes a balancing action, parties with AEOI at the end of the day are cashed out on a prorated basis for the amount of gas purchased/sold by the Balancing Agent

The industry is making progress towards improving pipeline balancing arrangements. The current initiative is to make changes to the MPOC which MDL contends will better target balancing charges to the shipper that caused the imbalance, improve efficiency, enhance transparency, provide customers clarity about their exposure to balancing charges, and, with tighter compliance incentives, put pressure on balancing downstream gas volumes with

¹ It was only free in the sense that the cost of balancing was not visible to shippers/retailers. Any costs associated with secondary balancing undertaken by the Maui pipeline were not able to be charged for separately.

savings to end users incentivizing them to also remain in balance. These changes are to be implemented sometime in 2013, a timeframe that allows Vector to introduce complementary changes to the Vector Transmission Code.

Figure 3: Maui vs. Vector Pipeline Comparison

| MAUI VS. VECTOR COMPARISON | | |
|---------------------------------------|--|---|
| Topic | Maui | Vector |
| Regime access | Common carriage | Contract carriage |
| Responsible party for balancing | Welded point operator | Shippers |
| Pipeline size | 750 mm to 850 diameter | 6 main subsystems for capacity reporting composed of numerous sections in varying sizes |
| Flow direction | Supply to direct connect consumers and to Vector interconnections | Vector pipelines deliver gas to major end users directly connected to the transmission pipeline and to distribution networks, at about 135 delivery points |
| Length of pipe | 308 km | 2288 km |
| Pipeline management system | OATIS (nominations, measurement, scheduled quantities) | OATIS (nominations, measurement, scheduled quantities) |
| Pricing, general terms and conditions | MPOC | VTC |
| Service types; capacity acquisition | Shippers have no specific right; open to all; no guarantee of availability; requires no advanced booking | Firm service guaranteed to be available except in emergency or force majeure; capacity booked in advance and paid for a full year, whether used or not; offers an authorized overrun service requiring no booking |

Source: Bullogic LLC

3.3 What Makes a Good Hub?

Trading at hubs provide energy markets with tremendous advantages. A ‘good hub’ should work in harmony with the open access codes and not require ‘special’ or ‘non-standard’ shipping arrangements that are more onerous than standard shipping arrangements. Hubs act as a central distribution and pricing point for market activity. Hubs should physically be located in a common market supply or demand center.

A successful hub will have several key components:

1. Operator of the hub must have rules in place for transparency and accuracy.
2. Physical delivery arrangements should be the same as standard open access requirements.
3. Pipeline allocations for physical locations must be timely and accurate.
4. Confirmations by operators of the hub should be made available according to regulatory standards and timelines.

5. Penalties should be in place for counterparties who do not abide by the standard set of rules defined by the hub or regulatory agencies.

One example is the Henry Hub, a distribution hub on the natural gas pipeline system in Erath, Louisiana in the United States. It connects 9 interstate and 4 intrastate pipelines. Transportation capacity at the Henry Hub is 1.8bcf a day. Because of its importance to the US pipeline grid, it lends its name to the pricing point for natural gas futures contracts traded on the New York Mercantile Exchange (NYMEX) and OTC swaps traded on Intercontinental Exchange (ICE), as well as being the central spot for physical natural gas pricing and support. Spot and future prices set at the Henry Hub are generally seen to be the primary price set for the North American gas market.

4. Arbitrage, Multi-Commodities, and Spreads

4.1 Arbitrage

The definition of arbitrage is “the practice of taking advantage of a price difference between two or more markets”. In principle and academic use, arbitrage is risk-free. In common use, it may refer to *expected* profit, though losses may occur. There are always risks in arbitrage, some minor (such as fluctuations of prices or decreases in profit margins), some major (such as devaluations of currency or derivative). For the New Zealand energy industry, arbitrage opportunities will be mostly utilized by companies who produce or consume gas. An example of an arbitrage opportunity for a producer would be to enter into a long term contract to sell his gas to a particular market at a fixed price to hedge his production and ensure he has a market. For a market consumer, such as a retail distribution company, they could enter into a storage contract arrangement, adding flexibility to always have a backup supply of gas when supplies are not readily available on a given day due to unforeseen circumstances, such as a force majeure or major weather event, such as a tsunami or earthquake. More arbitrage opportunities may evolve over time as the market becomes more sophisticated and more products are added, such as financial derivatives trading.

