



Transmission Pipeline Gas Balancing: International Benchmarking and Good Practices

James Whistler, Joe Sant | 28 February 2014



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For information on this paper please contact:

James Whistler
emTrade
L19, PwC Tower
113-119 The Terrace
Wellington 6011
New Zealand

+64 4 590 6843 | james.whistler@emtrade.co.nz

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1. Introduction

Pipeline balancing and associated markets and protocols have been a topic of debate for the New Zealand gas industry for some time. This debate has continued recently on the back of;

- (a) the recent Maui Pipeline Operating Code (**MPOC**) change request application submitted by industry to the industry for pre-consultation prior to being submitted to the Gas Industry Company (**GIC**); and
- (b) Maui Development Limited's (**MDL**'s) own MPOC change request already submitted to the GIC.

This paper highlights differences between the current and proposed gas balancing practices in New Zealand, and draws comparisons against internationally recognised good practices as well as arrangements used in more established regions.

2. Reference Material

This paper is premised on the guiding principles on gas balancing set forth by European Regulators Group for Electricity and Gas (**ERGEG**). These principles have been widely relied upon as the international benchmark for good practices as they relate to transmission pipelines, associated markets and operational procedures. The ERGEG principles have been contributed to by a wide cross section of the natural gas supply chain, including the largest; Exploration and Production companies; Transmission System Operators (**TSOs**); and downstream retailers, traders and consumers.

In addition, this paper references various regulatory and academic papers produced over the last 20 years. Most relate to the European energy markets as the size, scale and period in which energy markets were liberalised are similar to New Zealand.

The choices taken in Europe with regards to gas balancing retain differences from one country to another, but each have a foundation similar in good practice. There has been much debate over the lengthy development of European gas transmission arrangements, resulting in a raft of consultation materials produced. These are available for study (see Appendix B).

The United Kingdom (**UK**) provides an excellent case study into how forward thinking market arrangements assisted the transition into what is now seen as the most liberalised gas trading market in the world, complimenting commercial practices and long-term planning for asset requirements. The success of balancing in the UK is primarily down to the effectiveness and competitiveness of the spot markets in a complex physical delivery environment.

3. Summary

Overall, the regime currently in place in New Zealand, although robust in most areas, diverges from what is considered good practice when it comes to gas balancing. Most parties are unable to gain certainty over risk and are therefore unable to reasonably hedge their exposures, which is a fundamental flaw in design and should be corrected promptly.

The BGX, whilst a positive step when introduced, failed to evolve into a double-sided competitive marketplace. The effect of this is overly punitive cash out and peaking prices, with the industry subsidising windfall profits to a limited group of BGX participants.

The Back to Back version of the MPOC and the Industry CR, together, represent a significant step towards fixing these shortcomings and put New Zealand on a positive path towards good practice in gas balancing. emTrade encourages affected parties to support the Industry CR and look to further enhancing the gas balancing regime to fully align with the principles set out in this paper.

A UK case study shows that for New Zealand to adopt good industry practices in gas balancing, a single leap to the finished article is not appropriate. However, it would be extremely helpful to lay clear the direction of travel so that industry participants have certainty and are able to adapt their commercial practices as gas balancing rules evolve.

The UK did this through firm regulation while New Zealand will more likely approach this as a negotiation between shippers and the TSOs. It should also be considered that steps such as zero tolerances, intra-day balancing and marginal pricing should only be introduced if the TSO can highlight to shippers that their behaviours are not sufficient in maintaining a balance in the network simply due to market forces.

4. Foundations of Good Practice

Prior to looking at how New Zealand's pipeline balancing regime works (or may work in the future), let's start by setting out benchmark expectations of what an open, transparent and efficient balancing mechanism should consist of. The choice for New Zealand is how far to move along the path to total liberalisation considering the market environment in this country.

