



## **State of the Market Report 2012**

An Assessment of Structure, Conduct, and Performance  
of Alberta's wholesale electricity market

December 10, 2012



## PREFACE

The *Alberta Utilities Commission Act* gives the Market Surveillance Administrator a broad mandate to oversee Alberta's electricity and retail natural gas markets. The MSA's everyday job is monitoring, investigating and enforcing market rules, reliability standards and competition rules. However, an important part of the remit is stepping back periodically to assess the structure and performance of the wholesale electricity market, a large, complex and dynamic market central to the prosperity of the province and the provision of electricity services to the people of Alberta. This report, called the *State of the Market 2012*, provides that assessment in relation to the purposes of the *Electric Utilities Act* (section 5) – effectively, the state of competition and efficiency within this market.

Since 2009 and explicitly with the release of the *Offer Behaviour Enforcement Guidelines* in 2011 the Market Surveillance Administrator has employed a classical competition law and economics analytic framework in discharging its responsibilities. This approach, mirrored in other sectors of the economy, allows market participants the freedom to set and implement commercial strategies as long as they do not prevent or lessen competition – undermine the *fair, efficient and openly competitive* operation of the market, in the words of the *Electric Utilities Act*.

The purpose of the *State of the Market Report 2012* is to inform and sharpen the Market Surveillance Administrator's market monitoring and enforcement by identifying the key factors specific to Alberta that make a difference in promoting or interfering with competitive outcomes and the achievement of economic efficiency. The work may also assist policy makers shaping the evolution of the wholesale market because of extensive data analysis contained in the Report and the eight underlying 'building block' reports assembled during 2012.

Although dated 2012, the Report includes market information for several years, sometimes as far back as ten years or more. In our view the 'energy-only' design of the Alberta market requires a longer period of assessment than the conventional 12 months and for that reason the Market Surveillance Administrator plans a three year cycle for state of the market reports with the next release targeted in 2015.

The Market Surveillance Administrator is an independent enforcement agency that protects and promotes the fair, efficient and openly competitive operation of Alberta's wholesale electricity markets and its retail electricity and natural gas markets. The MSA also works to ensure that market participants comply with the Alberta Reliability Standards and the Independent System Operator's rules.



# Table of Contents

Overview.....	1
1. Structure .....	6
1.1 Introduction.....	6
1.2 Vertical integration.....	7
1.2.1 On-site generation and cogeneration development .....	8
1.2.2 Generation and retail load .....	9
1.2.3 Reasons for vertical integration .....	10
1.2.4 Consequences of vertical integration .....	10
1.3 Horizontal integration .....	12
1.4 Market power.....	14
1.4.1 Generator market power.....	14
1.4.2 Buyer market power .....	16
1.4.3 Transmission rights on interties.....	17
1.5 Investment and barriers to entry .....	19
1.5.1 Investment and the Alberta Market .....	19
1.5.2 Barriers to entry.....	20
2. Conduct .....	23
2.1 Introduction.....	23
2.2 Conduct to support fair, efficient and open competition.....	23
2.2.1 MSA investigations, conduct and guidelines.....	23
2.2.2 Compliance with market rules and reliability standards.....	24
2.3 Power pool market participation.....	25
2.3.1 Generator participation.....	25
2.3.2 Load participation.....	26
2.3.3 Intertie participation.....	27
2.4 Forward market participation.....	29
2.4.1 Direct sales / bilateral agreements .....	30
2.4.2 Liquidity in the financial forward market .....	30
2.5 Exercise of market power .....	37
2.5.1 Market power and the Alberta market design.....	37
2.5.2 How can generators exercise market power? .....	39
2.5.3 What incents generators to exercise market power?.....	40
2.5.4 What limits the ability of a generator to exercise market power?.....	42
2.5.5 The exercise of market power in practice .....	44
2.6 Investment .....	46
2.6.1 Capacity changes by fuel type.....	47
2.6.2 Capacity changes by firms.....	49

2.6.3	Future capacity developments .....	50
3.	Performance .....	51
3.1	Introduction.....	51
3.2	Price signals.....	52
3.2.1	Price volatility.....	52
3.2.2	Price received by different generating technologies .....	58
3.2.3	Forward market convergence.....	60
3.3	Relationship between scarcity and price .....	61
3.4	Static efficiency.....	64
3.5	Dynamic efficiency .....	65
3.6	Long run marginal cost.....	67

## List of Tables and Figures

Figure I:	Alberta Wholesale Market .....	2
Table 1.1:	Types of markets, from pure competition to pure monopoly.....	6
Figure 1.1:	Cogeneration capacity has grown more quickly than flow to the grid due to on-site use .....	9
Figure 1.2:	Gross production has grown with on-site use .....	9
Figure 1.3:	Generating assets operating in the market are often connected to many companies.....	13
Figure 1.4:	Some market participants have access to a large amount of generator availability information .....	14
Table 1.2:	The Adjusted-RSI metric indicates a decline in market power in the first half of 2012 (Percentage of hours) .....	15
Figure 1.5:	There have been a number of periods where this selected firm was able to exercise market power.....	16
Table 1.3:	Percentile statistics summarizing the hourly capacity (MW) available on Alberta's interties (January 2010 - September 2012 inclusive).....	18
Figure 1.6:	One firm holds most of the firm transmission rights on the BC intertie .....	19
Table 2.1:	Financial penalties issued for non-compliance with ISO rules and Alberta reliability standards .....	24
Table 2.2:	Average number of restatements for most fuel types have increased in 2011 .....	26
Table 2.3:	Increases in restatement activity have been concentrated among the five largest firms .....	26
Figure 2.1:	Prices in Alberta have often been higher than in neighbouring markets .....	28
Figure 2.2:	Net imports and exports occurred to exploit arbitrage opportunities in 2011 .....	29
Table 2.4:	Forward market liquidity has been falling .....	31
Figure 2.3:	Trading volume fell dramatically in June and July of 2010.....	32
Figure 2.4:	Most traders are now brought together through the forward exchange.....	32
Figure 2.5:	Most forward market participants are regulars in the market.....	33
Figure 2.6:	Banks have made up a declining portion of forward trading .....	34
Table 2.5:	Monthly contracts have made up 66.5% of traded volume so far in 2012.....	34

Figure 2.7: Monthly contracts are now the most common.....35

Figure 2.8: Longer term contracts will be traded farther in advance more often than shorter term contracts (2008 – September 30, 2012).....35

Table 2.6: Most contracts are "flat" .....36

Figure 2.9: Some generators dispatched offline take a long time to restart .....40

Figure 2.10: There are times when economic withholding of even a large amount of offered energy would have little impact on the pool price.....43

Figure 2.11: The non-vertically integrated firm exercised more market power than the vertically integrated one.....45

Figure 2.12: Economic withholding contributed to pool prices over \$400/MWh in this example .....46

Table 2.7: Over 5,000 MW of net additional capacity has been installed since 2000 .....47

Figure 2.13: There has been significant growth in wind and cogeneration capacity .....48

Figure 2.14: A number of new facilities have been built since 2000 .....49

Figure 2.15: Uprates have been an important source of capacity growth.....49

Table 2.8: A third of new capacity has been developed by smaller firms.....50

Figure 3.1: In aggregate, the mean monthly price for electricity is not on an upward trend.....53

Figure 3.2: Prices are low more often than in the past, but there are months with price spikes .....54

Figure 3.3: Polarizing prices: Pool prices over \$700/MWh have grown increasingly common .....55

Figure 3.4: Off-peak prices are falling while on-peak prices averaged the same.....55

Figure 3.5: Recent peak hour prices are high relative to 2009 and 2010, but not to other historical periods .....56

Figure 3.6: After relative lows in 2009/10, inter-day volatility has been increasing .....57

Figure 3.7: The price of natural gas has been falling.....57

Figure 3.8: Wind production and imports have been proportionally increasing .....58

Table 3.1: Wind generation occurred in hours with lower pool prices .....59

Figure 3.9: Natural gas and peaking plants have earned the highest average prices .....59

Figure 3.10: Weak evidence of convergence between forward and spot prices.....60

Table 3.2: Average difference between spot prices is particularly high in 2012 .....61

Figure 3.11: Supply cushion and pool price have shown a strong, non-linear relationship .....62

Table 3.3: There have been more upper outliers at larger supply cushions recently .....63

Figure 3.12: The number of upper outliers has climbed since 2009.....63

Table 3.4: Losses are small in comparison to overall pool price.....65

Figure 3.13: Since 2010 there have not been sustained periods of high or low prices.....66





## Overview

### KEY POINTS:

The Alberta wholesale electricity market is effectively competitive. This conclusion rests on the assessment that over the medium term the market delivers a wholesale price of electricity that is no higher than necessary to secure the reliable supply of electricity to consumers now and in the future. The finding is consistent with the legislative standard of *fair, efficient and openly competitive*.

Wholesale price volatility and price polarity (periods of low prices interspersed with shorter periods of high prices) are an expected outcome in an electricity market such as Alberta's and consistent with effective competition. In fact, these price signals promote innovation and economic efficiency.

Like any market, factors such as market power and barriers to entry can shape the competitive environment in important ways and require the continuing attention of the Market Surveillance Administrator and policy makers. However, there is no need for substantive change to the policy framework, or the Market Surveillance Administrator's existing enforcement framework. In fact, policy continuity and stability has been an important foundation for the success of the Alberta market and will continue to be so in the future.

### *Our motivation*

Alberta has chosen to deliver meaningful segments of electricity services through a market construct rather than regulation or state ownership. The market is not an end in itself, but is a means to achieve the goal of providing electricity to consumers at a cost no greater than necessary to ensure reliable service now and in the future. A market mechanism can achieve this outcome only if the natural forces of competition effectively 'regulate' outcomes.

And that is where the Market Surveillance Administrator comes in – as an independent agency with technical expertise and extraordinary powers to monitor, investigate and enforce so that the market meets the standard set out in section 6 of the *Electric Utilities Act* - *fair, efficient and openly competitive*. The MSA regularly reports on market events. We also conduct investigations as a result of complaints, or our own market observations, to ensure market participant conduct conforms to the standards set out in legislation. Where necessary we take matters to the 'court', the Alberta Utilities Commission, for adjudication on competition violations and the levying of financial penalties. While reports on events and investigations are important, they are narrow in scope. From time to time the MSA believes a more searching broad-based assessment covering a meaningful period of time is required. This is the purpose of the MSA's *State of the Market Report*.

The analytical work in support of the Report also allowed us to test and refine the enforcement framework enunciated in the January 2011 *Offer Behaviour Enforcement Guidelines*. This framework applies mainstream competition law and economics (antitrust) standards to the specific circumstances of the Alberta wholesale electricity market. The distinguishing feature of Alberta's market is that it is 'energy-only' market. What this means is that market participants receive revenue based on the energy they produce. It is on the basis of these revenues that the large capital investments needed for generation plant and equipment are supported. However, there needs to be a balance so that an effectively competitive market ensures that consumers are not overcharged for the energy they use as reflected in the wholesale prices. This is what is meant by the statement above that the market provides electricity to consumers at a cost no greater than necessary to ensure reliable service now and in the future.

### What We Looked At

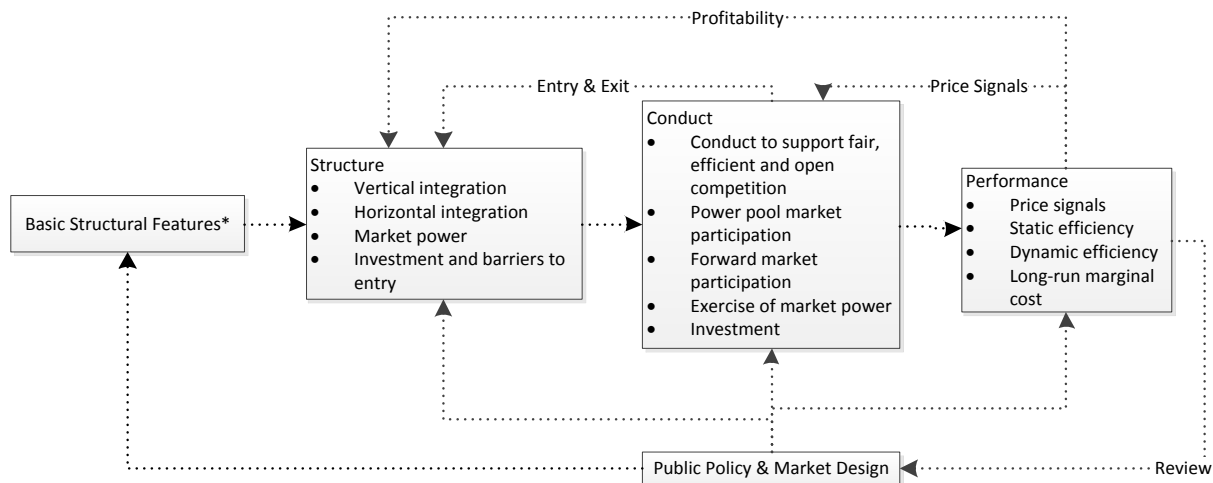
The MSA's state of the market report is an assessment of the state of competition within, and the efficiency of, the Alberta wholesale electricity market. The focus of the report is on the Alberta power pool and the forward financial market. The report does not consider markets for ancillary services or retail issues, although the MSA may return to consider these parts of the market in future work. Transmission and distribution remain regulated and as consequence are not part of the competitive framework, or part of the assessment we have undertaken.

To organize our analysis and conclusions we have described the market in terms of *Structure*, *Conduct* and *Performance*:<sup>1</sup>

- **Structure** – means market structure, usually described in terms of buyer and seller concentration, barriers to entry, product differentiation. Descriptions of structure sometimes distinguish between derived characteristics like concentration and intrinsic (or basic) demand and supply conditions like available technologies.
- **Conduct** – refers to firms' behaviour including pricing strategies and investment decisions of both incumbents and potential entrants.
- **Performance** – describes the market outcomes in comparison to benchmarks, usually in relation to concepts of efficiency.

The competitiveness and efficiency of a market also depend on the interaction and feedback between market structure, conduct and performance. Structure, conduct and performance are the subject of separate chapters in this report. Each chapter provides insights into what really matters but they need to be considered together for a final view. These three basic descriptors of the market and the main inter-linkages between them are shown in Figure I below.

**Figure I: Alberta Wholesale Market**



While the Structure-Conduct-Performance framework has been employed for decades in many industries, the analysis conducted here is specifically tailored to Alberta's electricity market. The

<sup>1</sup> For further discussion on this organizing device see section 1.1 in the MSA's *State of the Market: Framework for Analysis*.

analytics recognize that electricity is an unusual commodity: it cannot easily be stored; it has few substitutes; and consumers expect a continuous and uninterrupted supply. Even among electricity markets Alberta's is a novel design<sup>2</sup> and as a consequence there are few direct comparators. The consequence is a unique challenge and a unique *State of the Market Report*.

Conclusions are reached on each element of the Structure-Conduct-Performance framework. The overall test of the whether the market is working is appropriately one of performance. We test against a benchmark of 'effective competition'. More formally:

A level of competition (and related outcomes) that (i) achieves efficient investment with the lowest possible short-run inefficiencies, (ii) does so over a reasonable timeframe, and (iii) where open competition ensures neither collusion, abuse of market power, or anti-competitive practices.

Additional material to support the analysis found in the report is provided in a number of 'building block' reports. These 'building block' reports set out some of the detailed methodology used to assess the market. A full list of these reports and links to each are provided in the References section of this report. Given that this is the first State of the Market assessment undertaken by the MSA the methodology is particularly important. Over the coming months the MSA expects to refine that methodology further based on stakeholder input. The methodology would then be employed in future reports providing a consistent basis for assessment.

### ***What We Found***

- **The Alberta wholesale electricity market is effectively competitive.**

The adjective 'effective' or 'effectively' does not mean a qualified finding - a 'B' grade as opposed to an 'A'. It is simply the term employed for a real world standard of market performance, and is distinguished from the analytical term used by economists "perfect competition" that populates textbooks but not actual markets. It reflects the reality that on the supply side, the Alberta market is an oligopoly; the leading five firms possess market power and use that market power to move the wholesale price from time to time. There is nothing exceptional or unusual in this finding. The same could be said for many different product markets in Canada and around the world, although these markets are not subject to the same kind of dedicated oversight as exists in Alberta. Our detailed evaluation of market power shows that the generators' ability to exercise market power is variable and dynamic; it can change considerably from one hour to the next with changes in market demand, unit outages and capacity derates, volatile wind supply, and varying flows on the interties. And of course the exercise of market power when it does occur is circumscribed by a price cap and a price floor and a monitoring for any anticompetitive behaviour associated with the resulting price changes.

- **The static efficiency losses of the Alberta wholesale electricity market 2008-2011 were insignificant and outweighed by dynamic efficiency gains.**

When evaluating the performance of market in the short-run, productive and allocative efficiencies are the conventional measures of static economic efficiency employed by economists. The term 'static' denotes a measure taken at one point in time with the prices of all other goods and services taken as fixed. Static efficiency is a useful indicator but not a single or all-encompassing measure of economic efficiency. As stated in the MSA's *Offer Behaviour Enforcement Guidelines* many economists view the true

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<sup>2</sup> The Alberta electricity market design often described as an 'energy-only' market. What this means is that payments between consumers and producers are limited to electricity consumed. Some other electricity market designs feature additional payments to producers for available capacity that occur whether or not any energy is actually produced.

benefit of competition as being to spur dynamic efficiency gains that can outweigh static efficiency losses but require a longer term perspective. Dynamic efficiency recognizes that over time there is the ability to innovate and invest leading to superior allocative and productive outcomes.

This context is important because in a high fixed cost industry such as electricity generation, where revenue is obtained only from sales into the wholesale market (Alberta's energy-only market) it is not appropriate that firms be expected (or required) to price at their marginal cost because they will not be able to cover their fixed costs, make a normal return and afford to reinvest in the market (or attract other investors to the market because of the stable revenue platform). The catch is that static efficiency is measured by the departure of price from marginal costs. This departure is allowable and expected in Alberta but the MSA wanted to ensure that it is not excessive, particularly in an enforcement arena where economic withholding would not be challenged (unless it resulted from collusive behaviour or actions taken to limit a competitive response).

The findings are startling: total static efficiency losses were less than 1 percent of the average wholesale market price over the period measured, 2008-2011. The MSA regards this magnitude as insignificant, and easily outweighed by dynamic efficiency gains. On that front, the record is that since deregulation in 2000 over 6,800 MW of new capacity has been developed and 1,400 MW of inefficient capacity has been retired - this in a market with a peak demand in the order of 10,000 MW. Sixty percent of the new capacity has come from cogeneration facilities that take advantage of production economies of scope. The addition of over 1,000 MW of wind generation is also significant. The diversification and timing of the changes is evidence that the market has created opportunities that previously were not available without causing sustained periods of low or high prices.

- **The MSA's standard, developed for this Report, is that over the medium term the market delivers a wholesale price of electricity that is no higher than necessary to secure the reliable supply of electricity to consumers now and in the future.**

Whether organized as a regulated monopoly, public ownership or a market, the delivery of electricity services involves an exchange of money between consumers and producers. In a market context competition is relied on to ensure that consumers are not overcharged. The MSA's role in the preservation of effective competition is multifaceted: (1) monitoring, investigating and seeking financial penalties where appropriate to deter anticompetitive conduct, (2) identifying policies, rules or conditions that limit effective competition and acting to remove these roadblocks, and (3) deploying market metrics to flag developments in the marketplace that are important for competition and economic efficiency.

A metric or series of metrics evaluating that price outcomes are in line with what is needed to ensure that new investment occurs when it is profitable falls into this last category. To this end the MSA draws on the concept of the long-run marginal cost of investment as a way of capturing how much of a transfer needs to occur from consumers to producers in order to allow a full recovery of fixed costs and sufficient profits as an incentive for new investment. At any given point in time prices may be higher or lower than the long-run marginal cost but a well-functioning market should not see that persist over time. Simply put, if prices are expected to be lower than the long-run marginal cost of investment, investment will be cancelled or postponed until prices rise. If prices are expected to be higher than the long-run marginal cost of investment, then investment of some type should occur. Absence of that investment would suggest a problem, for example barriers to entry.

The MSA has not specifically tested whether Alberta wholesale prices were no higher than they needed to be in the past in order to ensure generation investment. However, the record of investment in the market over the last dozen years and the absence of sustained periods of high prices over the period are

indicative that this standard has been met. This medium term price metric will be an important part of the suite of measures deployed by the MSA in the future.

- **Volatility is expected and necessary**

Hourly prices in the Alberta wholesale market are determined by the intersection of market demand and market supply. These 'market fundamentals' are in turn based on a number of factors. For example, market demand will vary across the hours of the day, days of the week and seasons of the year. On the supply-side of the market, total supply can change considerably as units come and go from outage, as wind generation fluctuates and as flows on the interties change. Market participants cannot readily store electrical energy when prices are low and sell this stored energy when prices rise.