People who engage in arbitrage are called **arbitrageurs**, such as a bank or brokerage firm. This term mainly refers to trading in financial instruments such as bonds, stocks, derivatives, commodities, and currencies. Arbitrage is not simply the act of buying a product in one market and selling it in another market for a higher price at a later time. The transactions must occur simultaneously to avoid exposure to market risk. Successful arbitrage transactions will be a balanced transaction, where the buy and sell offsets each other for the highest amount of profit to be made while also mitigating possible risks in each time period.

4.1.1 Arbitrage Mechanics

Arbitrage is the practice of taking advantage of a state of imbalance between two or more markets. Where this can be exploited (after transaction, storage, and transport cost) the arbitrageur locks in a risk-free profit without investing any of its own money. In general, arbitrage ensures that the law of one price will hold. Arbitrage also equalizes the prices of assets with identical cash flows and sets the price of assets with known future cash flows.

4.1.2 Law of One Price

The “law of one price” means that the same asset must trade at the same price on all markets. Where this is not true, the arbitrageur will buy the asset on the market that has the low price and simultaneously sell it short on the market with the higher price, will deliver the asset to the buyer, receive the higher price, and pay the seller on the cheaper market with the proceeds and pocket the difference. Short selling in commodity markets usually means

the trade is with a broker where the counterparty has a margin account, or collateral. The counterparty takes a position where he sells an asset, such as a natural gas contract, making his position 'short' for that time period. The broker then will watch the client's position and alert them once the supply opportunity arises.

4.1.3 Assets with Identical Cash Flows

Two assets with identical cash flows must trade at the same price. Where this is not true, the arbitrageur will short sell the asset with the higher price and simultaneously buy the asset with the lower price, fund his purchase of the cheaper asset with the proceeds of the sale of the expensive asset, and pocket the difference, then deliver on his obligations to the buyer of the expensive asset with the cash flows of the cheaper asset.

4.1.4 Assets with a Known Future Price

An asset with a known price in the future must today trade at that price discounted at the risk free rate.

Scenario 1:

Where the discounted future price is higher than today's price:

1. Arbitrageur agrees to deliver the asset on the future day, sells it in the forward market, and simultaneously buys it today with borrowed money.
2. On the delivery day the arbitrageur hands over the underlying and receives the agreed price.
3. He then repays the lender the borrowed amount plus interest.
4. The difference between the agreed price and price owed is arbitrage profit.

Scenario 2:

Discounted future price is lower than today's price:

1. Arbitrageur agrees to pay for the asset on a future day, buys it forward, and simultaneously sells short the underlying today, and he invests the proceeds.
2. On the delivery date he cashes in the matured investment which has appreciated at the risk-free rate.
3. He then takes delivery of the underlying and pays the agreed price using the matured investment.
4. The difference between the maturity value and the agreed price is the arbitrage profit.

4.1.5 Arbitrage Examples in Physical Natural Gas Trading

The two main examples of arbitrage in physical natural gas trading are transportation and storage. In some markets in the United States, shippers entering into firm transportation must pay a reservation or demand fee to own firm capacity. This fee is charged whether the capacity is used or not. When making the business decision to utilize the transportation, a trader will weigh the variable cost of usage plus any additional commodity fees and fuel cost against the price where the supply could be bought versus where the market could be

sold. A business decision will be made whether it is more profitable leave the transport “idle” if the cost of buying and selling on the open market will be less expensive between the buy point and the sell point than the variable cost utilized in the transport.

Hedging and trading storage capacity can be one of the most interesting and profitable structure transactions in the natural gas industry. If accurately evaluated and properly hedged, storage can provide a broad range of trading opportunities, whether it is used as arbitrage vehicle or a tool for operational purposes.

The basic idea behind storage from an operational standpoint is that it provides flexibility for a pipeline, producer, or an end user during periods of discrepancy between supply and demand. During high or low demand cycles, these market participants can utilize storage capacity to smooth out the peaks and valleys in their supply and demand profits. Hedging the cost of storage for these purposes is sometimes difficult and is viewed by some market participants as a cost of doing business which can’t always be avoided or minimized. An example would be miscalculating injection or withdrawal expectations from customers in periods of high demand due to extreme weather conditions. The value of arbitraging storage as a trading tool will provide far more profits than the occasional risk of an outlier, such as a rare weather event.

From a trading perspective, storage capacity can be utilized to protect against or profit from discrepancies between forecasted low demand cycles and high demand cycles and the resulting price discrepancies between the two.

New Zealand has one storage facility, the Ahuroa Gas Storage (AGS) facility in Taranaki, New Zealand. Opened in May 2001, it is the first storage facility to be developed in the country. It has extraction capacity of 45 terajoules a day (TJ/d). The project was developed by Contact Energy and Origin Energy. Origin owns a majority stake in Contact and is operator of this facility.