Key principles from the European Regulators Group for Electricity and Gas (**ERGEG**) guiding principles on gas balancing¹:

(a)	<i>"market participants should have access to appropriate information, adequate re-nomination procedures and flexibility tools/services so that they can manage their imbalance positions (and therefore risk) efficiently, taking into account the relevant characteristics of the balancing system, in particular the balancing period and/or the width of the tolerance margins"</i> Para 1.9 ¹
(b)	<i>"Where a TSO's balancing regime permits the acceptance of bids and offers for balancing gas as a means to balance the system it should procure flexibility (including gas) in a transparent and non-discriminatory manner using market based mechanisms"</i> Para 1.27 ¹
(c)	<i>"In relation to balancing costs TSOs should be cost neutral and have the correct incentives to ensure that the costs incurred of taking residual balancing actions are efficiently incurred."</i> Para 1.26 ¹
(d)	<i>"TSOs shall provide sufficient, well-timed and reliable on-line based information on the balancing status of network users"</i> Para 3.41 ¹
(e)	<i>"It shall be the primary responsibility of network users to balance their own inputs and offtakes over the relevant period according to the rules and incentives of the respective balancing regime"</i> Para 4.11 ¹

None of the above will be particularly unfamiliar to those experienced in the on-going debate on implementing an efficient balancing mechanism in New Zealand. However, these key principles highlight that gas balancing is a process with responsibility between the TSO and the Shippers to come together in a manner that creates the fairest and most efficient overall outcome.

Transparency of quality information; open and competitive markets to manage risk; and completing actions in as cost-less a manner as possible, are the expectations placed on a reasonable and prudent TSO.

¹ ERGEG_GGPGasBalancing_PC_2006-04-20 (Guidelines for Good Practice for Gas Balancing)

5. Physical Balancing: Ex-Ante vs. Ex-Post

In seeking a consistent approach to balancing arrangements across multiple regulatory markets, the ERGEG has published extensive public consultation material that allows excellent reference when considering how New Zealand could, without controversy, design a lasting approach to balancing.

ERGEG states, in reference to the role and responsibility of the TSOs, that:

"Each TSO retains the overall responsibility for the economic and efficient operation of its system and therefore should retain a residual role to maintain physical balance to ensure the safe, efficient and reliable operation of its system, subject to the incentives, information and flexibility and tools provided to shippers to balance their individual portfolio." Para 3.2¹

It is a natural concession that the TSO is the owner/operator of its asset, and that safe and efficient operation is at the core of any network's code and Standard Operating Procedures (**SOPs**). However, at the same time, it cannot be overlooked that this monopolistic asset is also an integral part of the gas supply chain. It is in place for the good of the entire gas industry and, most importantly, end users.

In New Zealand, without an industry regulator proper, it is the TSO that has a direct responsibility as a reasonable and prudent operator to ensure that its balancing arrangements lead to efficient operation on behalf of industry and are non-discriminatory.

Keyaerts and D'haeseleer build on ERGEG principles and state:

"The primary objective [of gas balancing] is to transfer the financial responsibility for ex- post balancing services to unbalanced shippers by means of balancing charges. These charges should, in principle, reflect the actual balancing costs for the system operator. The second objective consists in incentivising shippers to balance ex- ante, often by means of a non-cost-reflective penalty for unbalanced positions." Section 2²

'Ex-post balancing' means that end-of-balancing-period imbalances are financially settled through cash out. Short shippers pay a fee to the TSO for gas consumed over and above that injected, whereas long shippers receive a fee from the TSO for gas injections over and above the volume consumed. Ex-post arrangements could come in the form of 'full' cash out, where all imbalances over a tolerance are cashed out, or 'net' cash outs, where imbalances on the net side are cashed out (prorated against the net quantity).

² Forum Shopping for Ex-Post Gas-Balancing Services, Nico Keyaerts and William D'haeseleer (July 2012)

Good practice of balancing does not require a TSO to take physical actions to balance line pack on an ex-ante (or reactive) basis. Instead, consistent ex-post management of operational imbalance is viewed as being far more effective than occasional reactive balancing actions.