As a result of these factors, it is not surprising that wholesale market prices in Alberta's electricity market are volatile. It is also a necessary part of the wholesale market since it acts as a signal for market participants to change behaviour. Some producers may seek higher prices through the exercise of market power; others may see opportunity for profit and lower prices. Some larger industrial consumers reduce consumption as prices rise, in turn moderating volatility. Over the longer term, more volatile prices will incentivise different kinds of investment, producers might develop flexible 'peaking' capacity to take advantage of periods of higher prices, interconnections to other markets might be developed and the economics of storing power become more attractive. In short, wholesale price volatility is entirely consistent with the market's framework of *fairness, efficiency and open competition*. Wholesale volatility doesn't imply all consumers should face volatile prices. Many consumers will choose to buy power through longer term fixed-price contracts, which, in turn, makes it easier for generators to develop new capacity, and gives them less incentive to exercise market power.

- **MSA next steps**

Much of the *State of the Market Report* is dedicated to outlining the competitive process, the important actions and reactions that over time drive effective competition. Notwithstanding our conclusion that the market is effectively competitive, understanding these processes are the basis on which the MSA will monitor and measure whether market rules or participant behaviour impede competition. Participants acting to impede competition will face enforcement action from the MSA. Careful observation and enquiry will also look for weaknesses, scope for improvement and serve as early warning of emerging issues. While the MSA does not intend to produce another state of the market report until 2015, the detailed observations contained within this report will form the basis for much of the MSA's work. With that in mind the MSA will seek input from stakeholders and other interested parties on where the focus of the MSA's monitoring should lie and where questions remain unanswered.

# 1. Structure

## 1.1 Introduction

This section of the report summarises our analysis of market structure and provides our assessment of the implications for the competitiveness and efficiency of the Alberta market. It draws on a number of building block papers already published as part of the MSA's work in support this report.

Market structure establishes the landscape on which competition occurs. The extremes of market structure are pure competition and pure monopoly. Few markets are associated with these extremes, with most sitting between the two. A simple classification is shown in Table 1.1. Alberta's electricity market sits in the middle of this taxonomy, most closely resembling a *tight oligopoly*.

**Table 1.1: Types of markets, from pure competition to pure monopoly<sup>3</sup>**

Kind of Competition	Number of Producers	Example Sectors	Degree of Control over Price
<i>Pure Competition</i>	Over 50, none have appreciable market share	A few agricultural industries	None
<i>Monopolistic Competition</i>	Many: None has over 10% of the market	Retailing, clothing, some services	None or very slight
<i>Loose Oligopoly</i>	Leading 4 firms combined, have 40% or less of the market	Much of manufacturing	Some; insignificant to moderate
<i>Tight Oligopoly</i>	Leading 4 firms have 60-100% of market	Aluminum, cement	Significant 5-10% or more
<i>Dominant Firm</i>	One firm has 50-100% of the market and no close rival	Often local markets	Substantial
<i>Pure Monopoly</i>	One firm has 100% of the market	Local public utilities	Very Substantial

Market structure is often driven by the intrinsic characteristics of a particular industry. Industries characterized by large capital investments in plant and equipment are unlikely to have a large number of producers especially if these investments are also characterised by efficiencies of scale or scope. In this case many producers might lead to inefficient outcomes. In other industries the existence of few rather than many producers may simply reflect the past successes of some and the failure of others. What this means is a concentrated market structure might emerge for good reasons entirely consistent with a competitive market. There are also industries characterised by a large number of producers but products are differentiated from one another giving each some discretion over pricing.<sup>4</sup>

Electricity markets also have a number of other intrinsic features that make them different from most other industries. For instance, since electricity cannot easily be stored, electricity systems frequently oscillate between periods of surplus (for example, when the availability of a plant is high or demand is low during the night) to periods of relative scarcity (for example, where outages or maintenance at plants reduces supply or demand is high during the day). Market prices are set frequently to capture these

<sup>3</sup> Adapted from Chessler (1996).

<sup>4</sup> In contrast, electricity is usually thought of as a commodity with little or no product differentiation.

changing conditions. Further, the responsiveness of demand to price changes within this time frame tends to be low and the Alberta market does not feature strong connections to neighboring electric systems. This means essentially that competition in the Alberta real time market is often limited to generator on generator competition and at times one or more generators will find they have sufficient market power to influence price. This is not unusual for most product markets in Canada or unique to electricity.

Alberta's electricity market is described as an 'energy-only' market. This means that generation participants receive revenue based only on the energy they produce. Some other markets, adopting a different design, restrict prices in the energy market and provide generators with additional revenue in the form of capacity payments, essentially these are payments for making units available whether they are used or not. No matter what design is chosen, the total revenue to generators needs to be sufficient, over time, to pay for the total cost of prudent investments in generating capacity and sufficient profit that they would not be better off investing their money elsewhere. Different designs do differ in the amount of risk different groups bear. In an energy-only design, risk is borne by investors and returns need to be somewhat higher to compensate.

There are a number of other intrinsic factors that shape the landscape for competition in Alberta, including legislation and the Power Purchase Arrangements that established the starting point for the competitive market.<sup>5</sup> In the remainder of this chapter we look at some of main structural characteristics of Alberta's electricity market. These are:

- Vertical integration;
- Horizontal integration;
- Market power; and
- Barriers to entry.

## 1.2 Vertical integration

Vertical integration occurs when a company expands its business into areas that are at different points on the same production chain. In the Alberta electricity market there are two major forms of vertical integration:<sup>6</sup>

- First, industrial users of electricity choosing to build their own on-site generation rather than purchasing from the market or existing suppliers. There may be a number of reasons to do so; the most prevalent in Alberta is to take advantage of opportunities for cogeneration, where both heat (usually in the form of steam) and electricity are produced as inputs into the primary production process. Many of these operations are centered on the development of the oil sands. The building and expansion of cogeneration plants has been a key feature of Alberta's electricity market and it is forecast to continue.<sup>7</sup>

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<sup>5</sup> For readers seeking a greater understanding of the structure of Alberta's wholesale electricity market, see the MSA's *Alberta Wholesale Market - A description of basic structural features undertaken as part of the 2012 State of the Market Report*.

<sup>6</sup> Vertical integration can also describe situations where a generator expands into distribution or transmission related activities.

<sup>7</sup> See for example, *AESO 2012 Long-term Outlook*, p. 68.

- Second, generation and retailing may be consolidated within a single firm, creating a ‘gentailer’.<sup>8</sup> This form of vertical integration is common in many electricity markets. In Alberta, only one of the major retailers has significant generation assets.

### 1.2.1 On-site generation and cogeneration development

As part of the work leading to the *State of the Market Report* the MSA conducted a survey of industrial loads.<sup>9</sup> One factor revealed by the survey was that a significant number of respondents relied on on-site generation to supply their needs. The scale of the responses made it clear that much of this was cogeneration. Cogeneration has significant cost advantages over the separate production of steam and electricity resulting from economies of scope. There may also be advantages to both cogeneration and other types of on-site generation in that they may pay lower transmission fees.

The addition of gas-fired cogeneration capacity has been a major feature in the development of the Alberta market over the last 10 years, with natural gas-fired cogeneration capacity having doubled since January 2002.<sup>10</sup> Figure 1.1 shows this and also the net flow of power from cogeneration facilities to the electricity grid (based on metered volumes). It has gone up much more slowly than the growth of capacity, consistent with the idea that most of the generation is used onsite. Figure 1.2 shows a similar pattern, looking at a slightly different set of generators with on-site generation.<sup>11</sup> For this shorter period of time we show gross production (rather than capacity) and the portion of that production produced and consumed on-site. On average 70 percent of gross on-site production is consumed at the same site,<sup>12</sup> although there are significant differences between sites and there is some seasonality evident.

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<sup>8</sup> This terminology is used in some other electricity markets see, for example, the Australian Energy Regulator’s *State of the Energy Market 2011*, p. 12.

<sup>9</sup> For further details see MSA’s *Identification of impediments to forward contracting: A Survey of Industrial Loads undertaken as part of the 2012 State of the Market Report*.

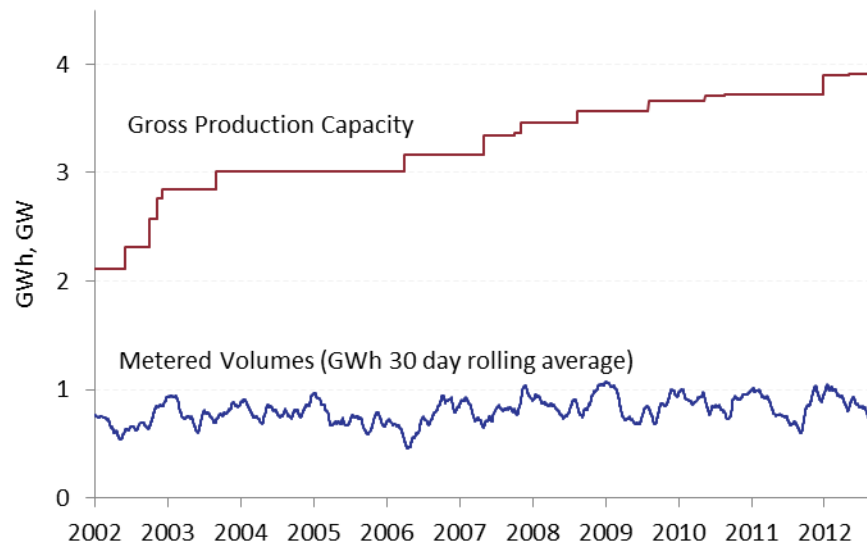
<sup>10</sup> A unit’s Capacity is generally defined by its Maximum Capability (MC) from December 3, 2007 onwards and by its Maximum Continuous Rating (MCR) prior to this date. The exceptions here are units which currently state MC based on Net-to-Grid capacity. To avoid distortions, the capacity figures used for these units prior to AESO’s Quick Hits initiative are also a net capacity figure rather than gross capacity figure. See Section 3.4 of the MSA’s *Measuring Generator Market Power* for further discussion on capacity, capability, and cogeneration assets.

<sup>11</sup> Not all facilities with on-site generation are cogeneration facilities.

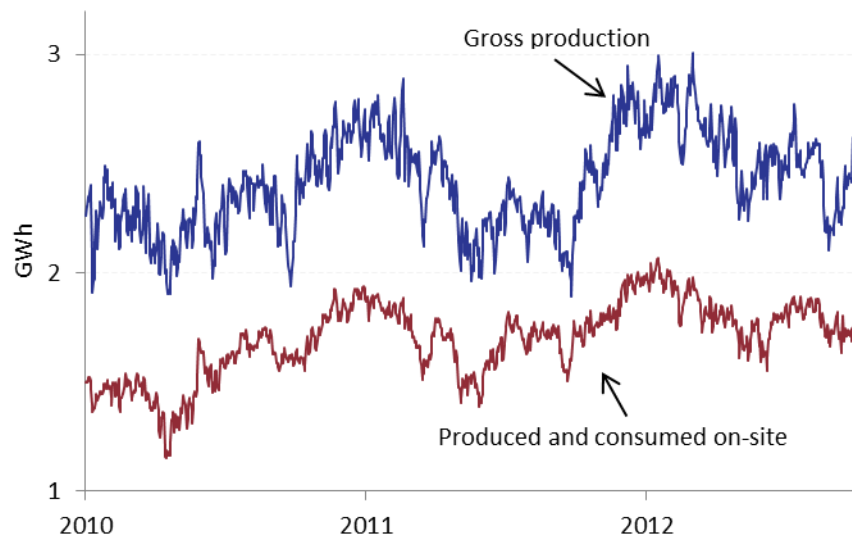
<sup>12</sup> It is worth noting that the generation produced and consumed on-site will understate the total on-site load at these facilities since some facilities systematically pull power from the Alberta grid, while other sites will pull from the grid only when outages or derates mean that on-site generation is not sufficient.



**Figure 1.1: Cogeneration capacity has grown more quickly than flow to the grid due to on-site use**



**Figure 1.2: Gross production has grown with on-site use**



### 1.2.2 Generation and retail load

The term gentailer refers to firms which are highly involved in both the generation and retail sector of electricity markets. Some generation companies enter into direct sales agreements with customers<sup>13</sup> (in electricity, consumers are often referred to as 'load' but a gentailer describes a much closer and longer lasting integration). Alberta's retail market features three main competitive retailers, a larger number of

<sup>13</sup> See Section 2.4.1: Direct sales / bilateral agreements.

boutique retailers and some Rural Electrification Associations. Only the largest competitive retailer is highly vertically integrated, a gentailer.

There are also three main providers of the Regulated Rate Option (RRO),<sup>14</sup> along with smaller municipalities and Rural Electrification Associations. The *Regulated Rate Option Regulation* allows self-supply, although the current Energy Price Setting Plans used by the main RRO Providers are effectively procurement plans. For the period from mid-2006 to mid-2011 two of the main three RRO providers essentially were vertically integrated.<sup>15</sup>

### 1.2.3 Reasons for vertical integration

Vertical integration in the form of on-site generation may occur to:

- Take advantage of economies of scope that result from cogeneration;
- Avoid costs associated with transmission or distribution tariffs;
- Avoid possible delays associated with accessing supply from the transmission grid; and
- Reduce exposure to wholesale price risk.

Vertical integration in the form of gentailers does not typically have advantages related to economies of scope or avoidance of transmission costs (since the load served is widely dispersed). Instead benefits may occur to:

- Reduce exposure to wholesale price risk. The combination of generation capacity and retail load provides a natural hedge to one another. This can be important to retailers who in the presence of high prices may face increased credit requirements or bankruptcy; and
- Reduce investment risk associated with generation assets, because retail loads provide an increased certainty for future revenue.<sup>16</sup>

In a small market like Alberta individual generator outages can have a significant impact on price. In these circumstances a gentailer will still face the risks associated with forced outages and planned outages at its facilities. This may mean there is a scale benefit to gentailers (as there is to other generation market participants who have sold forward) in that multiple facilities provide a hedge against one another.

### 1.2.4 Consequences of vertical integration

#### 1.2.4.1 Benefits of vertical integration

Vertical integration through the development of cogeneration capacity in Alberta provides considerable benefits in terms of reduced costs of production, lower net emissions and reduced need for transmission. We have not quantified these benefits as part of this report but are of the view they are likely considerable. They are also important in understanding market dynamics. For example, behind-the-fence generation (i.e., that serving on-site load) removes a portion of demand from the market which in

<sup>14</sup> For further details on the Regulated Rate Option see Section 4.3 in the MSA's *Alberta Wholesale Market: A description of basic structural features undertaken as part of the 2012 State of the Market Report*.

<sup>15</sup> See Table 3.1 in the MSA's *Quarterly Report: April -June 2011 (Q2/11)*.

<sup>16</sup> In a recent study commissioned by the MSA increased certainty over revenue was one factor that was seen to assist generation investment. See the MSA's *Investor Perspectives on the Attractiveness of Alberta's Electricity Generation Market* for further discussion.

turn has implications for the estimation of market power.<sup>17</sup> Excess generation at cogeneration facilities is often offered at low prices that also shapes competition in the hourly market.<sup>18</sup>

Vertical integration in the form of gentailers also has some benefits. First, the consolidation of generation and retail will in theory help to get new generation capacity developed. In fact the main gentailer in Alberta has made significant generation investments over time. Second, gentailers will still participate in the forward markets in order to manage outage risks, and to deal with the exposures caused by the shape of their retail load.

Vertical integration can play an important role in reducing the exercise of market power in the real time market. Generating firms which are vertically integrated into the retail market have less incentive to increase the wholesale price through the exercise of market power because their retail market sales reduce their exposure to the real-time price. For example, a gentailer with a relatively large retail load can be a net buyer from the wholesale market and so the firm can profit from a lower market price. Some evidence that this economic theory holds in practice has been found in analyzing the behaviour of independent generators and gentailers in another electricity market.<sup>19</sup>

#### 1.2.4.2 Costs of vertical integration

Vertical integration reduces the reliance of market participants on forward contracts to manage their risks. A recent MSA report noted that one factor contributing to low levels of forward contracting is the prevalence of cogeneration in Alberta.<sup>20</sup> Since the use of cogeneration allows independent energy companies to meet a large proportion of their electrical needs, they face little exposure to the pool price and they have less incentive to participate in the forward markets. Likewise, the consolidation of generation and retail can lead to a reduction in forward market trading (sometimes called 'liquidity') as previously separated generators and retailers no longer need to engage in the same level of contracting.

Reduced forward market liquidity has the potential to impact competition in both the retail and generation sectors. In the retail sector, a fall in forward market liquidity can make it difficult for independent retailers to manage their physical market risks competitively. In this way vertical integration can create a barrier to entry for new retailers because building their own generator becomes a prerequisite to being competitive.

A reduction in forward market liquidity can also make it difficult for new entrants to build generation capacity, particularly if a company is unable to finance the project from its balance sheet. In many cases the feasibility of generation development by an independent power producer relies upon a sufficient amount of profitable forward market sales. In order to sell a substantial amount of generation into an illiquid forward market, a potential entrant may drive forward prices below their expected likely value or be deterred by the weak signals provided by the market.

While these 'costs' of vertical integration relate to reduced forward market liquidity it is important to recognize one of the drivers for vertical integration may be pre-existing low levels of liquidity (e.g., the forward market was insufficient to manage wholesale price risk prompting investment in generation). This is important since low levels of vertical integration do not necessarily imply liquid forward markets.

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<sup>17</sup> See section 3.4.3 of the MSA's *Measuring Generator Market Power* for further limitations.

<sup>18</sup> Sometimes offers at \$0/MWh represent electricity that is produced as a result of 'must-run' constraints, i.e., a certain level of steam production is needed for other processes and the electricity is just a by-product of that need.

<sup>19</sup> See Mansur (2007) for an analysis of the behaviour of independent generators and gentailers in the PJM market.

<sup>20</sup> See the MSA's *Identification of impediments to forward contracting*.

The classic antitrust ‘issue’ with vertical integration is the squeeze that a dominant firm can theoretically apply to competitors in the upstream or downstream segment of the production chain. Vertical foreclosure is said to occur when a dominant incumbent in a market pre-empts or otherwise deprives competitors or potential competitors of a major source of supply of a critical input or a major downstream outlet or customer for their product. In 2010 the MSA published the results of its investigation into allegations of this nature that concluded there remained significant opportunities for competitors to expand and a theory of competitive foreclosure was not supported by the evidence.<sup>21</sup> As discussed later in this chapter we have no reason to believe that the validity of this conclusion is called into question today.

### 1.3 Horizontal integration

Horizontal integration occurs when firms at the same level of the production chain, i.e., competitors, enter into arrangements between or among themselves. The term is not meant to encompass collusive agreements or arrangements. As with vertical integration, there are potential benefits and potential costs for competition and efficiency from this form of industrial organization. Horizontal integration is an important feature of Alberta’s electricity market and needs to be taken into consideration when assessing the landscape on which competition occurs. The MSA will be guided by the perspective the Competition Bureau applies in the review of arrangements among competitors.<sup>22</sup>

Horizontal integration results for a number of reasons. Joint ventures are common in Alberta’s electricity market. They may form in order to share development costs, provide easier access to capital or to share project risk more widely. Some owners of generation may also enter in arrangements with other firms that are able to supply plant operators or other expertise.

A number of linkages between market participants result directly from the Power Purchase Arrangements (PPAs). For coal- and natural gas-fired units the PPAs transferred offer control of most of the capacity from the unit owner to the PPA buyer. This was a ‘virtual divestiture’ in that the original owners of the units still own and operate them. While the natural gas PPAs have all ended most of the coal PPAs remain as does the owner-buyer relationship. In some cases arrangements were such that the PPA buyers were effectively syndicates of generation and load participants creating yet more linkages.

The net effect of all the factors listed above is that a large number of generation assets in Alberta are linked by a web of interrelationships. These are illustrated in Figure 1.3, which shows the asset identifiers of all of the major assets in Alberta.<sup>23</sup> Each of the main market participants is represented by a shaded area. Linkages between market participants are represented by overlapping areas. Outside the core of interlinked assets a few assets have no linkages.<sup>24</sup> Comparative pictures from other markets are not readily available but the MSA believes the pattern in Alberta is an uncommon and an important part of understanding its market structure.

The reason why linkages are important is that they imply communications between market participants who in all other respects are competitors. Since the Alberta market relies extensively upon generator on generator competition this is particularly important. Alberta’s legislation specifically recognizes two

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<sup>21</sup> See the MSA’s *Electricity Services Agreement* (2010).

<sup>22</sup> See Competition Bureau, *Competitor Collaboration Guidelines*, particularly Chapter 3, “The Civil Agreements Provision”.