This storage facility could provide operational flexibility for Contact and potentially third parties. It will enable the company to inject or store during periods of low demand, and extract or withdraw during period of high demand or high price. The facility could insulate operations against gas price fluctuations. Potentially, It would also be available to receive gas from a number of other sources such as any future natural gas imports.

4.2 Natural Gas in the Electricity Picture

In New Zealand, 70% of natural gas demand is used to generate the high heat required for electricity generation. In 2011, 18.4% of the total of electricity generated was from gas fired power plants. Gas use for electricity generation began in 1976 when the New Plymouth Power Station was converted to dual oil/Kapuni gas operations. It was further converted in 1979 to run on Maui gas. The New Plymouth Station was decommissioned in 2007, and today the main gas fired generators are operated by Contact Energy, Genesis Power Limited, Mighty River Power, and Todd Energy.

Internationally, natural gas trading is very closely aligned with power trading. More and more power generators are moving to natural gas as a supply source as a safe, efficient,

and more environmentally friendly commodity, compared to coal or fuel oil. Power generation demand centers rely on natural gas to source supply centers for these gas-fired plants. Trading gas and power together has become more of a standard process in North America, as the indexes and spot prices are correlated with similar geographical locations. For example, a power trader serving markets in the northeast United States demand area must be mindful of natural gas prices and the locations on pipelines whose transportation ultimately supplies the power demand. Advantages in cohesively aligning gas and power trading in organizations, along with open communication of strategies, fundamentals and market objectives will provide a clearer understanding for the two groups to work together for a common objective, which is to make as much profit as possible for each, without hindering the other.

In February 2013, there were curtailments in the northeast due to capacity restrictions and constraints on some of the US pipelines delivering natural gas to the major demand centers in the area. Northeast US power markets were hindered by the capacity restrictions on Algonquin Gas Transmission and Texas Eastern Transmission in locations near Boston, Massachusetts and New York City. Power traders took natural gas position on Algonquin and Texas Eastern in the northeast US to hedge power prices. This strategy failed if the traders were buying on the spot market since pipeline capacity constraints caused natural gas prices to widely swing up and down daily depending on weather, demand, and capacity utilization. The lesson learned in the industry was that until more unified approaches to managing natural gas demand in the power markets, strategies to mitigate winter crisis demands will not necessarily be successful. The same markets could have been supplied by firm contractual setups on the pipelines in question, which could have alleviated the problems caused by buying on the spot market, but there is no guarantee of success.

4.3 Gas and Power Spreads

A *spread* is the difference between the buy price and sell price, often referred to the bid-offer spread. The trader's goal is to earn a profitable spread every day. The bid-offer spread is widely used as an accepted measure of liquidity cost in exchange traded securities and commodities. Under competitive conditions the bid-offer spread measures the cost of making transactions without delay. In both gas and power instances, if the trader is not making a market they can instead obtain a market either OTC or on the exchange. Even though the last price traded on the exchange is printed on the quote screen, good commodity traders will always ask the **market** for that product before placing a buy or sell order.

They do this for four main reasons:

1. On an exchange traded commodity, the last price posted on the screen doesn't necessarily reflect the current market.
2. Most quote screens do not offer the current bid-offer spread.
3. Some over the counter derivatives have no quote screens to rely on for pricing, but only over the counter brokers who are in constant contact with other traders. (Refers to financial instrument)
4. To obtain additional market information other than price (such as how many buyers are there vs. sellers, or how much volume is on the bid vs. the offer).

5. Risk and Exposure

5.1 Definition and Context

Risk is the chance that an investment's actual return will be different than expected. The importance of having a centralized risk management function cannot be overstated, especially in larger trading organizations. There are four main purposes of risk management:

1. Provide daily position reports to senior management that detail the organization's risks and all trading functions.
2. Allow for efficient and accurate management of trading opportunities other than current month cash transactions.
3. Promote specialization among various business activities by breaking the activity into separately functioning, and profit oriented units.
4. Provide market information for decision making.

5.2 Risk Profiles

The definition of risk profile is an evaluation of an individual organization's willingness to take risk, as well as the threats to which the organization is exposed. A risk profile identifies:

1. Acceptable level of risk an individual or corporation is prepared to accept. A risk profile attempts to determine how the company's willingness to take risk (or aversion to risk) will affect its overall decision making strategy.
2. The risk and threats faced by an organization. The risk profile may include probability of negative effects on risk and a measure of the potential cost, level, and disruption for each risk.

In general, the greater the risk associated with any investment, the greater the return required. Risk is often measured in terms of risk probability, the likelihood that a risk will occur, and risk impact, a measure of the consequences of the risk that occurs.