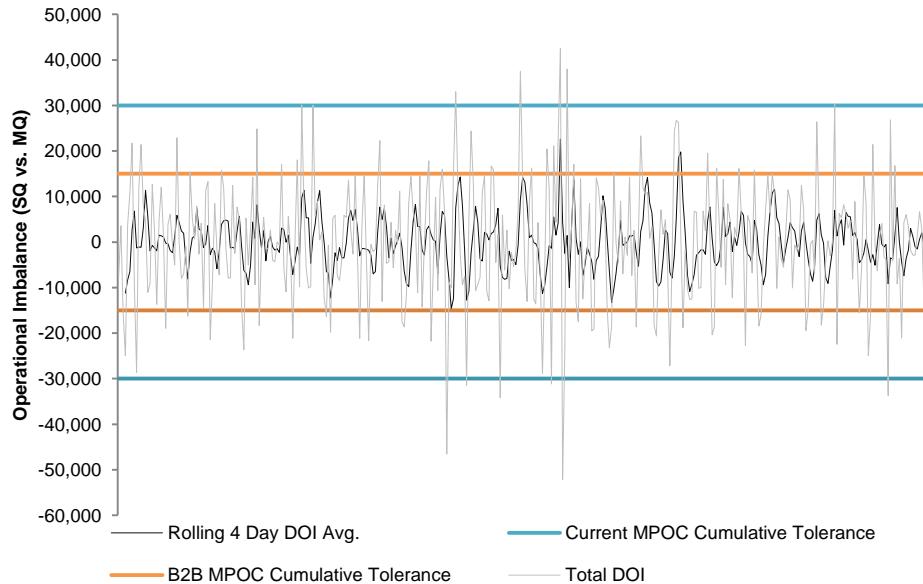
In relation to the ERGEG statement that a TSO should always retain ownership of how their transmission asset should be operated, ERGEG also state: "***The balancing rules should be designed to minimise the residual physical balancing role of the TSO subject to the safe and economic operation of the network***". Para 1.5¹

Specifically, ERGEG contend that, if tight operational imbalance tolerance levels are necessary for safe and efficient operation or the balancing period is particularly short (hourly) then "***cost-reflective tolerance services... [that] facilitates competition***" should be offered.

For example, if MDL's Balancing Agent took a back-to-back balancing action / cash out every day (on an ex-post basis) for the net Accumulated Excess Operational Imbalance (**AEOI**), the Maui pipeline would likely be more stable, safe and reliable as compared to ex-ante actions.

An ex-post balancing regime is likely to have an increased frequency of cash out transactions (and balancing actions) over an ex-ante regime. However, provided that such transactions are at a spot market price this should be an immaterial effect as it is (when excluding inherent price movement) cost reflective.

Figure1: Daily Operational Imbalance (DOI) Analysis, 2013



Source: Maui OATIS, SQ/MQ Reports

Taken day-to-day, the DOI only breaches the current MPOC tolerances very occasionally. However, a more useful and insightful indicator is the 4 day average of the DOI. This is because there are significant day-on-day corrections taking place that would either be cashed out (under B2B with start of Day positions) or be incentivised away. Essentially, the 4 day average corrects for the tolerant 3 day Imbalance Limit Overrun Notice regime currently in place.

Should the pipeline require management intra-day due to critical conditions, the Critical Contingency Manager is in place to ensure the asset will never reach such low pressure to put that asset at risk. With that said, there has never been a Critical Contingency event that was caused by operational imbalance. Rather, unplanned outages or pipeline breaches have been at the root of all such events.

emTrade's view is that ex-post balancing action to manage DOI is more appropriate than the current balancing arrangements in New Zealand, and would align with good practice without compromising the TSOs RPO obligations as they relate to the safe management of the pipeline.

6. Pricing Structures and Incentives

The simplest pricing structure to apply to ex-post balancing is to cash out at a reference market price, independent of shippers actions to cause or mitigate the system imbalance.

Keyaerts and D'haeseleer also promote the TSO using proprietary trading of gas to procure balancing services and using the marginal price of dispatched flexibility (high for system short and low for system long) to determine cash out. This method relies on the TSO trading in a market to procure / sell gas rather than instructing a trade on behalf of offsetting shipping parties to return to acceptable tolerances.