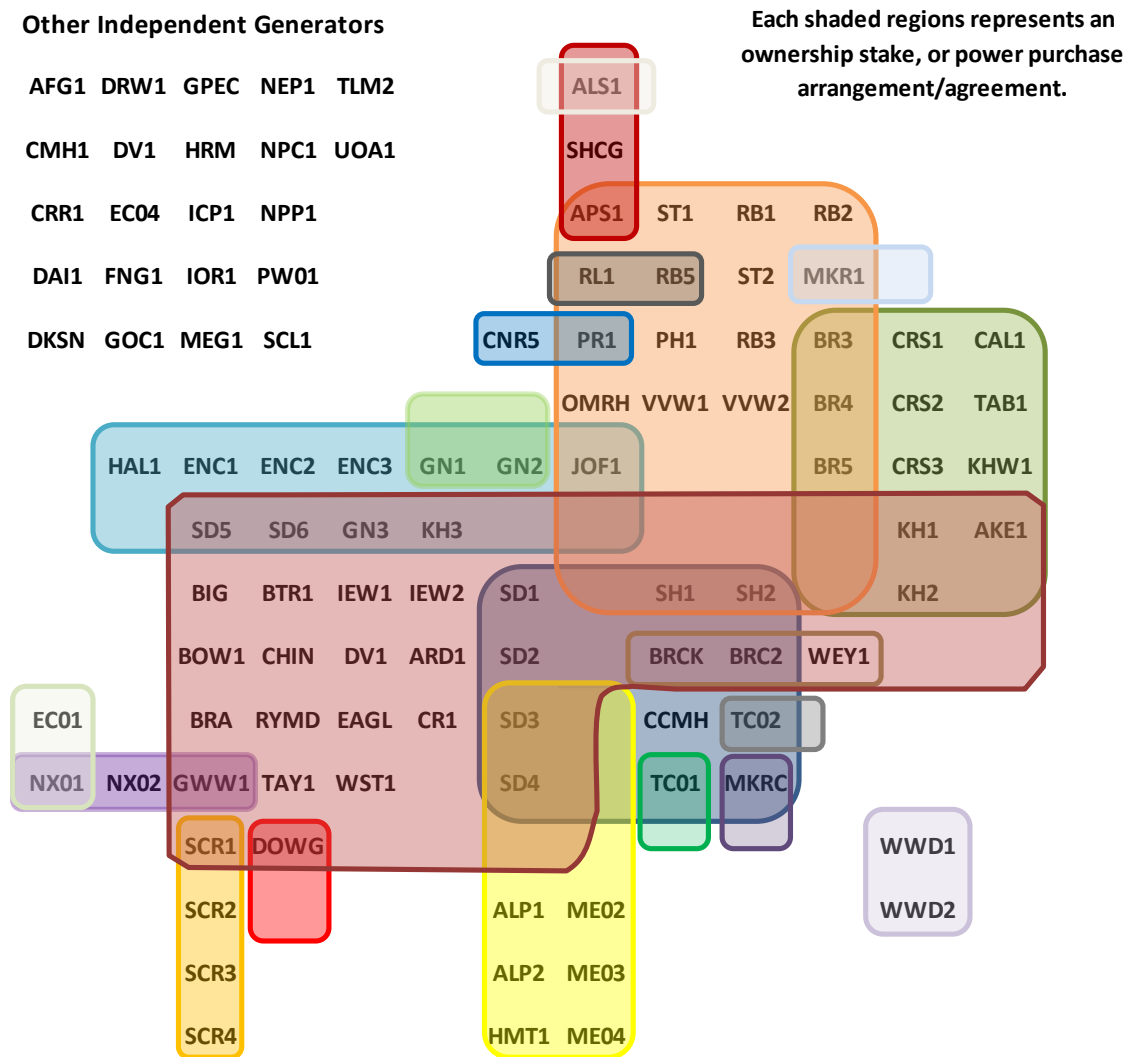
<sup>23</sup> The assets are listed on the AESO’s *Current Supply and Demand* report. This does not include assets smaller than 5MW.

<sup>24</sup> Some secondary linkages are not shown.

areas where information is important in shaping competition: the sharing of offer information and the use of outage information for purposes of trading.<sup>25</sup>

Many of the linkages shown relate only to relatively mundane flows of information, others less so, particularly in the case of joint ventures or PPAs that result in multiple parties exerting control over offers. Where information that is relevant to competition flows between parties it is obviously essential that there are robust procedures in place to avoid anti-competitive conduct. The MSA observes that with the end of the PPAs in 2020 the picture would look quite different with considerably less overlap between larger market participants.

**Figure 1.3: Generating assets operating in the market are often connected to many companies**

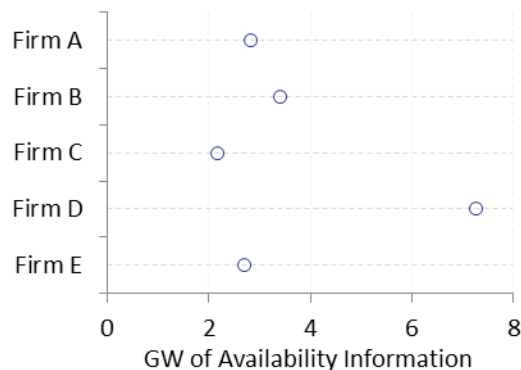


Another way of looking at corporate linkages and information is shown in Figure 1.4. This shows for the five largest generators the estimated visibility of generator unit availability.<sup>26</sup> One of these generators has

<sup>25</sup> Section 3 and 4 of the *Fair, Efficient and Open Competition Regulation*.

potential information on 7,000 MW of capacity (about half the total installed capacity in Alberta). To some extent the advantage conferred by having access to this information is mitigated by being made available to the public (and other market participants) on the Alberta Electric System Operator's (AESO) website and Section 4 of the FEOC regulation that prohibits the use of non-public outage information for the purposes of trading. Trading on outage information is only allowed after the AESO has made public aggregated records.

**Figure 1.4: Some market participants have access to a large amount of generator availability information**



## 1.4 Market power

It is the foundation of any market that suppliers should seek to maximise profits. Market power is the ability to affect the market clearing price. The MSA has been clear that unilateral actions with this effect would not face enforcement action unless competition was impeded.<sup>27</sup> The design of Alberta's energy-only market relies on the generation sector being such that no one participant can significantly control market outcomes through the exercise of market power. Consequently, measuring the extent of market power within the wholesale market is an important component in assessing the market as a whole.

In our structural assessment of market power we look at the power associated with three distinct groups: generators, buyers (consumers), and intertie market participants. In this section of the report the focus is on the structural issue of whether market participants have the ability to influence the market clearing price.

### 1.4.1 Generator market power

Under the *Fair, Efficient and Open Competition Regulation*, no market participant in Alberta is permitted to control more than 30 percent of Alberta's total generation capacity. The Regulation also requires the MSA to report, at least annually on the market share of offer control of larger market participants.<sup>28</sup> The Alberta generation market is relatively concentrated, with the largest five participants controlling approximately 70 percent of total market capacity, and the province's largest two controlling approximately 30 percent between them.

<sup>26</sup> More formally, the figure assigns the Maximum Capability of a given unit to all parties involved with that generating asset and totals the result for all linked assets for each of the five largest generators. Maximum Capability numbers listed on the Current Supply and Demand page of the AESO's website as of October 31, 2012 are used.

<sup>27</sup> For further details on the MSA's enforcement stance see Section 2.2 of the *Offer Behaviour Enforcement Guidelines*.

<sup>28</sup> See the MSA's *Market Share Offer Control 2012* for further details. The legislation makes a distinction between ownership and control over capacity.

Although such concentration measures are somewhat informative, an annual snapshot of market shares fails to capture the dynamic nature of competition in the electricity market (or any auction based electricity market for that matter). The supply side of the market can change considerably from one hour to the next with unit outages/capacity derates, volatile wind supply, and altering flows on the interties. In addition, system congestion can meaningfully alter the extent of supplier competition.

The ability of generators to unilaterally influence market outcomes will also depend upon the demand-side of the market. All else equal, the market power of sellers will increase as demand rises. During times of high demand, the exercise of market power can be profitable for a generator because the ability of other generators to respond is often constrained by capacity limits. On the other hand, when demand is low there is generally a significant amount of excess capacity so the ability of generators to exercise market power is usually limited at off-peak times.

In summary, the ability of a generator to exercise unilateral market power changes quickly and considerably as these fundamentals change. As part of the work leading up to this report the MSA completed a comprehensive study of different structural measures of market power. These measures show that in a large percentage of hours there should be sufficient competition to limit the ability of generators within Alberta to exercise market power.<sup>29</sup> These measures also show that in a small percentage of hours the larger generators have the ability to affect the market price substantially.

Table 1.2 below shows the results of one of the market power metrics developed called Adjusted-Residual Supply Index (Adjusted-RSI). The metric is based on measuring hours in which a generator is 'pivotal' or required in order for the market to clear, equivalent to hours in which it could have ensured the price would be set at the cap.<sup>30</sup> The Adjusted-RSI metric calculates a supplier to be pivotal where energy offered at a price of above \$0/MWh would make a participant pivotal. Table 1.2 shows the percentage of hours when each of the five largest firms were pivotal according to the Adjusted-RSI metric. For example, in 2011 Firm C was pivotal in some 13% of the hours, while Firm E was pivotal in 8% of the hours. By the same measure the firms have considerably less market power during the first half of 2012. This was caused by a combination of factors including the pattern of outages, mild weather in winter months and \$0/MWh offers.

**Table 1.2: The Adjusted-RSI metric indicates a decline in market power in the first half of 2012 (Percentage of hours)**

	2008 (Feb –Dec)	2009	2010	2011	2012 (Jan – Jun)
Firm A	1.5	0.5	0.7	1.1	0.6
Firm B	2.0	1.0	0.8	1.4	0.3
Firm C	19.0	3.0	5.0	13.0	0.4
Firm D	4.0	0.8	1.3	2.0	0.4
Firm E	8.0	5.0	5.0	8.0	2.7

Another of the metrics considered by the MSA further highlights the variability of generator market power. This metric uses an analysis of residual demand, essentially looking at demand net of the offers

<sup>29</sup> See the MSA's *Measuring Generator Market Power* in Sections 4.3 and 4.4.

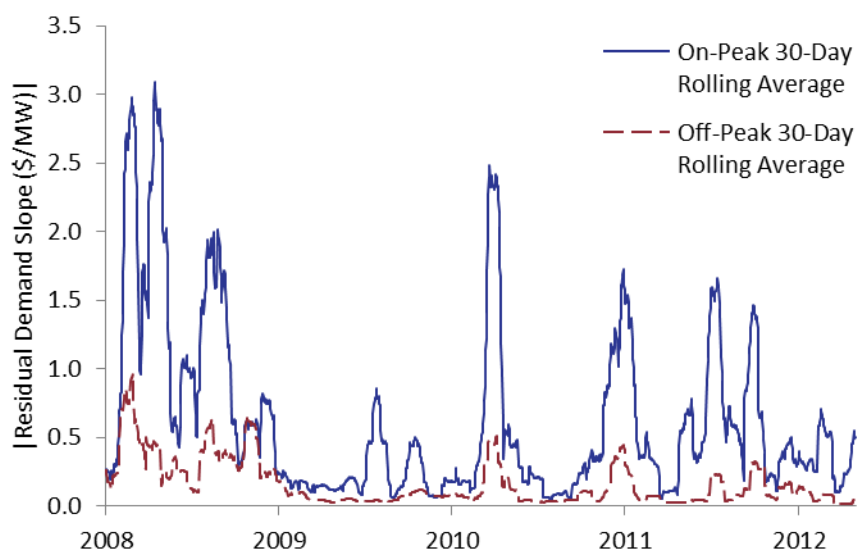
<sup>30</sup> Note that market participants who are close to being pivotal may still have considerable market power.

made by other market participants. Using this metric it is possible to look at the competition from other generators that a particular market participant faced around the market clearing price ('at the margin'). This gives useful information about how much a particular participant could expect to influence market prices.<sup>31</sup>

A higher absolute value of the residual demand slope is indicative of lower supply competition at the margin. In particular, a high residual demand slope indicates an hour in which there were few MW offered by competing generators around the market clearing price. In contrast, an hour in which a generator faced extensive competition at the margin from rival suppliers would yield a low residual demand slope. Therefore, a higher residual demand slope illustrates greater unilateral market power.

Figure 1.5 illustrates the 'on-peak' and 'off-peak' trends in the hourly residual demand slope faced by a large firm.<sup>32</sup> As shown by the figure, the generating firm saw notable highs in on-peak market power for large periods of 2008. The metric also indicates that the generator had less market power throughout much of 2009 and 2010, with May 2010 being a notable exception. The peaks in 2008 and 2010, correspond in large part to periods where significant generation was constrained due to transmission work. The firm's market power was also seen to increase at the beginning and end of 2011. In Q1 and Q2 of 2012, the metric indicates that the firm had relatively less ability to exercise market power. Note that all these statistics measure the ability of generators to exercise market power, not whether they did.

**Figure 1.5: There have been a number of periods where this selected firm was able to exercise market power**



### 1.4.2 Buyer market power

In general, we have noted market power is the ability to affect prices. The Competition Bureau adopts a narrow definition for buyer market power is "where the price of an input is depressed below the competitive level such that it results in a decrease in the overall quantity of the input produced or supplied in a relevant market."<sup>33</sup>

<sup>31</sup> For further details see Section 4.4 in the MSA's *Measuring Generator Market Power*.

<sup>32</sup> The on- and off-peak rolling averages are calculated in the same manner as the rolling average pool prices detailed in the PPA agreements. On-peak hours run from 7:00 a.m. until 9:00 p.m. on Alberta business days.

<sup>33</sup> See the Canadian Competition Bureau's *Round Table on Monopsony and Buyer Power*.



The buyer of a good can profitably exercise market power if by not purchasing units of good that they would normally choose to purchase at the prevailing market price (i.e., below the buyer's willingness to pay) they can lower the overall price they pay on each unit purchased. For example, suppose that a buyer is willing to pay \$50 per unit for a particular good. The buyer is currently purchasing 100 units of the good at \$40. The buyer may profitably refrain from purchasing another unit of the good if the market price would rise to \$49 as a result of the demand rise. By not purchasing the 101st unit, which is below his willingness to pay, the buyer is able to save a total of \$900 on the units which are purchased.<sup>34</sup>

Consumers of electricity in Alberta have very little flexibility or incentive to exercise buyer market power because for most consumers electricity is a necessary good, is difficult to store and has no reasonable substitutes. Further, the largest load market participants tend to have on-site generation (see Section 1.2 on vertical integration) and are as a consequence less interested in influencing real time prices. Retailers similarly may be vertically integrated or unable to control load. The loads that remain are far smaller than most of the generation market participants. In the MSA's view, these buyers are not sufficiently large to profitably depress wholesale market prices below the competitive level by reducing consumption. Some do respond to price but this price responsive load is aimed at avoiding high prices rather than exerting market power. We consider this in more detail in the conduct section of the report.

### 1.4.3 Transmission rights on interties

Interties play an important role in Alberta's market. For in-province generators, the interties represent both a source of competition (via imports) and an opportunity to access other markets (via exports). In addition, the net flow of electricity on the interties can have an important impact on the prevailing market prices in Alberta. Market rules require imports to be offered at \$0/MWh, and will tend to decrease the Alberta pool price.<sup>35</sup> In contrast, the flow of exports from Alberta will increase the demand for generation within the province, and this will tend to increase the Alberta pool price.

In comparison with other electricity markets, Alberta's interconnections with its neighbours are relatively small in proportion to overall load. Alberta has two interconnections; one to British Columbia<sup>36</sup> and one to Saskatchewan. A third interconnection to Montana is currently under construction, although it is not expected that the Montana tie will increase the aggregate transmission capacity of Alberta's interties due to its interactions with the BC intertie. Table 1.3 summarizes the distribution of the hourly transmission capacity that has been available on Alberta's two interties in recent years.<sup>37</sup>

Whilst there are no organised electricity markets like Alberta's in British Columbia and Saskatchewan, both can serve as conduits to access markets elsewhere. Through British Columbia market participants have access to electricity in Mid-C (an important and liquid bilateral market in Mid-Columbia) and other markets such as California. Through Saskatchewan there is potential access to the market administered by the Midwest ISO.<sup>38</sup>

<sup>34</sup>  $(\$49 - \$40) \times 100 = \$900$ .

<sup>35</sup> Imports and exports both act as price-takers in the Alberta wholesale market. Imports must be offered into the market at \$0/MWh and will receive the prevailing market price for their energy. Likewise, firm's wishing to export from Alberta will pay the prevailing price in Alberta.

<sup>36</sup> The Alberta-BC interconnection consists of one 500 kV circuit and two 138 kV circuits.

<sup>37</sup> For further information on ATC trends over time see Section 5 in the MSA's *Alberta Wholesale Market: A description of basic structural features undertaken as part of the 2012 State of the Market Report*.

<sup>38</sup> In practice transmission constraints elsewhere (i.e., not on the Alberta-Saskatchewan intertie) limit the opportunities for energy to flow between Alberta and markets to the east of Saskatchewan.

**Table 1.3: Percentile statistics summarizing the hourly capacity (MW) available on Alberta's interties (January 2010 - September 2012 inclusive)**

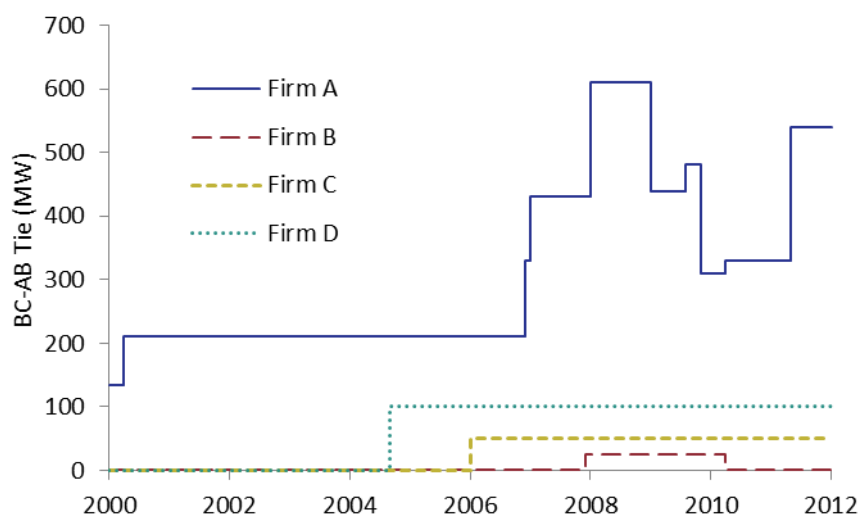
Percentile	Available Transmission Capability (MW)			
	BC Import	BC Export	SK Import	SK Export
5th	400	0	0	0
25th	500	0	153	75
50th (Median)	500	439	153	153
75th	575	735	153	153
95th	600	735	153	153

Alberta's market has no transmission rights, including on the interties. Alberta's market design is such that imports and exports are opportunity services, meaning that they will be preferentially curtailed in certain situations. However, the entities on either side of Alberta (British Columbia and Saskatchewan) have transmission rights that are administered through their respective Open Access Same-time Information Systems (OASIS). On these OASIS sites, participants wishing to import or export energy buy access to the applicable transmission capacity. The rights have different levels of priority or 'firmness' and corresponding levels of prices.

Participants who have purchased 'firm' transmission rights have the right to flow a specified number of MW on the intertie for every hour within the contract period. Participants can also purchase 'non-firm' rights, although non-firm rights provide a lower scheduling priority than firm rights. Non-firm transmission rights will allow participants to flow energy over the intertie when there is available intertie capacity that is not being used by the participants with firm rights.

The holding of firm rights on Alberta's two interties is a concentrated segment of the market. For example, Figure 1.6 illustrates how the holding of firm import rights on the BC intertie has changed over time. However, the high concentration of firm rights on Alberta's interties does not itself lead to a market power concern for the MSA. The ability of participants with firm transmission rights to profitably affect market prices requires that these firms can, to some extent, control the aggregate net flow of power along the interties. However, the rules around scheduling on the interties effectively prevent the holders of firm rights hoarding capacity and as such cannot prevent other participants from purchasing non-firm rights to profit from available arbitrage opportunities. Without impeding the ability of competitors to access the interties, it is not possible for participants to exercise market power on the Alberta interties.<sup>39</sup> In the conduct section of the report we return to consider flows on the interties (see Section 2.3.3: Intertie participation).

<sup>39</sup> Impediment of flows on the intertie was the subject of recent MSA investigation, see AUC Decision 2012-182 (July 3, 2012) for further details.

**Figure 1.6: One firm holds most of the firm transmission rights on the BC intertie**

## 1.5 Investment and barriers to entry

### 1.5.1 Investment and the Alberta Market

As part of work leading to this report the MSA hired Morrison Park Advisors (MPA) to conduct a survey of investor perspectives on the Alberta generation market.<sup>40</sup> The building of a generation plant requires sinking large amounts of capital today in order to bring it online typically 2-4 years later. The large sunk costs, the long lead-times, and the lengthy lifetimes of generation plants all create a notable amount of inherent risk and uncertainty. Regulatory uncertainty (in fact uncertainty of any kind) can also increase the hurdle for investment. Long term power sales are rare in the Alberta electricity market and as a consequence do not offer an opportunity to mitigate risk. This means that only certain kinds of investors are likely to be attracted to the Alberta market. The MPA report considers this question in some detail, noting the Alberta market is less attractive than some other electricity markets for developers using project financing (sometimes called ‘non-recourse’ financing) but this is less of an issue for companies with access to balance sheet financing. Indeed, companies with access to balance sheet financing already own or control a significant portion of the Alberta electricity market.

There are two further important points to note. Other electricity jurisdictions are more attractive to some types of investors because of the existence of long term contracts. These contracts have not emerged from market forces but instead usually stem from regulation to address concerns over reliability. In addition, they imply a shifting of the burden of risk from investors to consumers or tax payers and that is why they attract different kinds of investors. Outside the world of electricity, many industries face exactly the same set of constraints on financing that Alberta electricity market does. Often large amounts of capital need to be invested at considerable risk. In these industries investment still occurs and the industries remain competitive.