5.2.1 Energy Market Perspective

To reflect the natural gas industry perspective, different kinds of companies will have varying risk profiles:

- A regulated entity such as a pipeline or utility will have very low tolerance for risk. Regulated entities have a specific expected return based on rates and fees

outlined in tariffs or public utility documents either agreed upon by market participants or set by a government regulator.

- A producer's risk may be determined by an expected rate of production in the future that has been committed to a party paying an estimated future price, based on a project profile set up by the company. When the production comes in at a higher or lower rate, the producer's risk is adjusted accordingly on internal reports and in management discussions, and then reflected in the final return received when the market takes delivery, noting actual production volumes, rather than just estimates when determining original risk. If construction issues, financing, or equipment availability end up delaying or curtailing production, the risk the producer is willing to accept may be acceptable if the price for delivery to market justifies the risk.
- A trading company's position on risk may be to accept a higher expectation of risk to maximize greater returns on profit in the long term.
- Power generators will have a varied risk profile, usually dependent on the season. Gas-fired power plant generators have the challenge of meeting specific natural gas demands to fuel their power plant that has different and varying deadlines. In the US, gas transmission providers have a different set of rules for contracts and scheduling that are usually based on a total gas day, whereas power transmission providers usually trade for 24 separate hours or a strip of hours, such as an 8 hour strip for a day rate, or a 16 hour strip for weekends, or a number of varying hourly price structures. This poses a challenge during some peak demand cycles in the United States. Risks are much higher during winter or summer peak usage and lower during spring or fall when temperatures are milder.

5.3 Risk Management

Successful trading companies evolve from effective and detailed risk management. The setup of the risk management "food-chain" is critical. Time and effort must be taken to ensure that everyone understands their personal responsibility in how risk is taken from the front office to the back office, the CEO down to the receptionist. It's probably in everyone's objectives, but if it's not sponsored by the company in its mission statement, part of annual training, supported by corporate systems and technology, and risk strategy isn't always on everyone's mind. Most people think it's the traders' responsibility to worry about risk, but there is more than one kind of risk. Losing money is just one kind of risk. More problematic ones will be discussed in the next chapter.

The primary risks of trading to a company that has never traded gas on a market would be operational, credit and counterparty risk. If a company doesn't understand the regulations or how participants work together from the producer to the end user, it could cause significant risks. There are penalties from regulators for violating market rules so everyone should have proper internal training to ensure familiarity with particular tariffs and government regulations. Having agreements in place with credit worthy partners, making sure employees are properly trained, and hiring people who have some experience in some aspects of the marketplace could confidently convince new investors or respective Board of Directors to enter the marketplace.

5.4 Risk Strategy

To Organize Risk Management

1. Setup each trade function (physical gas, storage, transportation, power trading) in a separate *book*, essentially a record of all transactions that have occurred or will occur detailing price, volume, counterparty, location, and tenor of each transaction.
2. Each function (usually divided by commodities such as a separate natural gas desk or power desk), should have its own team of support personnel including systems, nominations, confirmations, and accounting. These teams should have proper skills and training. Generally, you need detailed skills, such as an IT background for systems, or an accounting or financial background for scheduling or accounting. The functions are usually very detail oriented in order to ensure accuracy throughout the 'life of a deal', from the trade to settlement. This is the control group that can identify problems throughout the deal time frame, meaning they are the personnel who control the process. There should be a person from each group in the process responsible for their particular role, from the trader who books the deal, the scheduler who nominates and makes sure the volumes flow, to the risk group who evaluates the profits & losses and finally to accounting, where the deal is settled and payment made or received.
3. The trade capture system software or hardware needs to be as robust as possible. There are packaged software systems available in the marketplace to handle most aspects of trading. The more transactions a company has, the more important it is that a higher level of technology should be used to track them. It should be sophisticated enough to capture every aspect on the trade from physical attributes, scheduling volumes, settlements, analyzing market risk, managing positions, and running profit and loss. This will save money in the overhead cost in the long run. Beginning set up of static data and deal flow processes are key to timely and accurate output. For smaller companies, Excel macro enabled spreadsheets may suffice, but as transactions become complicated, it's more difficult to analyze risk from a spreadsheet.

5.4.1 Setting up Separate Books

Depending on the complexities of the particular company, each business unit might have multiple "books". For physical gas trading, a company may separate books into fixed price book, index book, transport book, or a storage book. Each could have appropriate cost and profits allocated to get a more detailed view of which exact traders or teams are meeting financial obligations.