Penalties offer a clear incentive to primary balance, but offer either the TSO an opportunity for revenue generation or windfall gains to individual industry participants, neither of which are appropriate. By cashing out against a start of day position – a party's imbalance at the end of the primary balancing period and the beginning of the residual or secondary balancing period – with the transaction and cash-out to be priced in the following day, shippers are unlikely to forego certainty in favour of an unknown market environment. As such, they are incentivised to manage their imbalance positions within the balancing period.

In the UK gas market (see case study in Appendix A); a progressive approach was taken with regard to pricing and associated incentives to primary balance. First, the market moved to a competitive spot market pricing structure, using the volume weighted average price. Then, once data quality and liquidity had improved, a marginal pricing structure was introduced to further increase incentives.

7. Procurement of Balancing Services

As ERGEG states in its core principles:

"Balancing rules shall be fair, non-discriminatory and transparent and shall be based on objective market based criteria. Balancing rules shall reflect genuine system and market needs taking into account the resources available to the TSO and to the network user." Para 1.3¹

...and

"It is important that network users are not exposed to undue risks that they cannot manage effectively and/or without incurring inefficient costs that could create barriers to entry to the market." Para 1.9¹

(a) Balancing Gas Exchange

MDL currently procures its balancing services on the ‘Balancing Gas Exchange’³ (**BGX**) – an electronic online tender system. Moving from a paper-based tender process in 2008, this was a positive step for MDL in making balancing arrangements more competitive and transparent.

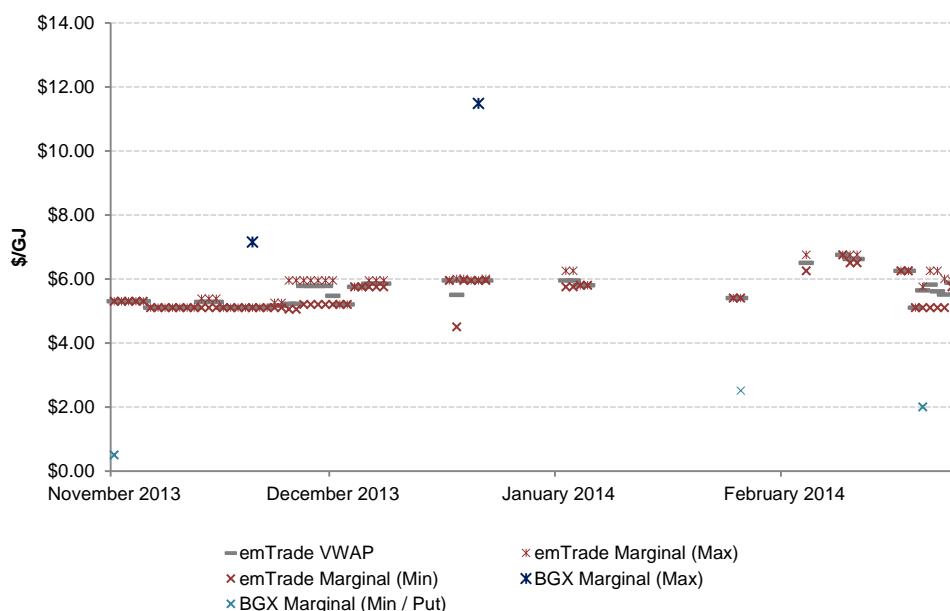
However, with plans of making the BGX into a competitive spot market⁴ never eventuating, MDL continues to use the BGX as its preferred procurement arrangement.

The BGX currently only allows “physical Welded Points⁵” to offer balancing services. This excludes Transmission Pipeline Welded Points. The effect of this is the creation of a significant barrier to entry for the majority of industry participants. As such, it is not reasonably available to the industry and fails to meet the ERGEG principles stated above.

(b) Market Power and Systemic Arbitrage

Due to barriers to entry, the BGX cash out prices are outside what could be considered as representative of market prices (see Figure 2 below).