Nevertheless, within the Alberta electricity market it is still worthwhile examining whether risk, uncertainty and delay caused by regulation or rules might be reduced. For example, permitting times and regulatory processes all create potential risks and additional costs. The MSA has not undertaken a

<sup>40</sup> For further details see the MSA’s *Investor Perspectives on Alberta’s Electricity Generation Market*.

formal comparison of different jurisdictions but the Alberta market appears to compare favorably both in terms of time and cost. While approval for generating projects is usually time-limited the Alberta Utilities Commission has allowed extensions for many projects. This flexibility is important in an electricity market where permitted projects may need to pause pending favourable market conditions. The current list of projects with regulatory approval totals 2,647 MW of capacity.<sup>41</sup> Access to the transmission system and the time associated with the interconnection process may pose a problem. With respect to the connection process the AESO continues to examine alternatives, most recently around market participant choice.<sup>42</sup> With the large number of connection and transmission need applications working their way through the regulatory process it is obviously important this does not become a growing concern.

### 1.5.2 Barriers to entry

In the previous section we discussed the hurdles that must be overcome by all investors, i.e., generation investment is costly and risky. Sometimes these are loosely referred to as barriers to entry. The MSA takes the more precise view that barriers to entry are really costs that must be borne by new entrants that incumbents do not (or have not had to) incur.<sup>43</sup> These types of entry barriers are important in the presence of market power since they inform as to when (or whether) an incumbent exercising market power will face competition from new entrants. We note that the work by MPA found, in a number of instances, a difference of view between incumbents and potential entrants as to whether certain features of the market posed a concern. We distinguish two types of barrier to entry, structural and strategic, and give examples of each.<sup>44</sup>

#### 1.5.2.1 Structural Barriers

Structural barriers to entry refer to instances whereby incumbents may have inherent advantages over entrants. Barriers may occur in a number of areas, some are significant in the Alberta electricity market while other types of barrier (if they exist at all) are low:

- **Minimum scale of investment** – The MPA report noted that several investors commented on a needing a certain scale to compete effectively both for developing integrated trading, hedging and operations, and in terms of having multiple facilities available. The MSA notes that this latter point is related to the impact outages have on market prices and the relatively illiquid forward market. On the positive side, the need for considerable new investment in Alberta may make it attractive to larger companies interested in larger scale investment.
- **Forward market liquidity** – A liquid forward market would provide an opportunity to forward sell output and attract investors with lower tolerances for risk. For other investors, a liquid forward market that provided a good signal of future spot prices would also help in evaluating new investment. In short, Alberta's forward market has not exhibited strong liquidity with very few trades out more than a couple of years.<sup>45</sup>
- **Expansion / redevelopment of existing sites** – Incumbents may have an advantage over entrants in that they are able to expand existing facilities or use common facilities. Some of these advantages may be the result from investments made prior to deregulation. Access to these sites

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<sup>41</sup> AESO's *Long Term Adequacy Metrics*, November 2012.

<sup>42</sup> AESO's *Request for Submissions for the Market Participant Choice Pilot*, October 3, 2012.

<sup>43</sup> See McAfee et al. (2004) for a summary of definitions of entry barriers in economic literature.

<sup>44</sup> Barriers to entry and exit are also important for retailers, as noted in our discussion on vertical integration of 'gentailers'. More detailed consideration of entry barriers in the retail market is beyond this report.

<sup>45</sup> See Section 2.4 for further details.

may imply a barrier for entrants if equivalent sites are not available elsewhere. In the Conduct section of the report we note that expansion of existing facilities has been a significant source of additional capacity.

- **Government ownership of generation facilities** – Unfair advantages to investors might result if government-owned market participants were able to access cheaper capital or other advantages as a result of their special status. The Alberta market is protected from distortions caused by the possibility of unfair advantages for government-owned participants by a two stage process: first, by the Section 95 review and authorization under the *Electric Utilities Act*, and second, through the continuing responsibility of the MSA to enforce the Section 6 obligations.<sup>46</sup>
- **Market knowledge / information** – All electricity markets differ in terms of structure and new entrants incur a cost of understanding the intricacies of the market design. Alberta features a relative abundance of market information and a relatively simple design although it has little in common with most other North American electricity markets.
- **ISO rules / reliability standards** – Electricity markets feature a number of market rules, technical standards and reliability standards. It is important these do not unnecessarily exclude competitors. The AESO is continuing work in a number of areas to remove technical barriers (for example, allowing loads to participate in providing additional kinds of operating reserves). Rule development and refinement continue to be major activities for the AESO and as a consequence larger market participants devote significant resources to advocacy. To the extent this is necessary to compete in the market it may present a cost but not a barrier specific to new entrants.

### 1.5.2.2 Strategic Barriers

Strategic barriers to entry refer to instances whereby the actions of incumbents might create and maintain barriers to entry. For effective competition to result the exercise of market power must be disciplined by the actions of competitors such that there is no expectation that a market participant can exert significant control over market outcomes. The MSA also has a role to play in ensuring the integrity of the marketplace. New entrants and investment may be dissuaded if they believe prices are only high because of market participant control, reasoning that post entry the controlling incumbent may set prices at a level that would not enable the entrant to recover costs.<sup>47</sup> Potential entrants may also be deterred if they observe a large amount of capacity being economically withheld.

### 1.5.2.3 Conclusions on investment and barriers to entry

In summary, while not all types of investors are attracted to the Alberta market a sufficient number have been over the last 12 years to see a large investment in new capacity. There have been new entrants among these new investors.<sup>48</sup> The MPA report cautioned that a considerable amount of new investment would be required in coming years.

With the background on past investment the MSA is of the view that barriers to entry have not rendered the market uncompetitive. Nevertheless this is one area where continued monitoring is appropriate as barriers (and perceptions of barriers) can change over time which might cause the market to respond

<sup>46</sup> See the MSA's *Electricity Services Agreement: A Report into alleged violations of sections 6 and 95 of the Electric Utilities Act* for its investigation report.

<sup>47</sup> In the competition literature this is sometimes referred to as limit pricing.

<sup>48</sup> We review this evidence in more detail in Section 2.6: Investment.

slowly to signals. There may also be scope for reducing barriers that do exist and as a result enhance competition further.

## 2. Conduct

### 2.1 Introduction

This section of the State of the Market Report focusses on the choices made by market participants or, more formally, their conduct.<sup>49</sup> Examining conduct is important for two reasons. First, it sheds light on the mechanisms by which competition occurs and what responses occur to signals from the market. Most of this section of the report is focused at conduct from this perspective since this is where we expect to see signs that indicate the health of competition. Second, poor or anti-competitive conduct could undermine the success of the market. Legislation places a number of requirements on market participants and tasks the MSA with monitoring and investigating whether these are met. In some cases this leads to enforcement action and the imposition of penalties. We briefly consider these requirements and the MSA's activities in this area in the next section. The remainder of the conduct section looks at:

- Active market participation in the power pool;
- Forward market participation;
- Exercise of market power; and
- Investment choices.

### 2.2 Conduct to support fair, efficient and open competition

The legislation governing Alberta's market also places an expectation on all market participants in regards to conduct, i.e.:

Market participants are to conduct themselves in a manner that supports the fair, efficient and openly competitive operation of the market.<sup>50</sup>

The *Fair, Efficient and Open Competition Regulation* expands on the meaning of this requirement and includes prohibition of a number of behaviours, including the sharing of some kinds of information between competitors and trading on non-public outage information. As well, the regulation includes a prohibition against market shares exceeding 30 percent.

In addition to the requirements of the legislation, market participants must also comply with market rules and reliability standards.<sup>51</sup>

#### 2.2.1 MSA investigations, conduct and guidelines

Part of the MSA's mandate is to investigate the possible failure of market participants to support the fair, efficient and openly competitive operation of the market. Investigations may result from the receipt of complaints, referrals or as a result of the MSA's own observations. In some cases initial enquiries result in the investigation not proceeding or the withdrawal of the complaint. In other cases investigations may take many months to complete. Typically, the MSA does not comment on ongoing investigations. Once an investigation into a major matter is complete there are number of possible outcomes. In cases where there is a finding of no breach the MSA may release a public report, indicating what was examined and the reasons for its findings. For example, in 2010 the MSA published a report examining allegations

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<sup>49</sup> The *Electric Utilities Act* defines conduct as 'includes acts and omissions'.

<sup>50</sup> Section 6 of the *Electric Utilities Act*.

<sup>51</sup> See Section 20.8 of the *Electric Utilities Act*.

about unfair advantages to a government-owned participant.<sup>52</sup> In cases where the MSA finds a breach it can bring the matter in front of the Alberta Utilities Commission (AUC) for an administrative penalty, including disgorgement of profits. The MSA brought one such matter in front of the AUC in 2011 that related to the impediment of import transactions. A penalty of approximately \$370,000 was confirmed in mid-2012.<sup>53</sup>

In addition to investigative activities, the MSA may issue guidelines for market participants. The guidelines clarify the MSA's enforcement stance in regards to specific activities. As an example, the MSA published its *Offer Behaviour Enforcement Guidelines* in early 2011.

## 2.2.2 Compliance with market rules and reliability standards

Since January 2008 the MSA has been responsible for the enforcement of market rules, also known as ISO rules, and later was also made responsible for enforcement of Alberta Reliability Standards. In the event of a breach of rules or standards the MSA can issue specified penalties (typically in the range of \$500-\$10,000 for rules and \$500-\$25,000 for standards) or seek an administrative penalty. Most such issues are isolated events and the small penalties serve to remind participants of their obligations and to incentivise good compliance practices. Persistent or flagrant breaches or instances of gaming would likely result in the MSA taking enforcement action and seeking much larger penalties. Table 2.1 summarizes the number of penalties issued (and paid) during each year from 2008 to Q3 2012. Penalties for ISO rule and reliability standard breaches are paid to the General Revenue Fund.<sup>54</sup> Since July 1, 2009 all notices of specified penalty have been made public on the MSA's website.

**Table 2.1: Financial penalties issued for non-compliance with ISO rules and Alberta reliability standards**

		2008	2009	2010	2011	2012 (Q1-Q3)
ISO Rules	Number	21*	57	430**	37	42
	\$	\$30,000	\$149,000	\$756,500**	\$71,750	\$51,250
Alberta Reliability Standards	Number	n/a	n/a	0	0	3
	\$	n/a	n/a	0	0	\$17,500
Total	Number	21	57	430	37	44
	\$	\$30,000	\$149,000	\$756,500	\$71,750	\$68,750

\*Including non-compliance and warning letters, \*\* 332 notices of specified penalty (totalling \$655,000) were issued to a single participant in 2010.

<sup>52</sup> *Electricity Services Agreement: A Report into Alleged Violations of Sections 6 and 95 of the Electric Utilities Act*, September 2010.

<sup>53</sup> *AUC Decision 2012-182* (July 3, 2012).

<sup>54</sup> Section 63(5) of the *Alberta Utilities Commission Act*.



## 2.3 Power pool market participation

### 2.3.1 Generator participation

#### 2.3.1.1 Background

Electricity generators make price and quantity offers in the power pool. The ISO sends 'dispatch' instructions to offered energy from lowest to highest price in order to match supply with demand. The system marginal price (SMP) is determined as the highest offer dispatched, with all those generators dispatched receiving the same price. The market is cleared hourly at the pool price, the time weighted average of the SMP. This kind of market design allows generation participants to be relatively passive in terms of offer behaviour, for example participants could choose to offer at \$0/MWh in order to maximize the chances of being dispatched but still get paid the market clearing price.<sup>55</sup> A generation market participant could also choose to be active, changing prices in order to compete with others or attempt to influence the pool price. Competition in the power pool is therefore a combination of both active and passive behaviour. It is also a function of ISO rules.

The rules require all generation participants, above a certain size, to make hourly offers for a given day by noon the previous day. Offers consist of up to seven price and quantity pairs for each asset. These can be standing offers, i.e., an offer which is the same each and every day. The rules allow the price of offers to be changed more than two hours prior to the start of an hour, i.e., before 8:00 a.m. for the hour beginning 10:00 a.m. Changing offers is done through a 'restatement', and any given restatement can impact prices for multiple hours subject to the noted restriction. The current rules that allow this restatement behaviour have been in place since late 2007. Prior to that time, less frequent restatements were allowed but they could be closer to real time. The AESO is currently consulting on whether further changes are desirable.<sup>56</sup>

Given the importance of generator on generator competition the choices of whether to be active or passive shape the competitive dynamics of market. Low levels of active participation might indicate a barrier, for example, due to transaction costs or that active participation presents few benefits for those unlikely to be able to exercise market power. In the next section we consider some metrics that present some insights into these issues.

#### 2.3.1.2 Restatement behaviour from 2008-2011

This section reports the price restatement activities of generators from year 2008 to 2011. A single price restatement can change the offer price or quantity offer in each of the seven blocks that together comprise an offer. Our focus is only on restatements during the current trading day. To control for the number of assets within a group we report average numbers of restatements per asset for a given fuel type or a given participant. The MSA also notes that price restatement activity is limited to a fairly small set of assets (between 46 and 51 depending on the year).<sup>57</sup> Average annual numbers of restatements for these assets by fuel type and market participant are shown in Tables 2.2 and 2.3, respectively.

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<sup>55</sup> Alternative market designs such as 'pay-as-bid' usually require market participants to be much more active. Active participation does involve transaction costs so this design would impose additional costs on certain participants.

<sup>56</sup> AESO, *Price Restatement Period Review*, January 24, 2012.

<sup>57</sup> Units that make no price restatements at all are not included in the denominator when calculating averages.

**Table 2.2: Average number of restatements for most fuel types have increased in 2011**

Year	Coal	Gas Cogen	Other Gas	Hydro and Other
2008	73	210	229	108
2009	140	252	200	67
2010	139	252	390	43
2011	266	358	507	103

**Table 2.3: Increases in restatement activity have been concentrated among the five largest firms<sup>58</sup>**

Year	Firm A	Firm B	Firm C	Firm D	Firm E	Others
2008	236	83	190	122	182	192
2009	203	92	249	130	171	255
2010	442	181	191	159	125	214
2011	506	358	421	231	311	228

Table 2.2 shows a noticeable increase in restatement activity in 2011 across most of the fuel types. Table 2.3 shows this is concentrated in the restatement activity of the five largest firms. Together they make up 84% of all price restatements in 2011, up from 70% in 2008. The MSA also notes that price restatement activity is limited to a fairly small set of assets (between 46 and 51 depending on the year). Further analysis of the correlation between the number of restatements on any day with average daily pool price and the standard deviation of pool price both suggest a weak positive relationship, i.e., more restatements when prices are higher or more volatile.

Overall the MSA concludes that the *Offer Behaviour Enforcement Guidelines* introduced in early 2011 appear to have encouraged an increase in price restatement activity among the five largest firms. No increase is seen for smaller market participants. This may be due to transaction costs associated with restatements or simply that price restatement activity has few benefits over and above a more passive strategy.

### 2.3.2 Load participation

While market rules require generators to offer energy using different price and quantity pairs, consumers (often referred to as 'load') do not face this same requirement.<sup>59</sup> Many consumers lack the ability and/or the incentive to respond to real time prices in the wholesale market. For example those without time of use meters usually pay prices based on an assumed load shape rather than true consumption. Other consumers may have contracted electricity needs ahead of real time and have less incentive to respond to real time price movements. A few consumers, however, choose to participate actively in the market. These are mostly industrial loads with flexibility over production processes for which electricity makes up a large portion of total costs. These consumers can take advantage of low prices and avoid high prices. While few in number their actions are an important part of the wholesale electricity market, limiting the market power of generators and reducing pool price volatility.

<sup>58</sup> Note that the letters assigned to firms are indicative and not necessarily consistent with data presented in other sections.

<sup>59</sup> Market rules allow loads to bid into the market but few have ever done so.

Six key loads have been identified as price responsive (primarily involved in the pulp and paper industry) providing up to 300 MW of price response at any one time.<sup>60</sup> Much of the response occurs at prices above \$100/MWh. In some cases price responsive loads provide other services, including provision of supplemental reserves and Load Shed Service for import (LSSi) that limit price responsiveness.<sup>61</sup> Recent survey work conducted by the MSA indicated that 11 respondents altered production processes in real time to manage pool price risk.<sup>62</sup> Three of these companies also had on-site generation, which may indicate that they varied electricity production rather than their conventional output. Price responsive load also changes over time, for example, when a price responsive load ceases operations and exits the market. As an example of how price responsive load can change electricity costs consider that a consumer with equal consumption in every hour of 2011 would pay on average \$76.22/MWh (the average price for the year). If that same consumer avoided hours when the pool price was above \$150/MWh (just under 9% of the hours in the year) it would have paid on average only \$33.10/MWh.

From the perspective of competition, price responsive loads limit the ability of generators to exercise market power. As a simple example, if load declines by 300 MW whenever prices are raised above \$100/MWh a generator would need to economically withhold more than 300 MW to raise market price through this threshold.

### 2.3.3 Intertie participation

Interties play an important role in Alberta's market. For in-province generators, the interties represent both a source of competition (via imports), and an opportunity to access other markets (via exports). Market participants can profitably take advantage of arbitrage opportunities by buying power from one area at low prices and selling it to another market for a higher price. Doing so results in efficiencies because energy flows to markets where it is most valued. The interties also allow some market participants to 'hedge' forward transactions and have additional benefits, for example, allowing reserve sharing between different jurisdictions improving reliability and in some cases reducing costs.

The MSA's *Offer Behaviour Enforcement Guidelines* outline that market participants are free to flow power across the Alberta interties in whichever direction they choose and there are no rules specifying that the flow of power has to be economic on a standalone basis.<sup>63</sup> This guidance is based on the premise that 'uneconomic' flows across the interties will create arbitrage opportunities for other market participants. For example, a participant that exports 20 MW from Alberta creates an additional 20 MW of capacity on the intertie for other market participants to import power into Alberta. If, for example, the export occurred at a significant loss (greater than cost to move power from one jurisdiction to another) there is likely a profitable import opportunity that can be exploited. It is primarily this competitive dynamic that limits the extent to which a participant can unilaterally affect the market price by flowing power on the interties.

The prevailing market prices in recent years have meant that it has often been profitable to buy power from neighboring markets, pay for the necessary transmission, and sell this power into Alberta. Figure 2.1 shows the average monthly pool price in Alberta (AESO) relative to prices in the Midwest (MISO) and

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<sup>60</sup> See AESO presentation *Currently Existing Demand Response*, January 27, 2009.

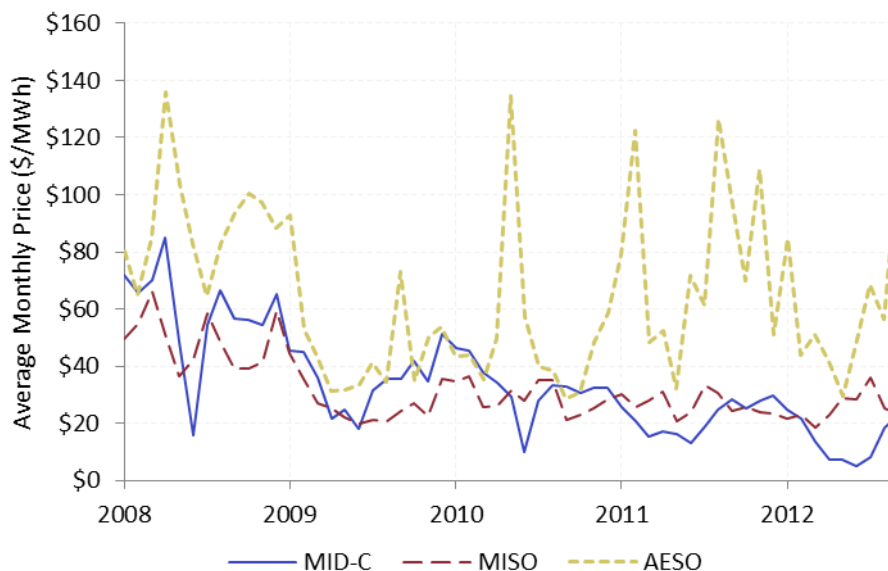
<sup>61</sup> As part of the MSA's work assessing static efficiency we have estimated the aggregate responses over the last few years. See the MSA's *Assessment of Static Efficiency in Alberta's Energy-Only Electricity Market* for further details.

<sup>62</sup> See the MSA's *Identification of impediments to forward contracting: A Survey of Industrial Loads undertaken as part of the 2012 State of the Market Report*.

<sup>63</sup> This represented a departure from previous guidance given by the MSA in 2005 when charges related to losses on the interties were considerably larger and there was a concern that the market would not correct 'uneconomic' flows.

Mid-Columbia (Mid-C) markets.<sup>64</sup> Given the prevailing market outcomes, it is not surprising that the majority of flows on the Alberta interties are importing power into the province. Flows from MISO via the intertie with Saskatchewan are more limited due to the capacity of the intertie and the difficulty associated with scheduling power through Saskatchewan and Manitoba.

**Figure 2.1: Prices in Alberta have often been higher than in neighbouring markets**



While imports are often profitable this is not always the case. In order to conclude that the interties are being utilised appropriately the MSA looks to see if net flows on an intertie are economic and when the difference between Alberta pool price and prices in neighboring markets is large the intertie is full in the direction expected to profit from the observed price difference.