5.4.2 Product Offering in New Zealand

Currently New Zealand does not participate in financial natural gas trading. As the New Zealand market evolves and becomes more sophisticated, the need or opportunity to add financial products to the complexities of a company's risk model may develop.

6. Credit and Counterparty Risk

6.1 The 5 C's of credit:

1. Capital:
Capital has become a standard of measuring the financial stability of a company, rather than just the balance sheet. Capital requirements are changing in the global marketplace for financial institutions to be measured by a capital ratio to risk weighted assets, to protect against losses and to give confidence to shareholders that the company is in sound financial shape. An example is the implementation of Basel III regulations in Europe going on today.
2. Capacity:
One of the criteria of a credit review is to determine the ability of a company to take on risk and make a profit for its shareholders. The 'capacity' is determined by weighing the rating of the company by any public agency, reviewing financial statements and evaluating specific assets and/or liabilities. An onsite review of facilities may be involved or gathering professional opinions, such as an engineer to provide an official record of verifying production reserves, as in an oil or gas company.
3. Conditions:
Various conditions can affect a company's credit standing. The proven track record of profits over a period of time will improve the chances of achieving a good credit review and keep the company in good standing with public credit rating agencies, if the company is public. Market conditions, such as a stock downturn from a negative press report or a bad earnings year can cause a downgrade of the company.
4. Collateral:
A letter of credit or a guaranty may be required after a credit team deems a company or a counterparty they wish to do business with analyzing all other standards. It may be required for all customers, or it may be an additional requirement for those companies whose credit was not as high as normal standards.
5. Character:
Most companies have a certain set of values they want to maintain, which could be a part of a larger mission statement. In evaluating potential clients, the same standard could be applied, such as making sure management is of high moral character, or that nothing in any background checks would embarrass anyone doing business with or for that company.

6.2 How Does Credit Risk Arise?

Credit risk is the potential for loss due to failure of a borrower to meet its contractual obligations to pay a debt in accordance with agreed terms. In commodity trading, credit risk usually refers to counterparty risk, also known as default risk; a risk that a counterparty will not pay what it is obligated to do when it is supposed to. Counterparties may have

temporary liquidity issues or longer term systemic reasons. Counterparty may have had too much exposure to a particular market risk, which is the potential loss due to changing market prices or values. Intangible conditions of a company may not be apparent to the public, such as internal scandals or mismanagement, and therefore not reflected in the stock prices until the media reports the news causing reputational risk fallout. The counterparty risk of default can be from any party on either side of the transaction. The company's financial condition may not be reflected in balance sheet valuations timely enough to avoid default scenarios, such as bankruptcy or credit downgrade from a national rating agency, such as Moody's or Fitch in the US. The failure of AIG in the US, along with other counterparties in the 2008 financial crisis, and the subsequent government bailouts, prompted the international financial reforms in the works today in the global markets.

6.3 Who Are You Trading With?

It is critical in any organization that you "Know Your Client". A diligent review should be done on the financial situation on any company or counterparty where a contract or deal is planned. It is better to be proactive than reactive, if there is going to be a credit default in the future. The character of a company, along with the other 5 C's of credit, is a good barometer to judge whether they would be a good business partner.

During the process of setting up or vetting new clients, the following analysis should be made:

1. Review financial statements
2. Assess creditworthiness
3. How long have they been in business?
4. Do any red flags appear in background searches of company or principals?

People in management or sales teams should have actually met the client. This may sound like an obvious point, but international policies are in place where it must be noted who in your company has a relationship with the client. The US Patriot Act issued after 9/11 implemented strict rules about Know Your Client. MiFID (Markets in Financial Instruments Directive) rules in Europe require firms to categorize clients as eligible counterparties.

Generally, training for client analysis, internal setup, and regulatory policies is handled by a compliance department. International trading companies usually have robust annual training programs due to continued regulatory scrutiny which also includes trading practices, money laundering, insider trading, and reputational operational risk.

Note, if an exchange is operating as central counterparty, CCP only the company owning the exchange represents potential credit risk.

6.4 Credit Risk Management

Credit Risk Management (CRM) is a process that involves identification of potential risk, measurement of these risks, the appropriate treatment, and the actual implementation of risk models.

For a company trading commodity products, a specialized credit officer and/or credit team with the experience evaluating energy products, along with the companies that trade them, should be in place. Their roles are setting and monitoring credit terms, working with structure transaction teams on specific deals to insure appropriate credit risk is determined, and making sure systems that interact with other departments are updated and monitored in real time to avoid entering into transactions with counterparties who are not creditworthy. Credit teams are responsible to maintain updated credit ratings, either using internal metrics or using credit ratings from standardized publications or sources, such as Moodys or Fitch in the US.