Figure 2: BGX prices vs. spot market (emTrade)



Source: BGX FX Disclosure, emTrade public data

The TSO does not profit from this as they remain cost neutral. However, windfall gains go to those limited parties that can take part in the market.

³ www.bgx.co.nz

⁴ The ‘BGX2’ was marketed to industry in 2010 through 2012, which was essentially a spot market open to all Shippers

⁵ BGX, Balancing Gas Terms and Conditions,

http://bgx.co.nz/documents/Balancing_Gas_terms_and_conditions_20101102.doc

Further, with the introduction of spot markets, gas can be transacted with MDL on the BGX and then recycled into the spot market at a profitable spread without realising risk. Arbitrage – the simultaneous purchase and sale of gas in order to profit from a difference in the price – isn't wrong in itself, but if it arises due to one market being restricted or anti-competitive (sometimes referred to as systemic- or regulatory-arbitrage) it is a clear sign of market failure.

The underlying issue with systemic arbitrage in the form described above is that the windfall profits gained by the arbitrageurs are provided by the rest of industry. This is due to MPOC section 12 cash out provisions using the BGX prices to set charges to industry for operational imbalance.

Frontier Economics prepared a report for GDF Suez in which they state:

"It may be that shippers being out of balance in particular periods causes significant costs for the relevant TSO, in which case cost reflectivity would indicate that those shippers should pay a high price for being short and receive a low price for being long. However, this will result in strong incentives to balance – which may create a barrier to entry if sources of short term gas which could be used to achieve a balanced position are in the hands of only a few shippers."
 Section 6.3⁶.

emTrade's view of good practice for gas balancing procurement is that it must be non-discriminatory and the rules of balancing should be inclusive.

8. Ability to Hedge Risk

As discussed above, ex-ante balancing by the TSO is not in line with good practice. One of the main reasons for this is the creation of uncertainty and the synthetic shortening of the allowable primary balancing period:

"Balancing mechanisms with more complex incentive schemes go beyond just imbalance settlement. They impose penalties for unmatched positions inside the formal balancing interval, effectively reducing the balancing interval." Section 2.2.2⁷

A lack of certainty for users of the gas pipeline hinders commercial decision making and, in our opinion, runs contrary to the Operational Balancing Agreement set forth in the MPOC. It also fails to provide parties with certainty of risk – a key ingredient in an efficient balancing solution. A lack of certainty in the timing of balancing actions negates the basic rules of operation for all shippers. That

⁶ Target Model for the European Natural Gas Market, Frontier Economics, London (June 2011)

⁷ Forum Shopping for Ex-Post Gas-Balancing Services, Nico Keyaerts and William D'haeseleer (July 2012)

is, the entitlement to daily nominations (as agreed by the TSO, producers and shippers in the MPOC) becomes less than daily when the balancing agent can take action on an ex-ante basis.

emTrade's view is that by adopting ex-post secondary balancing and spot market pricing structure, all parties bearing risk gain volumetric certainty and access to a market to hedge price. This is consistent with good industry practice and will lead to a more stable, fair and efficient regime.

9. Current New Zealand Environment

(a) Back-to-Back Change Request

MDL's October 2011 proposal to, amongst other changes, remove excess tolerances in the Maui pipeline and align balancing actions to cost to causer (known as the **Back to Back** change request⁸) shows positive intent to move closer to good practice balancing principles.

However, although accepted and approved by the Gas Industry Company (**GIC**), industry participants objected to some elements of the proposal; most notable being the lack of opportunity to hedge their risk in the BGX and urged the GIC to suspend implementation until a spot market had been developed. In approving the positive intent of the Back to Back proposal, the GIC called on industry participants to approach the change as a catalyst for further improvement.

It is now clear that the 'BGX2' will not be implemented, and the good practice of facilitating balancing actions through an open market will not be included within the latest network code, once adopted. It is also clear that ex-ante balancing will continue under Back to Back, as any cash out will be executed at the end of the day when a balancing action is taken. For reasons set out previously in this paper, these key characteristics fail the fundamentals of good practice.