Figure 2.2 illustrates a scatter plot of the relationship between the hourly Mid-C import margin and the utilization of the BC intertie in 2011. The import margin is simply the Alberta Pool price less the hourly Dow-Jones Firm Price index for Mid-C.<sup>65</sup> Utilization is calculated as the amount of energy that was scheduled to flow across the tie in that hour (or simply the net schedule) as a percentage of the Available Transmission Capability (ATC). By convention, negative values of the net schedule represent imports and positive values exports. Therefore, a value of -100% indicates that all of the import capacity on the BC tie line was being used by scheduled energy.

The scatter plot has four quadrants. The upper left and lower right quadrants correspond to economic flows, i.e., imports when the import margin is positive and exports when the import margin is negative. There is little activity in the quadrants that correspond to uneconomic activity (top right and bottom left). This is encouraging notwithstanding the pool price being unknown at the time transactions are arranged.

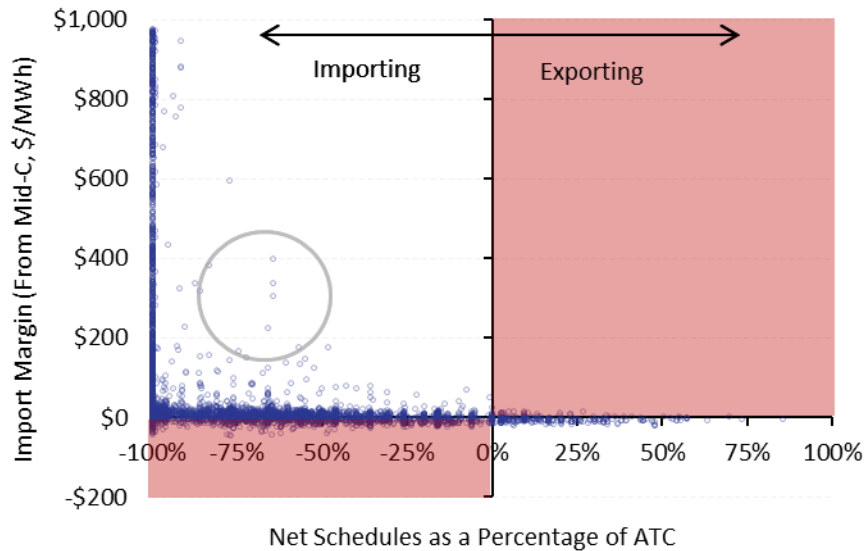
The figure also shows that for a large number of hours the arbitrage opportunities were fairly limited, i.e., points close to the horizontal axis where the margin was small. For example, in 70% of the hours the price difference was less than \$20/MWh. That said, in 9 percent of the hours in 2011 the import margin was above \$100/MWh. Given these opportunities it is not surprising to see a large number of points to

<sup>64</sup> Mid-C and Midwest ISO (MISO) are market hubs accessible via interties to British Columbia and Saskatchewan, respectively. For further discussion, see Section 5.2 in the MSA's *Alberta Wholesale Market*.

<sup>65</sup> See *Dow Jones Mid-Columbia Electricity Price Indexes* for further details.

the far left of the graph, and in total 60 percent of the hours the import capacity was more than 90% utilized.

**Figure 2.2: Net imports and exports occurred to exploit arbitrage opportunities in 2011**



To summarize, the figure above shows there is no systematic uneconomic import or export power flows. There are no hours in which the margin was large in absolute terms and scheduled flow was in the wrong direction. As well, there are relatively few instances in which the market did not take full advantage of the highly profitable arbitrage opportunities when they were available. There are a few instances where import flows could have been higher, some of which are highlighted by the circled area. In these cases, the import margin shows that meaningful profits were available to imported power and yet there was spare capacity for imports to flow on the intertie. Such outliers are predominantly caused by unexpected changes to the Alberta market. Since scheduled import changes cannot be made within close to real time (imports must be offered more than two hour prior to delivery), the ability of market participants to respond to these shocks is limited.

## 2.4 Forward market participation

Much of this report is focused on the power pool operated by the AESO. While all electric energy must be exchanged through the pool that does not prohibit transactions outside the pool where market participants' choose to exchange energy at a price negotiated in advance. There are two main types of exchange, a direct sales agreement between two parties (often called a bilateral) and forward contracts. Direct sales agreements are usually physical transactions (specify a buyer with physical consumption and seller with physical generation) and the details of the contract may be tailored specifically to needs (both a time period and quantity). In contrast, forward contracts are generally for standardized products (e.g., on- or off-peak), standardized time periods (e.g., monthly quarterly or yearly), and standardized volumes (e.g., 5 MW increments) to facilitate subsequent re-trading. Sellers of forward contracts do not need physical generation which allows participation of speculators.<sup>66</sup>

<sup>66</sup> A more detailed introduction to forward market trading can be found in the MSA's *An Introduction to Alberta's Financial Electricity Market*.

In terms of the MSA's State of the Market assessment two things are important:

- **Liquidity** –forward markets are sufficiently liquid such that this does not create a barrier to entry (see Section 1.5). Liquidity is also important in terms of driving vertical integration, e.g., retailers are better able to satisfy their needs by developing their own generation capacity. In Section 1.2.4.1, we noted that this may then further reduce liquidity. A lack of liquidity may also impact generators who are unable to forward sell capacity and offset risk. The forward market also provides generators with a means to offset risks associated with outages, and as a result the absence of liquidity may favour larger generators that can use other assets to offset these risks.
- **Impact on economic withholding**<sup>67</sup> – a generator who sells energy forward has less incentive to engage in economic withholding in the real time market. Similarly, a generator who is unable to find purchasers for forward power enters the real time market with a stronger incentive to engage in economic withholding. We consider economic withholding and the exercise of market power in more detail in the next section.

### 2.4.1 Direct sales / bilateral agreements

As part of the work leading up to this report the MSA conducted a survey of the members of the two main industrial load associations. The MSA estimates that those responding represented about 24 percent of typical electricity demand. The survey was designed to understand the low levels of participation by industrial loads in the forward market. One significant factor that explains low levels of forward contracting is the prevalence of cogeneration among the respondents. Approximately 90 percent of their consumption is offset by on-site generation. The MSA believes that this reflects efficiencies resulting from cogeneration rather than barriers to participation in the forward markets.<sup>68</sup>

Of the remaining respondents, a significant number are highly exposed to pool price and predominantly manage production in response to pool price rather than through forward contracts. The forward contracting that does occur is infrequent, occurs a considerable amount of time before the fact, and is dominated by bilateral contracts. For those industrial loads engaging in forward contracting many indicated that company policy prevented them from the trading of financial instruments and hence they could not use the forward exchange or brokers. Purchasing bilateral contracts posed no such problems as they tended to be classed as physical rather than financial instruments. As a whole the survey found mixed evidence on whether the surveyed loads experienced barriers to forward contracting. Some report no barriers at all. For others, barriers are significant and satisfaction with the options available is low.

While the MSA collects and analyzes broker and forward exchange data in some detail it does not regularly collect information on bilaterals or direct sales agreements. In 2005 the MSA conducted some survey work on forward market volumes.<sup>69</sup> Over the period from January 2004 to June 2005 the survey found 26% of the total volume was through a bilateral deal (70% transacted through brokers and 4% through the forward exchange). The MSA does not have equivalent survey results for more recent times but it appears the share of total volume that are bilaterals has declined significantly (along with an overall decline in volume). Further work is needed to establish the magnitude and reasons for this decline.

### 2.4.2 Liquidity in the financial forward market

From mid-2008 the MSA has collected detailed transactional information on forward market trades made through brokers and the forward exchange. In this section we present a summary of this data from mid

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<sup>67</sup> See definition provided in Section 2.5.2

<sup>68</sup> See the discussion on vertical integration in Section 1.2.

<sup>69</sup> MSA's *One Year On: Assessment of the Impact of the Trading Practices Guideline and Information Disclosure Procedure*.

July 2008 to September 2012. Note that volumes do not include direct sales agreements/bilaterals. Further, as the data are transactional, for each 'buy' there is a corresponding 'sell'. To avoid double counting we have only counted volumes from one side of the transaction.

#### 2.4.2.1 Trading volumes

As shown in Table 2.4, forward market liquidity measured by the trading multiple (total volume traded divided by the underlying load) has been declining for a number of years. The MSA's survey data from January 2004 to June 2005 indicates an equivalent value of about 0.52, not dissimilar to current levels.<sup>70</sup> Based on data until the end of September 2012, the trading multiple appears to be similar to the level observed in 2011. Trading multiples in other markets are often observed to be much higher.<sup>71</sup> For example, the Australian National Energy Market had a trading multiple of 2.31 in the 2011/12 fiscal year<sup>72</sup>, while the wholesale market in Great Britain was forecast for a 2011 trading multiple of 3.4.<sup>73</sup>

**Table 2.4: Forward market liquidity has been falling**

Year	Trades (TWh) [A]	Load (TWh) [B]	Trading Multiple [A]/[B]
2009	56.8	69.9	0.81
2010	46.1	71.7	0.64
2011	40.5	73.6	0.55
2012*	30.3	55.6	0.55

\*January to September, inclusive

The same volumetric data and load (underlying demand) are shown monthly in Figure 2.3 below. The figure shows a fairly dramatic decline in trading volume in mid-2010. Some monthly volatility has been evident since this time but both the peaks and troughs are lower than those observed previously. Some commentators have noted that 'news' or new information often cause trading as market participants adjust positions and that a better measure of underlying liquidity is the level of trading when there is no news.<sup>74</sup> At a simple level the low months prior to mid-2010 are between 3 and 4 TWh and between 2 and 3 TWh thereafter.

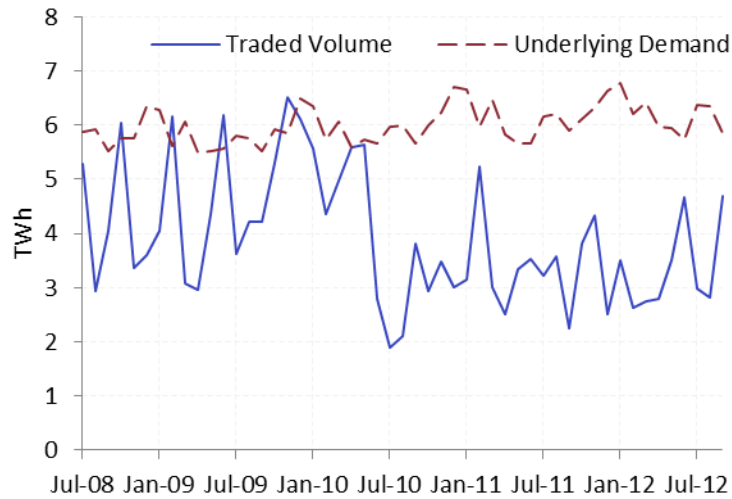
<sup>70</sup> These data indicated an overall trading multiple of 0.7 including bilaterals, or approximately 0.55 (0.7 x 74%) for non-bilateral trades. This data include both sides of the transaction.

<sup>71</sup> See Section 3.1 in the MSA's *Introduction to the Financial Electricity Market*.

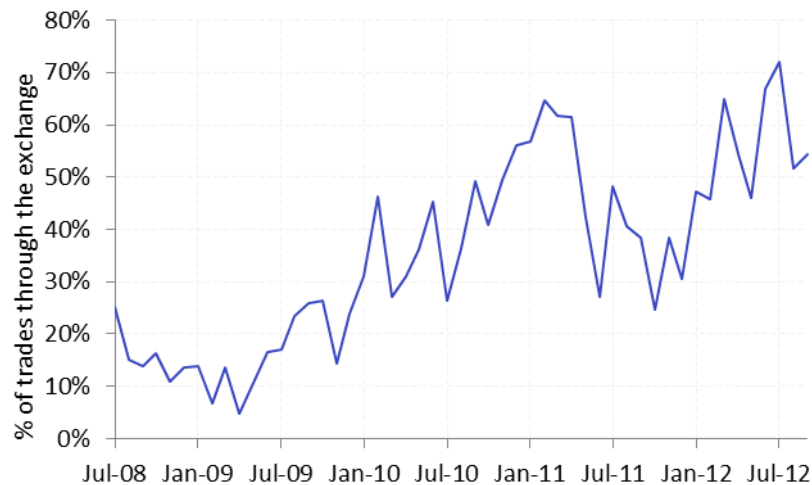
<sup>72</sup> See d-cypha Trade's *Energy Focus FY 2011/ 12* for further details.

<sup>73</sup> See OFGEM's *GB wholesale electricity market liquidity: summer 2011 assessment* (2011).

<sup>74</sup> For further discussion Sarr and Lybek (2002), p. 14.

**Figure 2.3: Trading volume fell dramatically in June and July of 2010**

In the past, most forward trades were conducted through brokers (sometimes called over-the-counter or OTC trades). In more recent times the forward exchange has accounted for greater volume of trading, with now over 50% of trades conducted through the exchange.<sup>75</sup> Exchange trades are important since transactions are more visible to other market participants (as opposed to those that use brokers or are direct sales agreements). This greater visibility is helpful for others gauging market prices.

**Figure 2.4: Most traders are now brought together through the forward exchange**

#### 2.4.2.2 Participation

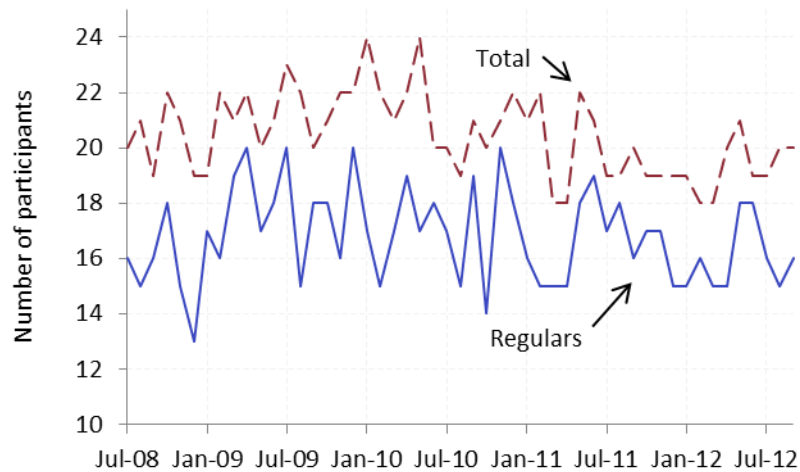
The number of participants in the forward market is typically close to twenty; with 80 percent of companies trading regularly (a regular trader is defined here as a company who has traded six or more times during the month). About forty companies have traded in the Alberta market at some point since 2008. The level of activity for each company ranges from thousands of trades to just a handful. The

<sup>75</sup> Some trades conducted through brokers also clear through the exchange.

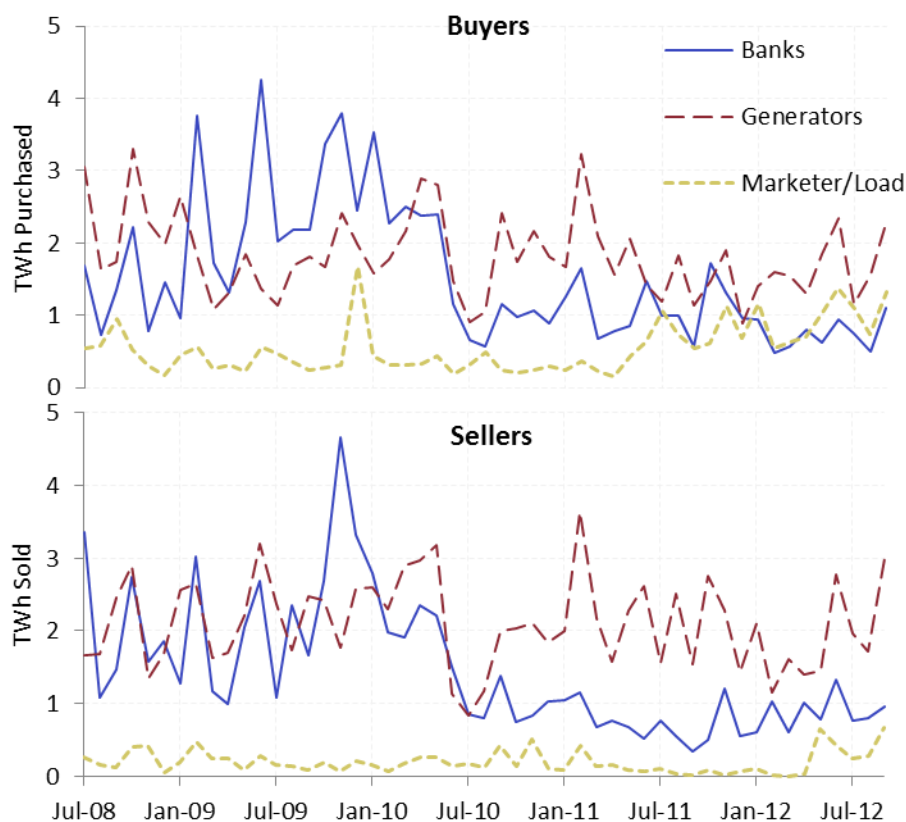


decline in the number of participants is far less pronounced than in overall trading volumes suggesting a reduction in activity rather than a net loss in the number of parties trading.

**Figure 2.5: Most forward market participants are regulars in the market**



Since 2010, banks and financial companies have made up a declining proportion of trading activity, while marketers and other loads have increased forward purchases. Figure 2.6 shows the number of terawatt hours bought and sold in a given month, separated by banks, generators and loads. In cases where companies control generation and serve load, they would usually be classified as a generator. The figure demonstrates that a reflection of lower liquidity in the Alberta forward market is declining trading activity of the financial players. There have also been important shifts in trading shares of participants within the other groups that are not visible when considering the various groups together.

**Figure 2.6: Banks have made up a declining portion of forward trading**

### 2.4.2.3 Trading by contract type

In Table 2.5 we show the breakdown of volume by contract type. Since 2010, monthly contracts have accounted for a majority of the total traded volume. One reason for this is the influence of the *Regulated Rate Option Regulation* that requires prices for RRO customers to be based on monthly contracts purchased 45 days in advance of the month. While this regulation was introduced in 2006, there was a transition where pricing was increasingly determined by the monthly contract.<sup>76</sup>

**Table 2.5: Monthly contracts have made up 66.5% of traded volume so far in 2012**

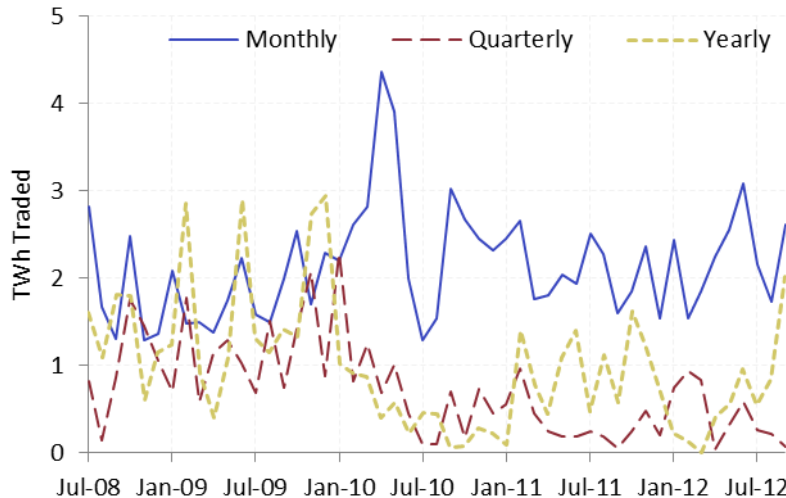
	Daily	Monthly	Quarterly	Yearly	Year ending
2009	0.8%	38.8%	24.3%	35.7%	0.4%
2010	0.7%	67.6%	19.0%	12.0%	0.7%
2011	0.4%	61.2%	9.9%	27.1%	1.4%
2012*	1.0%	66.5%	13.2%	18.7%	0.6%

\*January to September, inclusive

<sup>76</sup> In addition there have been changes to the Energy Price Setting Plans used by the main RRO providers over this time. For further details see the MSA's *Quarterly Report: April -June 2011 (Q2/11)*, Section 3.

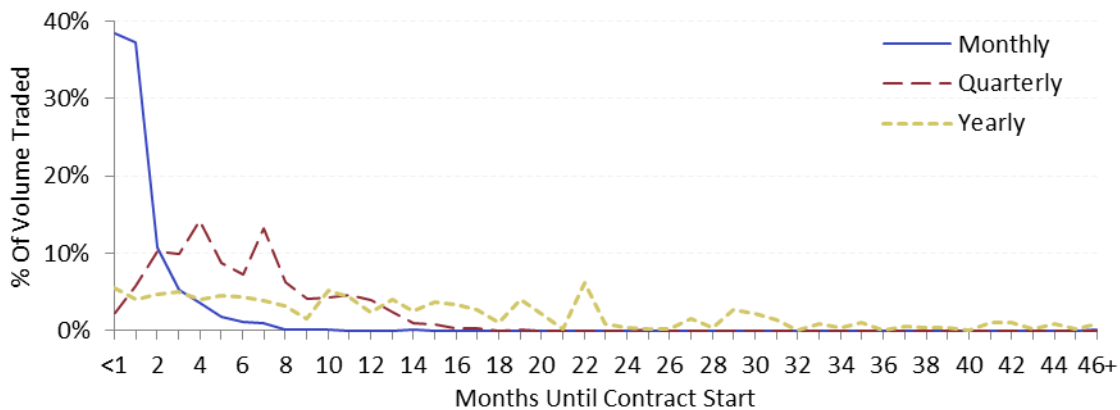
Figure 2.7 shows total terawatt hours traded by month and contract type. In the summer of 2010, quarterly and yearly contracts fall off considerably while monthly contracts remain roughly along the same trend.