6.5 Credit Risk Valuation

6.5.1 The Structure of Credit Risk Valuation

Valuation of credit risk in commodity trading usually happens at a portfolio level which may include a particular subset of books, clients, or products all part of one business such as physical natural gas desk. The portfolio will include all of the different supply and demand counterparties' credit information relating to the transaction comprising every aspect of the physical natural gas part of the business. A portfolio could be redefined into subparts to further analyze risk and run modeling evaluations. This is especially critical in larger structure transactions which have multiple teams running various models and metrics.

Figure 4: Possible Structure Setup

| Possible Structure | |
|--------------------|--|
| Business Unit | ABC Gas & Power |
| Book | Physical Natural Gas |
| Portfolios | Region (East, West, etc...) |
| Sub Portfolios | Transport Physical Gas Storage Structured Transaction |

Source: Bullogic LLC

6.5.2 How is Credit Risk Valued?

Determination has to be made by management in the structure of the company whether it recognizes accrual or mark-to-market accounting. Accrual accounting will reflect profits or losses in the month that the trade occurs, particularly showing valuations for future trades in future months, whereas mark-to-market accounting will show profits and losses the day the trade is executed on a current day report, no matter what period the trade reflects. Each type of accounting model will produce different evaluations of credit risk. For a trade with a component in the future, such as a storage transaction, where one leg of the deal is injected today, and the withdrawal of the deal happening in a future month, mark-to-market

accounting will show any profits or credit risk today. Accrual accounting reflects attributes of the deal such as credit exposure and profits in the future period.

Credit teams should have technological models and valuation programs to assist in evaluating credit risk. Risk in portfolio can be considered as pure default risk, or loss due to changes in market values and rating changes. Default mode models only take into account default risk; movements in the markets' value or any company's credit ratings are not relevant. Mark-to-market models consider the impact of changes in market values, credit ratings, and the impact of default events. These models allow a fair market value to be given to the portfolio. Since a value has to be computed to surviving transactions with other counterparties or portfolios as well, mark-to-market models are computationally more intensive. For trading portfolios, mark-to-market models are more appropriate, since the design of trading is to account for positive or negative PNL as it is traded, and not when it is settled once the deal is finalized. For hold to maturity portfolios with typically illiquid loans or assets, default mode models are more applicable, since these models more appropriately capture this type of risk. When no market prices are readily available mark-to-model approaches are a good alternative for mark-to-market. Advanced models go beyond pure credit risk and include interest rate scenarios.

6.6 Benefits of a Central Counterparty

One way to manage counterparty risk is by trading on a central counterparty market. CCP's eliminate the credit risks of participant members (or at least limit exposure to one party - the CCP).

Role of CCP:

- Acts as a central clearing counterparty for all transactions reducing customers' risk exposure to multiple counterparties. Clearing relates to identifying the obligations of both parties on either side of a transaction.
- Provides settlement of market transactions, which occurs when the final transfer of securities and funds occur.

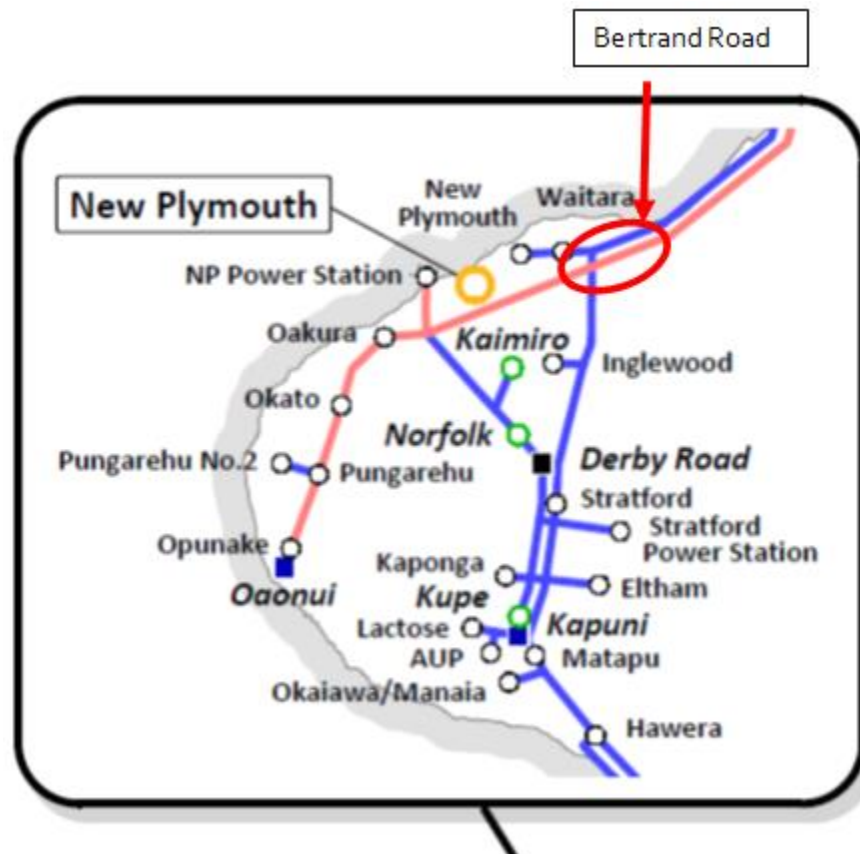
7. Current State of Exchange Trading in New Zealand