(b) Industry Change Request

An adaptation to Back-to-Back has recently been drafted by industry participants (**Industry CR**) and is currently undergoing pre-consultation, including with the TSO. The Industry CR attempts to make two succinct changes to the MPOC; (a) align cash out prices to a spot market; and (b) change cash outs to be on an ex-post AEOI basis.

The Industry CR states that cash out transactions should, where possible, be reflective of the spot market (or indeed multiple markets). As previously argued in this paper, this proposed change is in line with internationally accepted good practice and will allow parties to reasonably hedge their price risk. Further, it will avoid the negative effect of the BGX price pass-through.

The second change is to move cash outs to ex-post AEOI position instead of ex-ante. This will provide users of the system with the ability to primary balance their positions within-day, as well as provide volumetric certainty to inform hedging.

Whilst we agree with industry that their proposed changes are consistent with good practice, it could go further to avoid additional pitfalls. This includes setting out that the Balancing Agent should only balance on an ex-post basis and, in the first instance, on the identified open spot market. As currently drafted, the Industry CR could still result in socialisation of cost / profits due to under- or over-recovery

⁸ <http://gasindustry.co.nz/work-programme/mpoc-change-request-13-october-2011>



of balancing costs – something that should be avoided if possible. With that said, MDL may take it on itself as an RPO to act in a manner that achieves the same.

Good practice indicates that incentives should be embedded within the transmission regime to encourage ex ante balancing by shippers on the pipeline. The Industry CR sets cash out prices at the volume weighted average price on the spot market. Whilst we agree that this is necessary at present due to data quality issues (the lack of 'D+1' allocations for example) it may be prudent to move towards marginal pricing at some stage when appropriate to provide additional incentive to primary balance.

It is the CR's contention that by scheduling the balancing action against any Accumulated Excess Operational Imbalance (AEOI) at the start of Day₁ (end of Day₀), at the prices seen in the market on Day₁, then market forces will determine the scarcity or surplus of gas on that day. The incentive to primary balance is maintained as shippers will not want to be exposed to prices they are not able to influence. In accordance with good practice, they will be able to hedge their position in the market.

Appendix A: Case Study – Evolution of the UK Gas Market

Context on the problem of gas balancing is provided by using the UK market as a case study. While the story of the evolution of the UK market from a monopoly to full competition is not directly comparable to the situation of New Zealand, it illustrates how natural monopoly assets are regulated to promote efficiency, including the tools that are available to those assets to ensure shippers contribute positively to the mechanism.

Prior to the Gas Act of 1986, the whole Gas industry in the UK was monopolised by British Gas (BG). Slow progress was made to manage the monopoly advantage of BG until the Gas Act of 1995, which truly enforced liberalisation of the market, establishing competition and defining pipeline operators and shippers. The Network Code (1996) set out rules and procedures for third party access to the British transmission grid and introduced the concept of the National Balancing Point (NBP)⁹. The NBP is a theoretical, as in non-specific location, place where the grid is balanced by the TSO as a factor of multiple entry and exit points. It is an assessment of an individual shipper's imports vs. exports to/from the grid.

It is important to understand that the UK grid is significantly more complex than the transmission networks located on New Zealand's north island. A description from 2010¹⁰ states that it incorporates 6,600 km of pipeline at a range of pressure between 45 and 85 bar, employs 28 compressor stations, has over 140 offtake points and approximately 60 Direct Connect customers, including power stations.

Gas in the UK, at the inception of the network code, was generally traded through medium to long-term bilateral contracts. Trading developed, initially, at the UK import terminals at Bacton (south-east) and St. Fergus (northern Scotland) for short-term gas in response to long-term take or pay arrangements¹¹. This quickly developed into trading at the NBP with the implementation of the Network Code.