**Figure 2.7: Monthly contracts are now the most common**



As well, over 75% of monthly contracts have been made less than 60 days prior to the contract start date. In Figure 2.8, the total trade volume (since 2008) by contract term is plotted against how far in advance the contract is made. Daily contracts are not shown, as almost all (over 99%) are traded less than a month in advance.

**Figure 2.8: Longer term contracts will be traded farther in advance more often than shorter term contracts (2008 – September 30, 2012)**



Typically the financial contracts of Alberta electricity fall into one of the following types:

- **Flat:** A Flat electricity contract covers every hour each day in the contract period;
- **On-peak:** An on-peak electricity contract covers hour ending (HE) 8 to HE23 Monday through Saturday, excluding Sundays and North American Electric Reliability Corporation (NERC) holidays, in the contract period;
- **Off-peak:** An off-peak electricity contract covers HE1 to HE7 and HE24 Monday through Saturday, and all hours on Sundays and NERC holidays in the contract period;

- **Extended on-peak:** An extended on-peak contract covers HE8 to HE23 every day in the contract period;
- **Extended off-peak:** An extended off-peak contract covers HE1 to HE7 and HE24 every day in the contract period; and
- **Super peak:** Super peak contract covers HE17 to HE22 each day in the contract period.

The majority of forward contracts, historically and in the present, have been flat contracts. Extended on- and off-peak are the next most common types on contracts. On-peak, off-peak, and super peak have not been traded (in any significant way) since 2010. The Energy Price Setting Plans for the main RRO providers are important for determining the types of contract traded. These rely upon extended on-peak and flat contracts, although previously had used super peak as well. The proportion of traded volume by contract shape is presented in Table 2.6. Given the change in the distribution of pool price of the last few years (an increase in the number of high and low price hours) there has been relatively little change in the types of contract being traded.

**Table 2.6: Most contracts are "flat"**

Percentage Of Contract Volume						
	Extended Off-Peak	Extended On-Peak	Flat	Off-Peak	On-Peak	Super Peak
2008	1.0	3.0	93.7	1.6	0.5	0.1
2009	0.8	3.9	92.3	1.8	1.1	0.1
2010	1.7	5.6	92.4	0.3	0.0	0.0
2011	1.1	4.3	94.6	0.0	0.0	0.0
2012*	4.1	5.7	90.1	0.0	0.0	0.0

\* Year to September 2012

#### 2.4.2.4 Reasons for lower liquidity

There appears to be no single reason for the reduction in liquidity experienced in the market. Informal surveys of traders conducted by the MSA point at different factors. Some of those are listed below and a number, potentially the most significant, relate to changes outside the Alberta electricity market:

- **2008 recession and its impact on credit availability** - Forward trading in most markets has declined after 2008, including the electricity market in Alberta. Furthermore, it appears some market participants opted to re-trench into a smaller number of key markets;
- **Dodd-Frank** - The U.S. introduced the *Dodd-Frank Wall Street Reform and Consumer Protection Act* in July 21, 2010; although some regulation under the act is still uncertain. The Act and subsequent regulations have caused companies transacting in energy commodities (including electricity) to reassess trading activity. In the short term, at least, this appears to have a negative impact on liquidity;
- **Difficulty to hedge or close positions** - The lack of liquidity could be acting as a vicious circle. The lack of intertie capacity and scarcity of participating companies makes it difficult to close a position and may serve to discourage financial traders;
- **Exercise of market power in the power pool** – Companies with significant control over generating assets may in some hours be able to exercise market power in the power pool.

Financial trades (without generating assets) are unable to do so and as a consequence may be less willing to take positions to settlement. To the extent that the MSA's *Offer Behaviour Enforcement Guidelines* have been explicit that unilateral exercise of market power is to be expected this may explain some reduction in liquidity. Some market participants reported to the MSA that the final guidance was not an issue but the uncertainty during the guideline making process was a factor in lower liquidity during 2010;

- **Vertical integration (generators with load)** - Some load serving companies in Alberta own their own generation. This makes it unnecessary to trade forward, or reduces the need for it. Higher vertical integration (see Section 1.2.4) could be one reason for lower liquidity; and
- **Regulated Rate Option EPSP's monthly procurement** – The Energy Price Setting Plans made in accordance with the *Regulated Rate Option Regulation* have resulted in procurement of monthly product in a 45 day window prior to the start of the month. This likely has a mixed effect on liquidity – forcing more trades to occur within this period at the expense of less longer term forward contracts being bought.

## 2.5 Exercise of market power

Market power is the ability to affect the market clearing price. In Section 1.4 we examined the structural question of whether or not the larger market participants have the ability to unilaterally influence market prices. Our findings are that the ability of market participants to influence market prices is variable. In many hours the ability of the larger generators to move the pool price is limited by market fundamentals and by competitive forces. In a smaller number of hours the larger generators were shown to be in a position to meaningfully influence market outcomes. However, establishing that these generators could influence market outcomes is not the same as establishing that they do. Whether a generator chooses to exercise market power is primarily determined by the expected profitability of exercising market power for the firm.

### 2.5.1 Market power and the Alberta market design

Alberta's energy-only market design requires that prudent investments in generation should provide a sufficient expected return to investors. Generation investment involves a considerable amount of expenditure prior to the plant producing electricity; these fixed costs are also often sunk in that they cannot be redeployed elsewhere. The Alberta market places all of these risks on investors and none on consumers. This is a significant difference from a regulated design where consumers would pay for new generation that was approved even if it turned out that the investment was not needed. It also means investors will only develop generation capacity if the expected returns are sufficient to justify these risks. To help clarify the importance of market power in the Alberta design we consider three alternative designs: an energy-only market with no market power; an energy-only market with market power; and a capacity market design. Each of these is helpful in understanding the design in Alberta.

#### 2.5.1.1 Energy-only market without market power

In the absence of any generator market power, the hourly pool price would normally be determined by the variable costs of the marginal generating unit. In the rare event of scarcity, the market price would be determined by the willingness of load to curtail consumption because prices are too high. In this market framework, generators can earn rents in two ways. First, efficient generators will earn profits (sometimes called rents) when the market price is set by a generator with higher variable costs. Second, generators can accrue 'scarcity rents' in the event of a supply shortage. From these two sources of rent generators need to recover all their fixed costs and adequate returns to justify the investment. In practice while these

sources of rent are needed in the hourly market, many generators and customers would be expected to enter into forward contracts that reflect the same need to recover costs and a return on investment with a different allocation of risk.

In the absence of generator market power, the majority of generators would be heavily reliant on scarcity rents in order to recover fixed costs. There are two possibilities: either that scarcity becomes quite common or that prices would need to be very high when scarcity occurs. The former option is not desirable in that common scarcity would likely imply there would be some hours where generation was not only scarce but insufficient to cover demand. In the second option, scarcity would be uncommon but prices would in these circumstances need to be very high.<sup>77</sup> Infrequent scarcity events may also cause problems for investors in that the high prices associated with them may not occur for many years and that if those prices did result there is a risk of political intervention. Infrequent events also pose a problem in that an individual generator may find the scarcity event corresponds to period when their generators are offline.

#### 2.5.1.2 Energy-only market with generator market power

With generator market power, there is additional source of rents, i.e., generators can seek to raise the market price when there is no scarcity event. The ability they have to do this depends on a number of factors, obviously they may have more ability to do so in hours when the balance between supply and demand is tighter even though it may not correspond to a period of supply shortage. There are a number of implications from this. First, prices can be capped at a lower level and fixed costs can still be recovered. Second, it is important that there are short and longer term competitive forces that check the ability of market participants to exercise market power. If not, prices may not be seen as credible to new investors or, alternatively a market where prices are influenced by a small number of participants, may be viewed as higher risk.

#### 2.5.1.3 Capacity markets with or without market power

A third possibility is to allow for the recovery of fixed costs outside the energy market. In some electricity market designs this is done through 'capacity markets'.<sup>78</sup> At a simple level this provides a source of revenue for having capacity available, independent of whether or not it ever provides electricity. Having provided for the recovery of some or all fixed costs through this source, generators in the energy market who have the ability to exercise market power are usually subject to automatic mitigation procedures – essentially removing their ability to influence market prices.

#### 2.5.1.4 Energy-only market in Alberta with generator market power

The Alberta energy market has a price cap of \$999.99/MWh. The two electricity markets closest to the Alberta design, the Australian National Energy Market and the Electric Reliability Council of Texas (ERCOT) have price caps of \$12,900/MWh and \$4,500/MWh, respectively, with the cap in ERCOT set to increase to \$7,500/MWh in 2013 and \$9,000/MWh in 2015. The higher price caps in Australia and ERCOT have been introduced to ensure adequate supplies of generation whereas in Alberta there has been relatively little concern with future generation adequacy.<sup>79</sup> The comparatively low price cap in Alberta is

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<sup>77</sup> Theoretically prices in such a market would need to go as high as the Value of Lost Load (VOLL). Estimates of VOLL in the Australian National Electricity Market are used to determine the price cap in that market, which increased to \$12,900/MWh on July 1, 2012. For further discussion on the theoretical case for VOLL see Stoft (2002).

<sup>78</sup> A capacity market features in some of the main North American electricity markets such as those in New York, New England and PJM. Most designs of capacity market include demand-side response as a type of capacity.

<sup>79</sup> A 2011 report by the Brattle Group showed a positive outlook for the long-term sustainability for Alberta's energy-only market design. It did suggest considering increasing the price cap and reducing the floor but made no detailed

accompanied by an acceptance that generators may exercise market power.<sup>80</sup> If no market power was exercised it is likely that generation investment would fall, scarcity events increase and generation would be inadequate from the perspective of reliability.

The important point of this section is that there are a number of market designs that all essentially have the same purpose: to allow recovery fixed costs over the long term and a sufficient (but not excessive) return to investors to induce prudent investment. All should result in similar prices to consumers over the long term although with different allocations of risk. Different designs also have different implementation problems and any of the designs that are poorly implemented will correspond to higher prices or lower generation adequacy (or both).

Having considered these different designs we return to focus on the Alberta energy market and how generators can in practice exercise market power, what incentivises them to do so and most importantly what are the competitive forces that limit the exercise of market power.

### **2.5.2 How can generators exercise market power?**

Generators can exercise market power in the real time market (known as the power pool) through the 'economic withholding' of available supply. Economic withholding is defined as:

offering available supply at a sufficiently high price in excess of the supplier's marginal costs and opportunity costs so that it is not called to run and where, as a result, the pool price is raised. Such a strategy is only profitable for a firm that benefits from the higher price in the market.<sup>81</sup>

Not offering energy that would otherwise be available to the market, sometimes called physical withholding, is in most cases prohibited.<sup>82</sup> One variant of economic withholding which involves a physical element is where a unit's entire capacity is priced out-of-merit so that the generating asset is dispatched offline. For some units minimum-off times and start-up constraints mean that once the unit is offline, the asset is physically unavailable from the market for a number of hours. Figure 2.9 shows an illustrative start-up profile for a coal generator that has been dispatched offline. The profile shows an initial minimum-off time and an increasing time to restart depending on the length of time the unit has been idle.

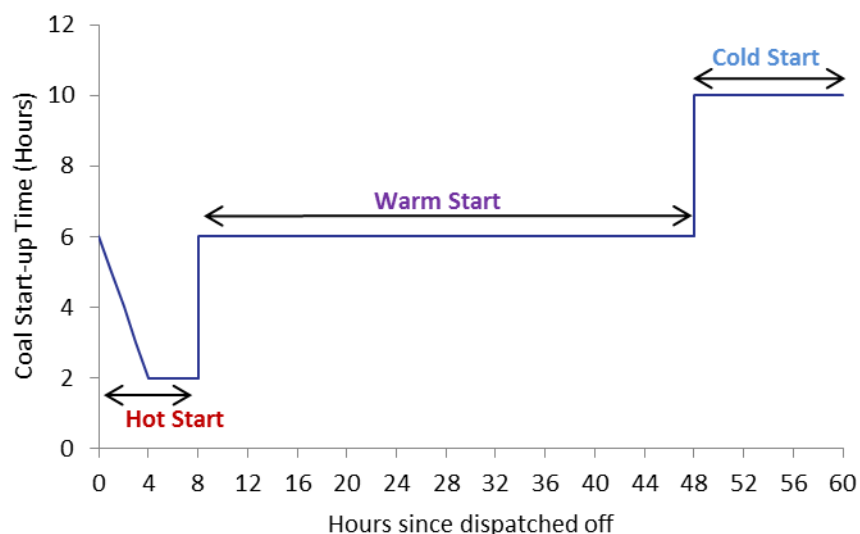
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recommendations. See *Evaluation of Market Fundamentals and Challenges to Long-Term System Adequacy in Alberta's Electricity Market*.

<sup>80</sup> In 2011 the MSA through its *Offer Behaviour Enforcement Guidelines* set out the circumstances in which it would not have grounds to investigate the exercise of market power.

<sup>81</sup> *Offer Behaviour Enforcement Guidelines*, p. 9-10.

<sup>82</sup> See Section 2(f) of the *Fair, Efficient and Open Competition Regulation*.

**Figure 2.9: Some generators dispatched offline take a long time to restart**

### 2.5.3 What incentivises generators to exercise market power?

The driving force behind all markets is the possibility to make profits. Generators will exercise market power through economic withholding if they expect the strategy to be profitable. Consider for example that a generator has 1,000 MW of energy (net of forward contracts) for sale in the hourly power pool. Suppose that if the generator offers all 1,000 MW such that it is dispatched, and generates power, the hourly pool price will settle at \$70/MWh. If the generator economically withholds 200 MW of generation the pool price is raised from \$70 to \$100/MWh. By supplying 800 MW rather than 1,000 MW the generator is able to increase the pool price and, by doing so, is able to increase revenues from \$70,000 (\$70/MWh × 1000 MW) to \$80,000 (\$100/MWh × 800 MW). In addition the generator is able to avoid the costs associated with running the 200 MW that is economically withheld. Assuming variable costs are \$15/MWh, the generator is able to save \$3,000 (\$15/MWh × 200 MW) in variable costs, a total increase in revenue of \$13,000 (\$10,000 + \$3,000) accrues through the withholding strategy.

Since such strategies are profitable, one would expect a generator seeking to maximize profits to do so. Note that pool price is impacted so all those market participants who have energy for sale in the pool are likely to gain not just the party withholding. Those who are net consumers pay more. Those who have entered into forward contracts covering all of their generation or consumption are not directly impacted by the economic withholding at all.

The above example highlights that the incentives of a firm to exercise market power are highly dependent upon the firm's exposure to pool price. In our example, the firm is able to increase its revenues by economically withholding 200 MW because 800 MW of exposure benefited from the higher price. If the firm had sold 500 MW forward at a fixed price, the strategy of economically withholding 200 MW to result in a \$30/MWh rise in pool price would not have been profitable.<sup>83</sup>

Exposure to pool price is dependent on a number of physical and financial factors and can change from hour to hour. These factors influence the market participant's portfolio position. A portfolio position can

<sup>83</sup> Revenues are \$35,000 (\$70/MWh × 500 MW) compared to \$33,000 (revenues of (\$100/MWh × 300 MW) plus cost savings of \$3,000).



be thought to be 'long' (a net seller at the prevailing pool price) or 'short' (a net buyer at the prevailing pool price). The main factors influencing portfolio position are:

- **Physical plant availability and offers:** generators with major outages or derates<sup>84</sup> find themselves with less for sale, in some cases outages (particularly unplanned ones) may cause a generator to become 'short'. Generators offering at different prices in the power pool will also find their length changes as different units get dispatched on (increased length) or off (reduced length);
- **Forward market/bilateral sales and purchases:** generators can alter their exposure to the hourly pool price by buying and selling forward contracts. Since the Alberta market is a pool, it is generally irrelevant to a forward market position as to whether the contract is physical (a direct sales agreement) or financial. By selling power forward at a fixed price the generator 'hedges' its exposure to pool price and will have less incentive to increase the real-time market price as a result. In contrast a generator can increase its exposure to the pool price by buying power forward at a fixed price and carrying this power into the real-time market. Some sales of forward power are unit contingent, i.e., only apply if the unit is physically available, which is a method of offsetting positions that result from the plant being unavailable. Derivatives and options are other methods that can create or hedge exposure to pool price but these are virtually unknown in the Alberta market;
- **Retail sales:** retail sales in many ways act in the same way as selling forward reduces a generators 'long position'. Whereas most forward contracts are standard contracts (a specific volume for a specific period) retail sales may create an exposure to pool price that varies through the day, e.g., residential consumers typically use little at night and more during the early evening hours. Some market participants have developed generation along with retailing ('gentailers'). For these vertical integrated firms, generation availability is often offset by retail sales, in other words it reduces its long position;
- **Operating reserves:** operating reserve prices (those products used to keep the system in balance and for contingency events) are indexed directly to the Alberta pool price. Because of this they factor into a market participants portfolio position when they are determining whether they would benefit from a higher pool price;
- **Imports and exports:** imports into Alberta will increase a generator's exposure to the pool price while exports from the province will reduce their exposure. Imports and exports are not allowed to set the market price but can be used to influence market outcomes however, in doing so create opportunities for other market participants to flow power in the opposite direction;
- **Availability Incentive Payments:** the Purchase Power Arrangements (PPAs) resulted in a virtual divestiture of capacity and were an important part of the establishment of a competitive market.<sup>85</sup> Today they still remain an important feature of the market place. Owners are provided a financial incentive through Availability Incentive Payments (AIPs) to make the units available to the buyers. Payments flow to owners when unit availability is above target and to buyers when unit availability is below target. From the perspective of portfolio position the PPAs are important because they expose owners and buyers to these AIPs which are in turn based on the

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<sup>84</sup> Derates refer to loss of some ability to produce electricity at a generating unit whereas an outage usually refers to a complete loss of ability to produce electricity.

<sup>85</sup> For further discussion see Section 3.2 of the MSA's *Alberta Wholesale Market: A description of basic structural features undertaken as part of the 2012 State of the Market Report*.

average price in the current and previous 29 days. The existence of these payments creates a virtual exposure to pool price during this period. For example, a higher price today as a result of economic withholding results in a change in the incentive payments for the current and next 29 days. The impact of the PPA AIP is increased since most of the PPA buyers and owners are also larger market participants that are able to exercise market power.<sup>86</sup>

## 2.5.4 What limits the ability of a generator to exercise market power?<sup>87</sup>

### 2.5.4.1 Short term constraints on generator market power

In the short-term, the ability of a generator to raise the pool price through economic withholding is limited to instances where they have structural market power and by the responses of other market participants. For example, during periods of weak demand or high wind generation even large generators may be unable to influence prices. These include:

- **Price responsive load:** Price responsive loads limit the ability of generators to exercise market power. As a simple example, if load reduces by 200 MW whenever prices are raised above \$100/MWh a generator would need to economically withhold more than 200 MW to raise market price through this threshold. Many of the price responsive loads in Alberta reduce their consumption within a matter of minutes in response to pool price spikes. Consequently, these loads can be an important and very timely constraint on the market power of generators;
- **Offers of rival generators:** Vigorous generator on generator competition is key to the competitive market structure chosen in Alberta. The rules for the Alberta market require all available capacity to be offered so the effectiveness of economically withholding will depend on the offers of other generators. For an example see Figure 2.10 below. Generators also may respond to observed economic withholding by restating offers for future hours. Market rules currently limit their ability to do so for the current and next two hours. This may include units with unoffered volumes that take time to deliver power to the grid. A factor in whether these generators respond will be an expectation about recovering start-up costs in the market prices that are anticipated; and
- **Increased imports:** By increasing the Alberta pool price a generator will increase the incentives for market participants to import energy into the province. The ability of participants to increase imports is constrained by the capacity available on the intertie. The response of importers is constrained by rules in the same way as restatements for in-province generators.

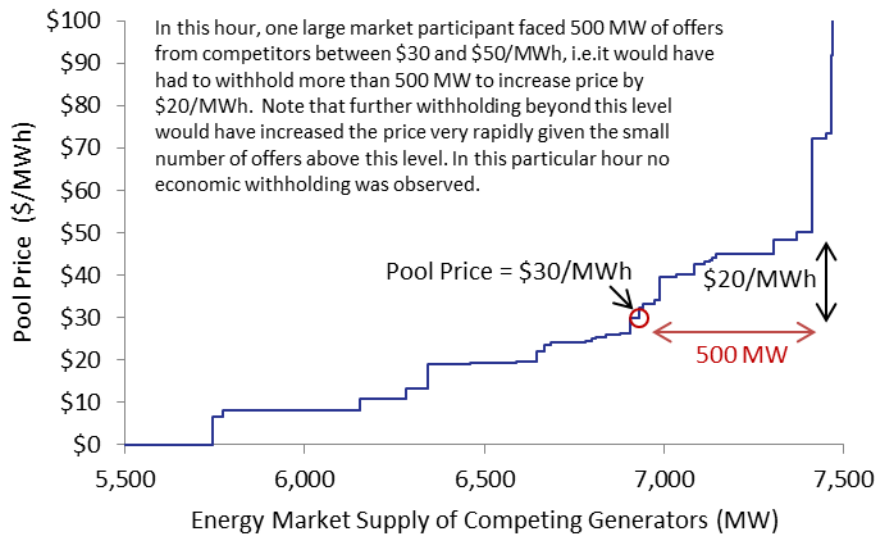
A market participant engaging in economic withholding may face some increased costs as a result that are incurred as a unit is dispatched or ramped from one level to another. Transmission congestion may also impact economic withholding either through withheld units directed to run to relieve constraints, or by limiting the impact of competitors to respond in the event they have been constrained off. Uncertainty may also constrain the practical ability of generators to profitably withhold, since neither the offers of competitors are known in advance, nor are other market fundamentals such as overall load or level of wind generation.