As of this writing, there are two different trading platforms available for trading natural gas in New Zealand: the New Zealand Gas Market (by NZX) and emTrade (by Transpower).

6.7.1 New Zealand Gas Market

NZX Limited holds a variety of roles in the financial and energy market space, operating the New Zealand securities and derivatives markets, as well as aspects of the energy markets. They are also a provider to the Gas Industry Company as the Allocation Agent for downstream gas allocation. The NZ Gas Market is not a registered securities market. This market is designed for physical trading of gas at the wholesale level, meaning participants must be able to make arrangements for the supply or uplifting of physical gas in order to fulfill their obligations under any contracts entered into on this market. The market is governed by a set of rules and participants in the market agree to bind themselves to those rules by executing a Participation Agreement.

Figure 5: NZX Hub



Source: NZX

Features of New Zealand Gas Market:

- Web-based electronic trading platform
- Open 7 days a week from 8:30 am – 10:15 am
- Access to real-time market results and data.
- Physical trading location is a virtual welded trading hub at Bertrand Road, on the Maui pipeline
- Traders are able to enter bids and offers for daily trades (up to 30 days in advance), weekly trades (up to 4 weeks in advance), and monthly trades (up to 6 months in advance)
- Bids and offers are listed anonymously. Traders are required to maintain whitelists of traders with whom they are prepared to make deals.
- Trades may be anonymous or transparent. Traders have the ability, both in listing and in accepting, of specifying if they wish to remain anonymous.
- Trades are formed when a trader accepts and posted bid or offer. The acceptance of a posted offer results in a binding bilateral contract between the buyer and seller. For a transparent trade, the system will notify both parties of the trade and the

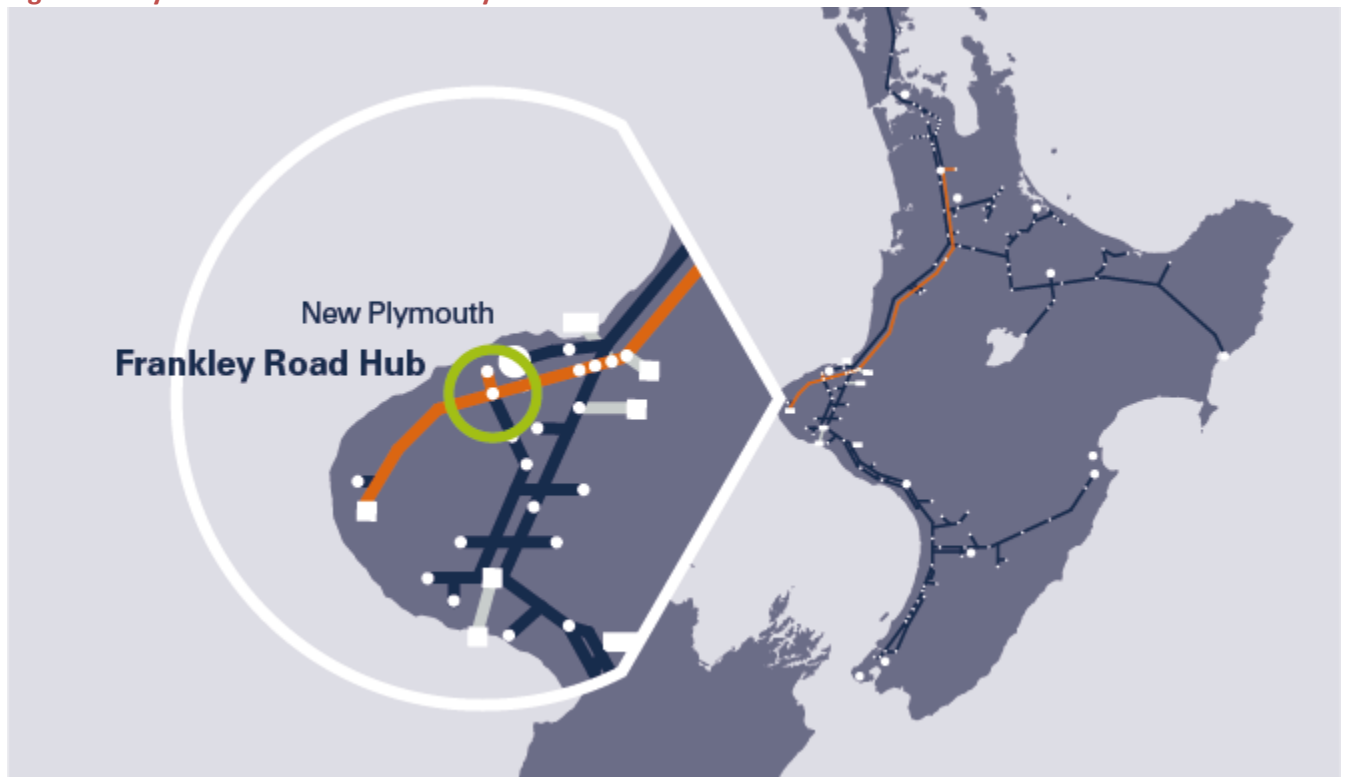
counterparty's identity. If either buyer or seller wishes to remain anonymous, then the system will notify only that a contract has been formed with an anonymous party.