The introduction of standard short-term contracts, with physical delivery to the grid or from the grid and financial settlement between the delivering/taking parties, enabled the tightening up of the UK balancing regime. Balancing was executed on a monthly basis, 15 days in arrears, and now shippers were obliged to start balancing on a daily basis. To incorporate this large scale change, the Network Code operated under a 'soft landing' regime:

"This regime allowed shippers to exceed their daily balance by 100 percent of the daily average of their deliveries and offtakes during the previous 30 days. The daily imbalance outside this tolerance was cashed out at the system marginal price. At the end of the month, if the monthly imbalance (the cumulative daily imbalances) did not exceed three times the tolerance level, it was cashed out at the system average price, equal to the average price of all accepted flexibility bids during the last 30 days. If the monthly imbalance was above the tolerance, the imbalance was cashed out at the system marginal price." Page 21¹¹ (see figure 3)

This non-punitive regime was not only introduced because of the differences from previous balancing regimes but more so because of data quality issues regarding supply point flows. The introduction to

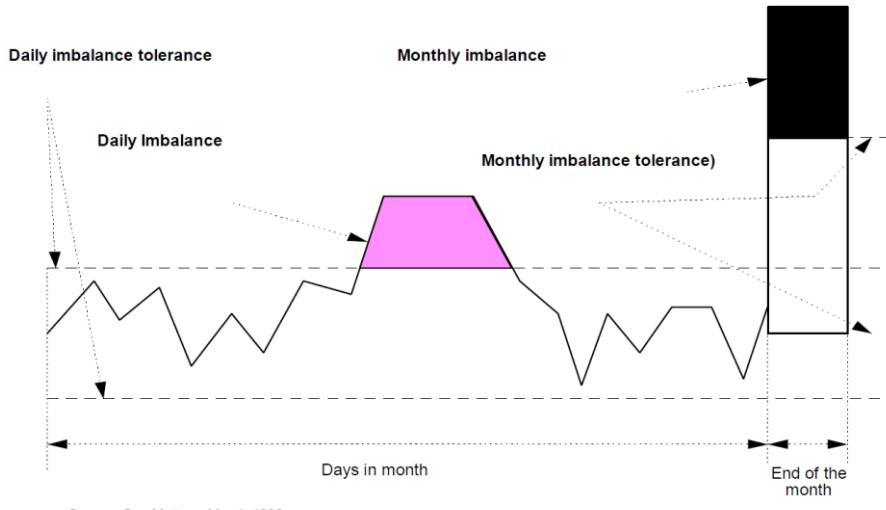
⁹ The NBP can be assessed to be similar in concept to MDL's concept of Notional Balancing Points on the Maui Pipeline.

¹⁰ The Evolution and Functioning of the Traded Gas Market in Britain, Patrick Heather, Oxford Institute for Energy Studies (August 2010)

¹¹ Market Development in the U.K. Natural gas Industry, Andrej Juris (1998). World Bank elibrary 1813-9450-1890

real daily balancing, including pricing at marginal trading prices and the slow withdrawal of tolerances over time, was dependent on improvements in real time data.

Figure 3: Balancing under the Soft Landing Regime of the Network Code



In combination with the standardised short-term contracts (day ahead, weekend, balance-of-week etc.), BGT used the flexibility mechanism (now called the OCM¹²) to trade imbalances. Operation is much like the spot market except that trading took place between BGT and shippers. Transactions were carried out via an auction because of BGT's monopoly/monopsony position as a seller or buyer of gas. This imitated a spot market and only functioned if the system imbalance caused a deviation from the spot market price; i.e. liquidity was unavailable to fulfil the system requirement. BGT selected the bids/offers that minimised the cost of restoring system balance.

Shippers were only willing to sell gas to the flexibility mechanism if the price was above that quoted on the spot market; and buy if the price was below that quoted on the spot market. However, as there were high levels of competition, both on the market and, when required, on the flexibility mechanism, price extremes were not normal.