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<sup>86</sup> This is further complicated as some of the original PPA buyers were syndicates of generation and load market participants.

<sup>87</sup> Parts of this section draw upon Cramton (2004).

**Figure 2.10: There are times when economic withholding of even a large amount of offered energy would have little impact on the pool price**



#### 2.5.4.2 Longer term constraints on generator market power

Longer term constraints are even more important than those that occur in the short term. We note a number of them here:

- **Forward contracting** - As noted above the incentive a generator has to engage in economic withholding is linked closely to its overall portfolio position. Exercise of market power is likely to impact future forward prices, for example loads may purchase more forward contracts to avoid pool price volatility pushing the price for those contracts higher. This may in turn reduce the incentives for economic withholding by the party selling the forward contract leading to lower volatility and perhaps yet more changes in the incentives for load to contract forward. For such a mechanism to work it is obviously important that loads do not suffer from any significant barriers to forward purchasing.
- **Economic withholding mostly benefits those generators not withholding** – Generators who regularly engage in economic withholding incur a cost. The conduct may still be profitable overall but some available capacity is left un-dispatched and therefore earns no revenue. A smaller generator, even one highly exposed to pool price, can reason that a larger generator will withhold and raise price. In this case the smaller generator can simply act as a price taker and gain from the higher price caused by the larger generator.<sup>88</sup> In the long term this is important to encourage the entry and growth of smaller firms which in turn reduces the ability of larger firms to influence market outcomes. Similarly, investments by firms that regularly engage in economic withholding may also be discouraged. At a simple level it makes little sense to invest in new capacity if you are idling existing facilities. More formally, firms that economically withhold need not only ensure that the new investment is profitable on a standalone basis but that its addition does not diminish the overall profitability of the portfolio.

<sup>88</sup> A further complication in a small market where unit outages drive whether market power may be profitably exercised is that smaller market participants may miss out on high prices that occur when they are offline.

Finding evidence of longer term constraints on market power is more difficult than observing short term influences. Survey work conducted by the MSA indicated that at least some loads were able to make use of bilateral / direct sales agreements but we have not found convincing evidence that the incidence of economic withholding has led to greater forward contracting. This suggests further work may be needed to ensure there is no barrier to this occurring. The impact of economic withholding on the investment of small firms is likely to be only observable over a number of years. We examine some of the evidence on investment trends in the next section. While we are unable to observe a definitive pattern to suggest small firms are investing in response to economic withholding this remains one of the indicators the MSA will monitor.

## 2.5.5 The exercise of market power in practice

In this section we focus on two insights into the exercise of market power. First, a firm's overall portfolio position is shown to have a notable impact upon a firm's offer behaviour. Second, we examine the extent to which instances of economic withholding are consistent with short run profit maximizing behaviour.

### 2.5.5.1 Vertical integration and exercise of market power

As a measure of ability to exercise market power in a given hour we use the adjusted-RSI metric developed by the MSA.<sup>89</sup> We then examine the offer behaviour at similar units belonging to one firm that is large but vertically integrated and one firm that is large but not. Our metric of offer behaviour for each unit is the highest offer price dispatched on a given day which we term the 'marginal offer price'.

Figure 2.11 shows the relationship between maximum daily adjusted-RSI and the marginal offer price for a vertical integrated firm and one that is not.<sup>90</sup> For ease of interpretation we show the inverse of adjusted-RSI such that higher values indicate structural market power. Both firms have similar levels of structural market power as measured by the adjusted RSI-metric.

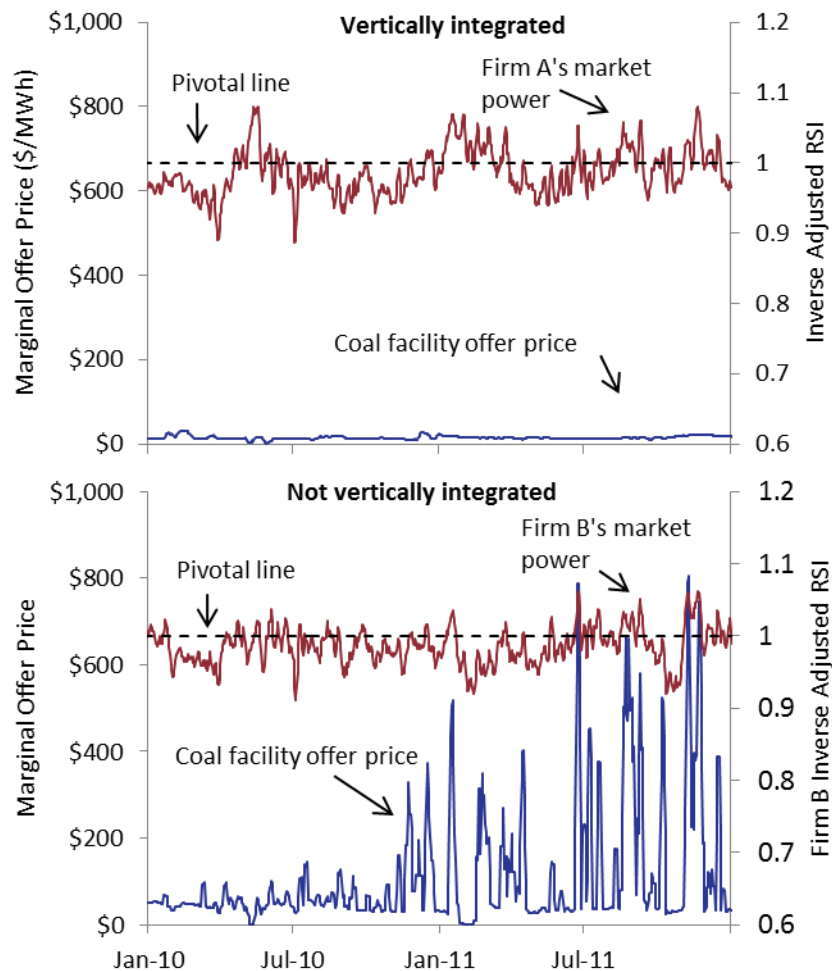
For the vertically integrated firm we find no clear relationship between marginal offer price and structural market power, i.e., while the participant has the ability to exercise market power it does not do so with that unit. For the other firm, we find a much stronger correlation between marginal offer price and structural market power. The results do not mean that vertically integrated firms never exercise market power, nor that non-vertically integrated firms always do. As noted above it is portfolio position (exposure to pool price) that determines incentives, for example a non-vertically integrated firm with large forward sales in a given month has little or no incentive to exercise market power.

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<sup>89</sup> See the MSA's *Measuring Generator Market Power*. Adjusted- RSI (or Residual Supply Index) is a measure of whether a supplier's generation is needed for the market in order to satisfy demand.

<sup>90</sup> Both the inverse-adjusted RSI and marginal offer price are plotted using a five day rolling average.

**Figure 2.11: The non-vertically integrated firm exercised more market power than the vertically integrated one**



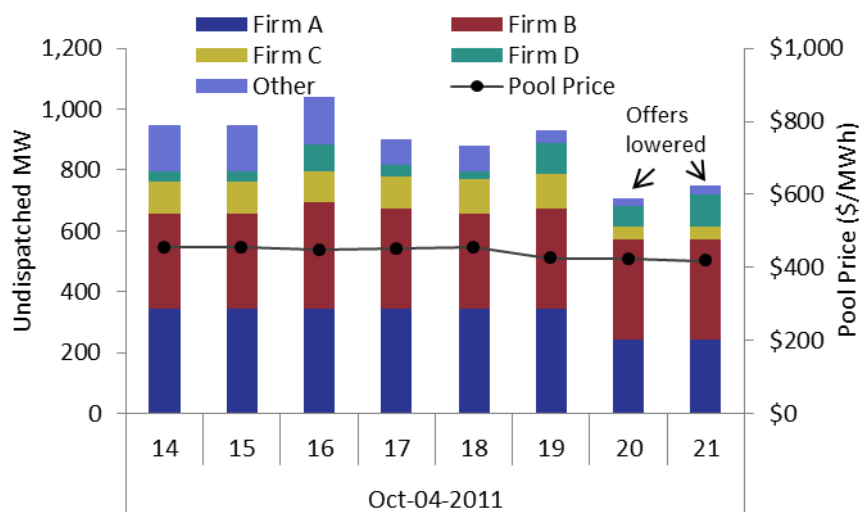
### 2.5.5.2 Economic withholding and short run profit maximizing behaviour

In the previous section we noted that small participants can act as price takers and still benefit from the economic withholding of larger market participants. This also applies to larger market participants in that they might choose to act as price takers with the expectation that another large participant has sufficient length such that the rival firm will economically withhold even in their absence. In instances when larger participants are simultaneously exercising market power, there is often still an incentive to undercut rivals in order to increase dispatch in order to raise overall profitability. Over the course of the last two years the MSA has analyzed and reported on a number of events involving economic withholding and reported on these in our Quarterly Reports. The surprising finding is that such events often involve a number of larger market participants engaging in economic withholding and that this equilibrium is relatively stable over a number of hours, or is repeated on subsequent days.

In Figure 2.12 we show an example of a stable pattern of withholding involving a number of market participants.<sup>91</sup> Pool prices during this period were between \$400/MWh and \$500/MWh with about 700 MW to 1000 MW of dispatched capacity remaining in the energy market merit order. From hours 14 through 19 two market participants are both observed to have about 300 MW of un-dispatched capacity. Only in hours 20 and 21 do we observe one of these lowering offers to increase dispatch and pool prices decline slightly as a result. Stable patterns of withholding could be explained if market participants with un-dispatched capacity do not believe they would the recover costs associated with starting up units. However, we note that in some cases competition is not as vigorous and effective as it could be because:

- **Rules may be impeding competition:** - A possible candidate is the lockdown on restatements during the current and next two hours. Market participants that see a profitable opportunity to undercut rivals might be unable, or less able, to exploit this due to the inability to restate; and
- **A small and stable number of rivals might lead to reduce competition** – Undercutting rivals might result in further undercutting from the rival in future hours. This is an important part of competition. Where the number of market participants engaging in withholding is small it is possible that individual participants may forgo the short term profits gained by undercutting in order to maintain prices and profits for the group over a longer period of time. There does not need to be an explicit communication between rivals for this to happen. Examining whether this is an issue in the Alberta market has been the subject of separate work by the MSA.<sup>92</sup>

**Figure 2.12: Economic withholding contributed to pool prices over \$400/MWh in this example**



## 2.6 Investment

Energy-only markets can only work if there is sufficient confidence from investors that investments will be profitable. In most cases, investments are a balance between long term sales (often through an industrial user located on the same site as the generation) and merchant (uncontracted) capacity that will subsequently be sold via forward markets or directly into the power pool. The growth in capacity in the Alberta market has been extremely strong and the diversity in technologies used put it in marked

<sup>91</sup> This example is from October 2011.

<sup>92</sup> The further work is focusing on whether certain public information made available by the AESO facilitates coordinated outcomes between market participants and that there is a potential for harm to competition overall. See, for example, a report commissioned by the MSA titled *Electricity Market Data Transparency*, November 22, 2011.

contrast to the regulated system that preceded it. The trends in investment are important in evaluating whether the market is delivering dynamic efficiency gains. In this section we consider the data on investment and capacity changes and return to consider dynamic efficiency in Section 3.5.

### 2.6.1 Capacity changes by fuel type

Alberta's energy-only market has been successful in adding and retiring generation capacity. Over 6,800 MW of new capacity has been developed since the market was deregulated in 2000. During this time 1,400 MW of capacity has been retired. The result has been a net addition of over 5,000 MW. Almost all of this capacity has been added without additional payments that are common in some other electricity markets.<sup>93</sup> Table 2.7 shows the breakdown of capacity changes by fuel type and by category. Generation additions refer to the creation of a new asset being added. Uprates include the addition of new generation at existing assets and efficiency uprates. Retirements result from removal of assets and derates indicate a permanent reduction in capacity. A small change in the total is as a result of a change in capacity definition introduced in late 2007.

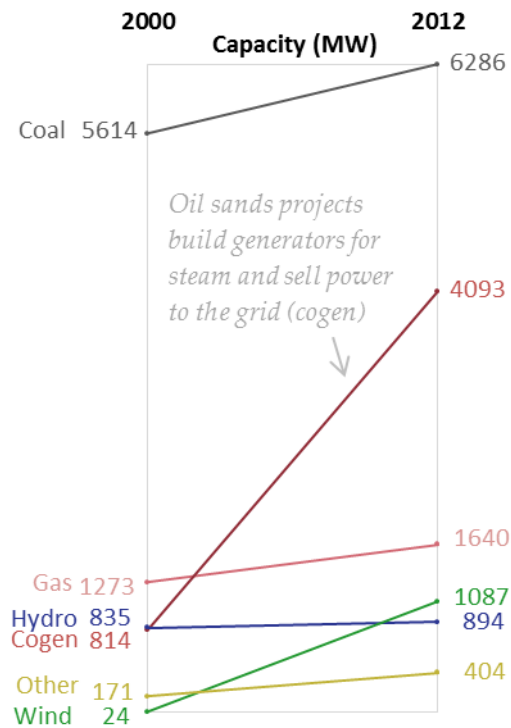
**Table 2.7: Over 5,000 MW of net additional capacity has been installed since 2000**

Fuel Type	Additions [A]	Uprates [B]	Retirements [C]	Derates [D]	Net Change [A]+[B]+[C]+[D]	Definition Change (Dec. 2007)
Coal	900	236	-547	-8	581	91
Gas	1,095	75	-861	-2	307	60
Cogen	2,448	702	0	0	3,150	129
Wind	1,013	54	-4	0	1,063	0
Other	161	70	0	0	231	2
Hydro	51	0	0	0	51	8
<b>Total (MW)</b>	<b>5,668</b>	<b>1,137</b>	<b>-1,412</b>	<b>-10</b>	<b>5,383</b>	<b>290</b>

As shown in Figure 2.13 a significant proportion, some 60%, of the net additions has come from cogeneration facilities. The addition of wind generation, although smaller in absolute terms, is also significant given the low level of capacity present in 2000.

<sup>93</sup> Some locational based credits to three generators were approved by the Energy and Utilities Board in 2000. See AUC Decision 2000-47 for further details. During the period the federal government also offered incentives to qualifying facilities through the Wind Power Production Incentive (WPPI, from April 2002 – March 2007) and the ecoEnergy Renewable Power program (April 2007-March 2011).

**Figure 2.13: There has been significant growth in wind and cogeneration capacity**



The annual capacity changes by fuel type are illustrated in Figures 2.14 and 2.15. Figure 2.14 shows the generation facilities that have been built and retired in each calendar year since January of 2000.<sup>94</sup> Even though some technologies involve large scale capacity being brought online at one time growth has been spread through the period, with only the period 2005 to 2007 seeing relatively little new generation. Upgrades (including additional assets) at existing facilities have also been an important source of growth; about 20% of the total for net additions (see Figure 2.15).

<sup>94</sup> These figures are based on when the generating units began / finished supplying power, rather than when the units were officially commissioned or decommissioned. Some facilities expected to come offline this year have not been included in the 2012 retirees.



Figure 2.14: A number of new facilities have been built since 2000

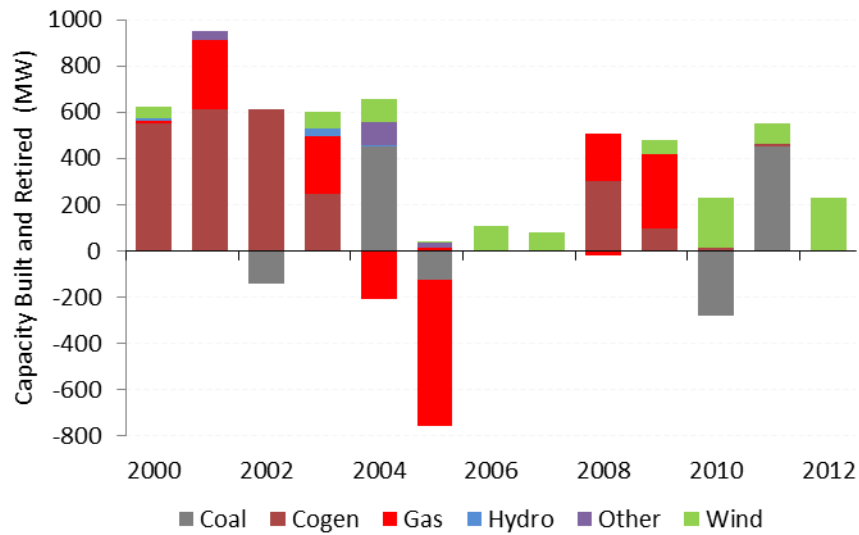
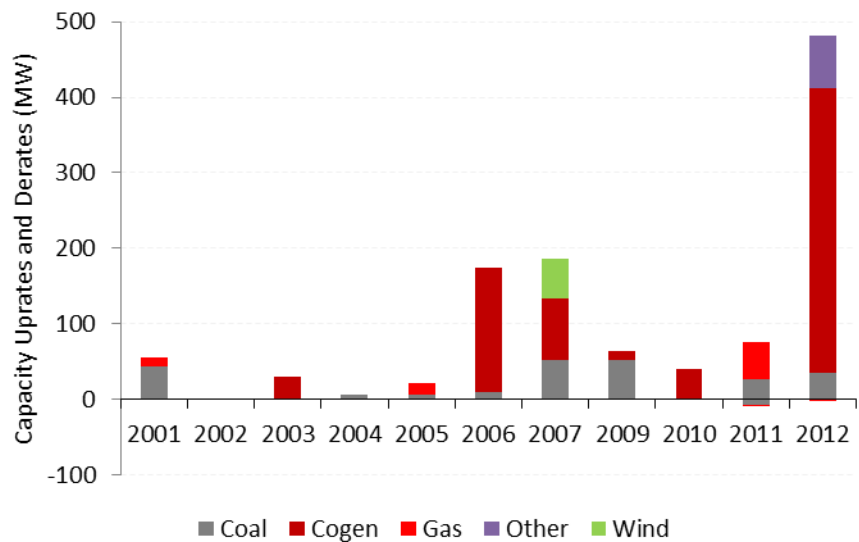


Figure 2.15: Uprates have been an important source of capacity growth



### 2.6.2 Capacity changes by firms

In the long run, the fair, efficient and openly competitive operation of the Alberta wholesale market will depend upon the extent to which new entrants can successfully enter the market. As noted above, the entry of smaller firms will be expected as a response to economic withholding by larger firms. Therefore, analysis of which participants develop and retire generation capacity is important in terms of discussing the dynamics of competition within the wholesale market.

At the time of deregulation there were three main generation firms. Since this time two generators have joined the group of major generators, both having acquired a significant amount of capacity through Power Purchase Arrangements. For the last few years, these five large firms have been significantly larger than their rivals. Since deregulation, over a third of the added capacity (nearly 2,500 MW) has been developed outside the five largest firms (see Table 2.8); however, over 500 MW has subsequently

been acquired by the large firms. The picture is further complicated by the type of capacity developed with some market participants developing significant wind and cogeneration facilities that do not directly compete strategically in the market.

**Table 2.8: A third of new capacity has been developed by smaller firms**

	Capacity Added / Upated (MW)*	Capacity Retired / Derated (MW)	Net Change (MW)
Firm A	1,123	-8	1,115
Firm B	890	-841	49
Firm C	263	0	263
Firm D	1,886	-547	1,339
Firm E	462	0	462
Others	2,472	-26	2,446
<b>Total</b>	<b>7,095</b>	<b>-1,422</b>	<b>5,673</b>

\*Includes MW associated with capacity definition changes in 2007

### 2.6.3 Future capacity developments

Currently, approximately 1,200 MW of capacity is under active construction and a further 2,600 MW have received regulatory approval.<sup>95</sup> The generation projects that are under construction are dominated by natural gas-fired additions but also include two biomass facilities. An 800 MW facility is being developed as a joint venture by two of the large five market participants and a further 350 MW is under construction relating to oil sands development.

Among those projects that have received regulatory approval coal uprates, wind, hydro, and natural gas projects. The sponsors of these projects include a number of participants outside the large five generators. While some of these projects may not proceed to construction, a long list of projects with the necessary approvals is a healthy sign that regulatory barriers are low and that there are potential entrants that would build if prices were sufficiently high.

<sup>95</sup> See AESO's *Long-Term Adequacy Metrics*, November 2012.

## 3. Performance

### 3.1 Introduction

In assessing the economic performance of a market, an appropriate benchmark is required. Choosing the appropriate benchmark has to recognize some key characteristics of a market. Some markets with both stable and predictable supply and demand may exhibit stable prices. In electricity markets, demand changes throughout the day with few options for storage. Investment in electricity generation involves considerable fixed costs; investment is often lumpy (some technologies benefit from a certain scale of production); some benefits accrue to participants with multiple facilities; and the future is uncertain.