- If the trade is not anonymous, then the buyer pays the seller directly for the purchased gas. If the trade is anonymous, then payment is made through a Settlement Operator.
- In the case of non-payment of an anonymous trade, then the Settlement Operator makes the identities of buyer and seller known to each other.

6.7.2 emTrade

emTrade has been developed by Energy Market Services, a commercial division of Transpower New Zealand Limited, and an industry consortium consisting of several key industry participants. emTrade aims to provide a centralised exchange platform and standardised terms for buying and selling natural gas on the Maui and Vector transmission pipelines. It offers end-to-end anonymous trading and a central counterparty to settle the markets, both financially and physically.

Figure 6: Physical Natural Gas - Frankley Road



Source: emTrade

Features of emTrade

- emTrade is the Central Counterparty, providing trading, risk, and operational benefits.

- Decreased counterparty credit risk
- Allows for multilateral exposure netting
- Consolidates bilateral exposure into a single, low risk exposure
- Central counterparty arrangements facilitate full end-to-end anonymity
- Open for trading all day, 7 days a week.
- 2 Markets offered; on-the-day for deliveries today and day-ahead for future deliveries up to 6 months.
- Has 2 market makers providing price support and liquidity.
- Access to real-time market results and data.
- Access to emTrade Natural Gas indices.
- Market reporting.

Summary

The New Zealand natural gas industry has tremendous potential for a spot market to change the economic climate in the industry. A spot market that is traded on exchanges via an electronic platform will transform the way businesses view trading. Growth in production, coupled with a robust demand market, will pave the way for new companies to get involved in the gas industry, either as a market participant on the supply or demand side, or as a newly developed marketing company, performing various functions for supply/demand participants.

Power generators and retailers can be confident they will have adequate natural gas supply at a competitive price, as well as be able to lock in these prices in the future. A spot market will pave the way for businesses that may not have considered trading natural gas in the past to consider the opportunities for cost-saving and profits that can be enjoyed by successful trading. For a new trading venture, careful planning in the early stages of systems design and developing sound risk strategies will greatly improve chances of long term success.

A market will provide many advantages for companies that are considering becoming a marketing company or getting in the energy business for the first time.

Currently, New Zealand does not have an exchange platform available for natural gas trading. The entrance of an electronic platform is appropriately timed with the expanding marketplace in New Zealand's energy sector today. As the industry comes to depend on the benefits of working with an electronic exchange in the short term, more and more participants will join. As the number of players grow, so will profits and opportunities.

Characteristics of NZX and emTrade:

| NZX (proposed) | emTrade (active Sept 2013) |
|---|--|
| Bilateral settlement | Central Counterparty |
| Maui pipeline delivery at virtual welded trading hub at Bertrand Road | Maui and Vector pipeline delivery at Frankley Road |
| Notional Welded Point physical delivery model | Hub delivery with standard code arrangements |
| Same-day cash out for full non-performance quantity | Standard code arrangements, no special cash out arrangements |
| Open 7 days a week, 1.75 hours a day | 7 days a week, 9 hours a day |
| Whitelist, no prudential assurance | Fully collateralized CCP |

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