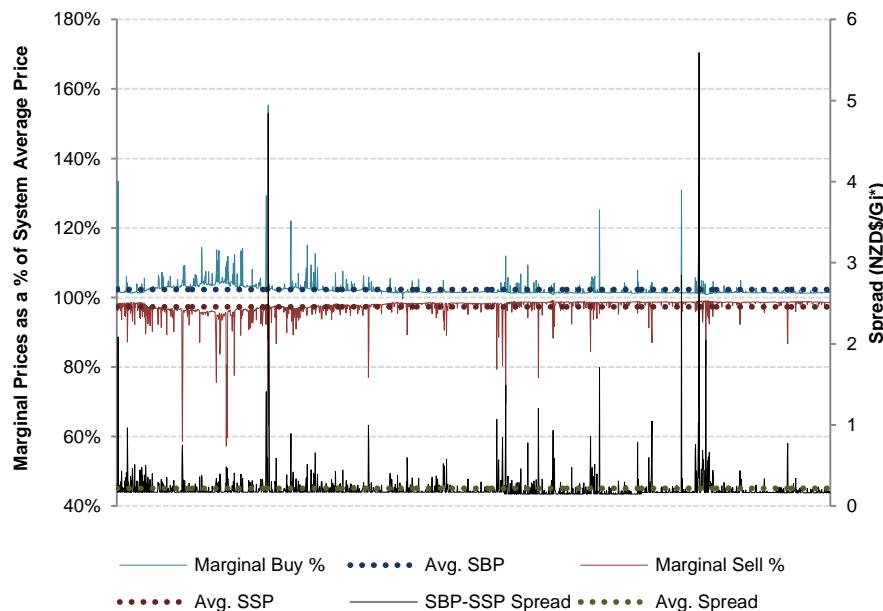
The UK market followed the 'soft landing' seven months after implementation by introducing marginal pricing for all imbalance volumes outside of the stated tolerance and, over the course of six years, eroded these tolerances down to 0. The reason for the staged approach was to allay fears of shippers who were initially sceptical as to its feasibility. Access to accurate and timely data was unproven as well as the bedding in of new procedures. Further, the within-day market developed sufficiently to allow shippers to balance their portfolios.

The UK market now has zero tolerance for shipper imbalance but high levels of data available to inform commercial decision making. If shippers trade out of imbalances within-day this is cost-less (though still exposed to market forces that drive price if the system is short or long) but if the trade is forced through the balancing mechanism then this is transacted at system marginal price

¹² The On-the-day Commodity Market

(highest/lowest prices transacted on the day), providing the incentive to primary balance. Empirical data for UK marginal prices can be seen in figure 4, below¹³.

Figure 4: Average UK Marginal Prices and Buy/Sell Spreads, 2008 – Feb 2014



Source: National Grid data Explorer. *NZD/GJ conversion from GBP/Therm at an FX rate of 2.005 NZD/GBP - IG Index, 10.30am 21/02/2014

The UK case study shows that for New Zealand to get back to good practices in gas balancing, it is clear that a single leap to the finished article is not appropriate. However, it would be extremely helpful to lay clear the direction of travel so that industry participants have certainty and are able to adapt their commercial practices accordingly.

The UK did this through firm regulation while New Zealand will more likely approach this as a negotiation between shippers and the TSOs. It should also be considered that steps such as zero tolerances, intra-day balancing, marginal pricing or even gross / net pool clearing should only be introduced if the TSO can highlight to shippers that their behaviours are not sufficient in maintaining a balance in the network due to transmission regime design.

A summary of how the rest of Europe set up their balancing mechanisms can be found in a 2009 paper by KEMA International¹⁴. Not all European countries adopt the same rules as the UK and, in the case of gas balancing, there will always be diverging views on the right approach. However, the work towards the target model in Europe leans towards the UK's approach and ERGEG principles as best practice¹⁵. It is simple in concept, provides appropriate incentive and price signalling and allows the

¹³ Sourced from National Grid Data Explorer,
<http://www2.nationalgrid.com/uk/industry-information/gas-transmission-operational-data/data-item-explorer/>

¹⁴ Study on Methodologies for Gas Transmission Network Tariffs and Gas Balancing Fees in Europe, KEMA International B.V. December, 2009

¹⁵ ACER (Agency for the Cooperation of energy Regulators); Framework Guidelines on Gas Balancing in Transmission Systems. 2011



competition of market forces to deliver a solution to scarcity or surplus in the pipeline. The UK model is entirely consistent with ERGEG's guiding principles.

Appendix B: Reference Catalogue

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