These features are the exact opposite of those present in the most commonly used benchmark economic analysis, *perfect competition*. In fact very few industries and very few markets meet the stringent requirements that would make this an appropriate benchmark. Economic theory focusses on *perfect competition* not because it is a useful descriptor of the real world but because it corresponds to many of the outcomes we want – profit seeking by individual market participants leads to efficient and sustainable outcomes with competitive forces keeping prices low. Many of these outcomes are entirely achievable by markets that do not correspond closely to a perfectly competitive market.

In assessing market performance the benchmark commonly used by competition authorities is ‘workable competition’, recognizing the desire for the same outcomes but also the constraints imposed by structure. For example, in the ideal of *perfect competition* prices are driven down to the short run cost of supply (sometimes called short run marginal cost), whereas in reality this would not allow recovering of fixed costs associated with investment. *Workable competition* instead recognizes competition still acts to drive prices down but only to a level where fixed costs of prudent investment can be recovered such that the market remains sustainable. While most competition authorities rely on some concept of *workable competition* it is not clearly defined. In some cases *workable competition* is also used to describe a different and arguably much lower standard, merely that the market outperforms government (or regulated) provision of the same service. The label *workable competition* also connotes an apologetic standard of sufficiency not success. For these reasons the MSA prefers the term *effective competition* to describe the high standard expected, that outcomes matter and efficiency gains over time should result and these should be observable over a reasonable timeframe.

In the context of the characteristics of the electricity market we define *effective competition* as:

A level of competition (and related outcomes) that (i) achieves efficient investment with the lowest possible short run inefficiencies, (ii) does so over a reasonable timeframe, and (iii) where open competition ensures neither collusion, abuse or anti-competitive practices.

This definition explicitly recognizes that getting an efficient outcome over time is the goal and in achieving it is acceptable to have some efficiency loss in the short run. The third part of definition of *effective competition* is the requirement placed by legislation on market participants in Section 6 of the *Electric Utilities Act*, such that:

Market participants are to conduct themselves in a manner that supports the fair, efficient and openly competitive operation of the market.

The monitoring, investigative and enforcement work of the MSA is part of a continuing assessment of whether market participants meet this standard.

Most of this section of the report is to test against the other parts of the benchmark. To do this we need to:

- Measure short run inefficiencies;
- Assess whether there is evidence of dynamic efficiency over time; and
- Ensure that price outcomes over the medium term are no higher than they need to be to ensure the market is sustainable (new investment occurs when it is profitable).

As a preliminary, we examine price outcomes and the importance of the price signal. This is not formally part of the assessment of market performance rather it is the signals that are being sent that shape conduct. Wholesale electricity market prices and volatility typically receive far more attention than efficiency even though they are in many ways less important. Often prices and volatility are just the drivers of change. Unimpeded these drivers should direct efficient outcomes over time. For example, the distribution of prices shapes what type of investment will be made. In the MSA's wider work on monitoring market participant behaviour and the impact of rules on market outcomes, price impacts still matter. Sometimes we use these as proxies for efficiency loss or have concerns that incentives might be distorted and that efficient investment would not result.

## **3.2 Price signals**

In this section we consider:

- Price volatility;
- Prices received by different generating technologies;
- Convergence of forward prices and pool price; and
- Scarcity and pool price.

### **3.2.1 Price volatility**

The pool price is the result of a complex set of interactions within the market. Electricity generators make price and quantity offers in the energy market. The ISO sends 'dispatch' instructions to offered energy from lowest to highest price in order to match supply with demand. The system marginal price (SMP) is determined by the highest offer dispatched which in turn determines the pool price (the time weighted average of SMP in a given hour). All else being equal, prices will be higher as demand increases or available supply falls (due to outages or maintenance). The choice of energy offers by generators in turn depends on costs and whether they would gain from exercising market power. As all of these factors change over time, some frequently, and as a consequence it is expected that the pool price will be characterised by some degree of volatility.

Price volatility is an important feature of the market for a number of reasons as it:

- Provides signals to invest in certain types of technologies and not others (e.g., high volatility will likely favour generation technologies with operational flexibility, or cause economic opportunities for storage);
- Encourages larger customers exposed to the pool price to curtail demand whenever it is above their willingness to pay. Price responsive demand in the short run may reduce volatility in the market and acts as a substitute for some capacity additions that might otherwise have been signalled; and

- May encourage forward contracting to avoid volatile prices. This may in turn reduce the incentives for generators to exercise market power.<sup>96</sup> Forward contracting may also prompt new investment.

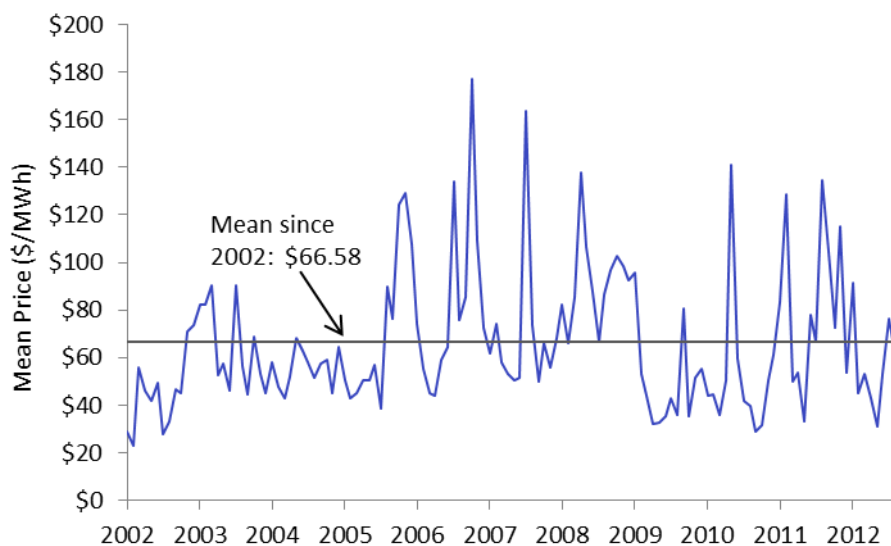
What matters most is that the volatility results from market fundamentals or from participant behaviour that can prompt a competitive response. High or volatile prices can also result from deficiencies in the market design, transmission congestion or impediments that are not likely to prompt efficient responses over time. Distinguishing the two is beyond the scope of the *State of the Market Report* but that the MSA has commented on a number of specific issues and events in its regular *Quarterly Reports*. Volatility of retail prices is often raised as a cause for concern. The important role that volatility plays in the wholesale market does not imply that all retail customers need to be exposed to that volatility; in fact their choices of fixed priced contracts are themselves an important driver in the market.

In the rest of this section we focus on the overall trends observed. As a final note while much is said of price volatility in electricity markets there is no single accepted measure. It sometimes used to mean a comparison of averages between different time periods, a measure of dispersion within a time period or a rate of change (sometimes called velocity). We consider metrics in each of these categories to present a fuller picture of 'volatility' in the Alberta market.

### 3.2.1.1 Average prices and price dispersion

As shown in Figure 3.1, wholesale electricity prices have averaged about \$67/MWh. Monthly averages have varied from less than \$30/MWh to over \$175/MWh, but in aggregate the price level has not trended up or down. Not shown in the graph is that for natural gas prices have declined significantly in recent years, implying the ratio of electricity prices to natural gas prices (known as the market heat rate) has increased significantly.

**Figure 3.1: In aggregate, the mean monthly price for electricity is not on an upward trend**

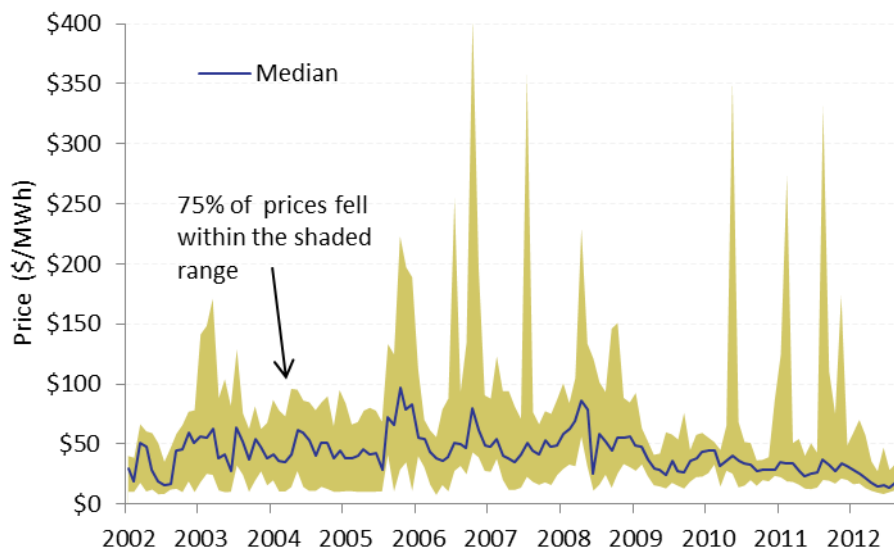


A mean or an average price is just one way of reducing information into a summary form so we can compare it over time. The median value is usually a better measure where the distribution of prices is skewed or asymmetrical and this is the case for pool price. In Figure 3.2 we show the median (50th

<sup>96</sup> See Section 2.5: Exercise of market power.

percentile), along with the 12.5th and 87.5th percentiles. This means that 12.5% of prices fall below the lower bound and 12.5% fall above the upper bound, leaving 75% of prices to fall between these bounds.<sup>97</sup> The purpose is to provide a sense of the distribution of pool prices that cannot be discerned from the mean (or median) alone.

**Figure 3.2: Prices are low more often than in the past, but there are months with price spikes**



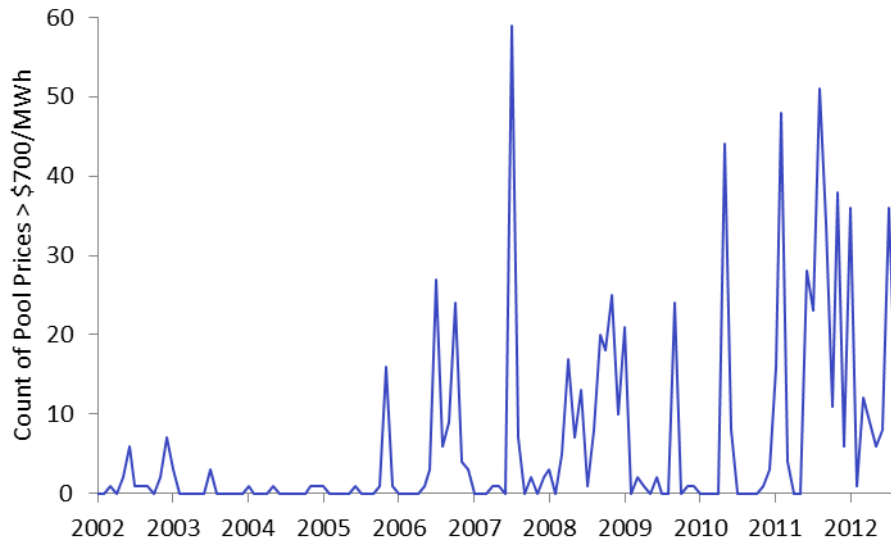
As shown, it is not obvious that the spread of prices within a month has been growing larger through time. In fact, it is more often that prices fall within a narrow range, with only certain months seeing high prices at the 87.5th percentile (shown in the figure as spikes in the distribution). In 2009 and 2010, monthly pool prices tended to be lower than observed during the period 2005 through 2008. Furthermore, 2009 and early 2010 did not exhibit the ‘spike months’ seen in the more recent years. 2009 and 2010 are interesting in that they correspond to a period of weaker than anticipated demand and low natural gas prices. Our structural measures of market power also record lows during this period.<sup>98</sup> The outcome is one of intense competition driven by less scarcity and lower fuel costs for gas generators. In terms of price outcomes, average prices were lower and so was the spread of prices. Averages prices and the spread of prices increase in 2011/12 but do not appear dissimilar to earlier years.

One of the key differences between current price patterns and those in the past is that the median is much closer to the 12.5th percentile. This is sometimes described as price polarization – more highs and more lows. One reason that low prices have trended to be more common today is because of the decline in off-peak prices. On-peak prices have not trended significantly up or down in a long term sense. These features are shown more clearly in Figures 3.3 and 3.4.

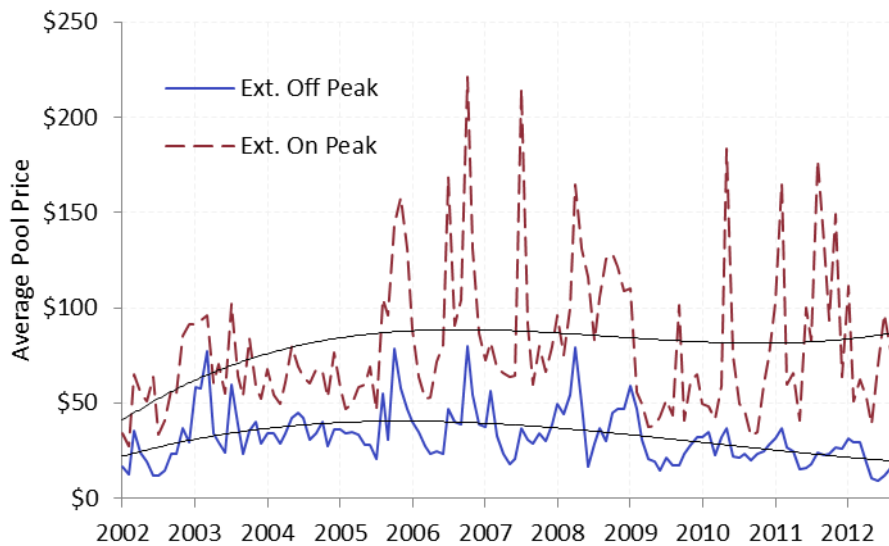
<sup>97</sup> Based on a volatility metric proposed in John Field Consulting’s *Characterizing pool price volatility in the Australian electricity market* (September 2003).

<sup>98</sup> See Section 1.4.1: Generator market power. May 2010 is a notable exception when there was significant transmission congestion.

**Figure 3.3: Polarizing prices: Pool prices over \$700/MWh have grown increasingly common**

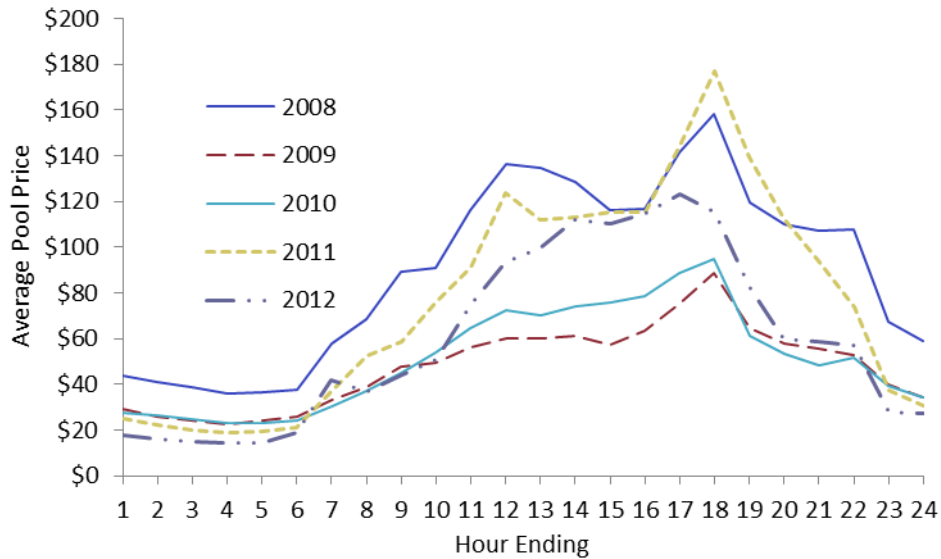


**Figure 3.4: Off-peak prices are falling while on-peak prices averaged the same**



The hourly price profile is especially important to companies who price products to retail customers at prices that do not vary through the day (often because the underlying customer does not have a time of use meter). These retailers often rely on forward contracts for flat and extended on-peak products to approximate the combined consumption of their customers. Again, relative to 2009 and 2010, recent years have higher prices during the evening peak; but not dissimilar to those observed in other years. This is shown in Figure 3.5.

**Figure 3.5: Recent peak hour prices are high relative to 2009 and 2010, but not to other historical periods**



### 3.2.1.2 Price velocity

Beyond the price spread, another important volatility concept is whether prices are unpredictable. There are a number of possible measures to answer the basic questions: Do prices follow a similar pattern day to day, season to season? Are prices on a consistent trend?

The measure selected to examine answers to this question over long periods of time is termed 'velocity'. This starts with the change in price between days (compare the price for an hour to the price for the same hour 24 hours previously). Mathematically:

$$\partial_{t,24} = |p_t - p_{t-24}|$$

These changes are then averaged over a time period (like a month) and divided by a measure of average price for the same time period or a longer one. To examine the long term trend in inter-day price movement, monthly aggregates are used.<sup>99</sup> These are:

- MVMA: Monthly velocity based on the monthly average of price

$$MVMA = \frac{\text{Monthly average of } \partial_{t,24}}{\text{Monthly average of } p_t}$$

$$MVOA = \frac{\text{Monthly average of } \partial_{t,24}}{\text{Overall average of } p_t}$$

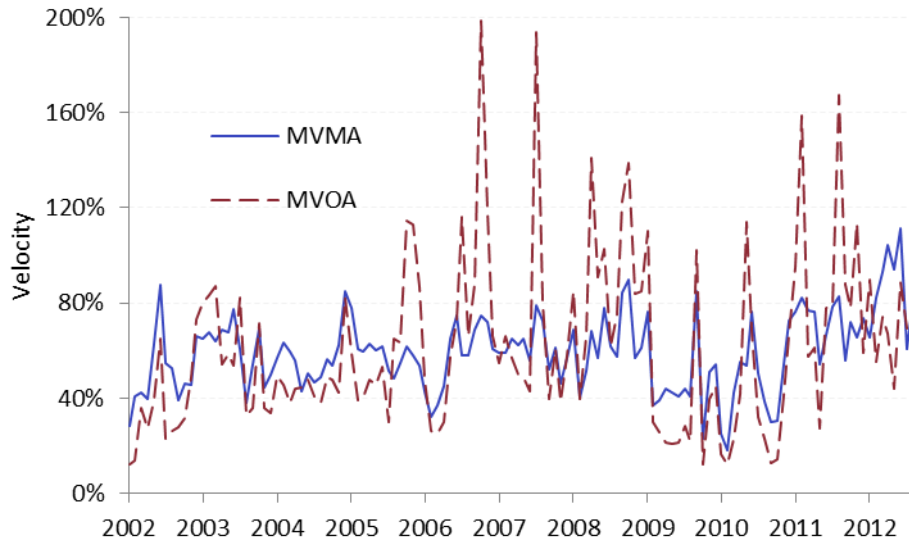
For example, in August of 2012 prices were an average of \$50/MWh different than the same time in the previous day. This average change is about 81% of the monthly average price (MVMA) or 75% of the

<sup>99</sup> Velocity measures have been used in Li and Flynn (2004), Zareipour, Bhattacharya, and Cañizares (2007), and AESO (July 3 2009).



overall average price since 2002 (MVOA). As Figure 3.6 shows, an upward trend in velocity has occurred since 2009/10, although 2007-2008 also exhibited periods of high velocity.

**Figure 3.6: After relative lows in 2009/10, inter-day volatility has been increasing**

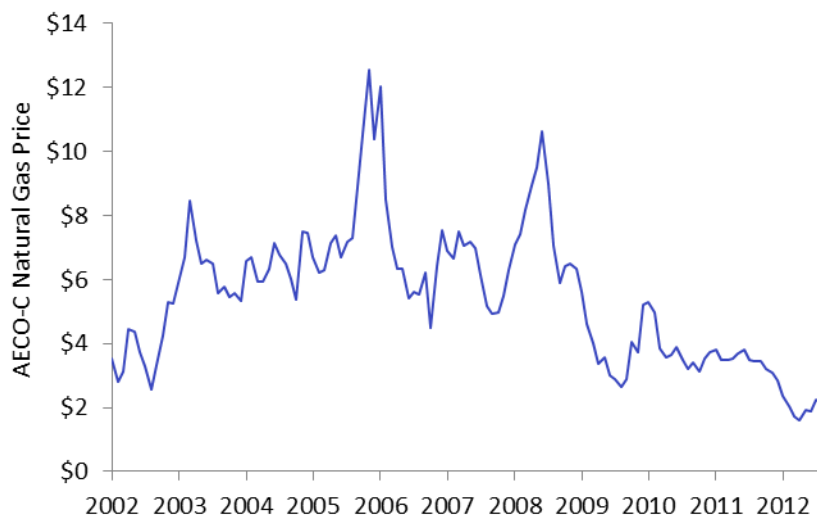


### 3.2.1.3 Causes of price volatility

Different measures of volatility (comparison of averages, measures of dispersion and measures of velocity) suggest an increase from levels observed in 2009 and 2010, but no higher than those observed in previous years. There are several reasons that may have contributed to this:

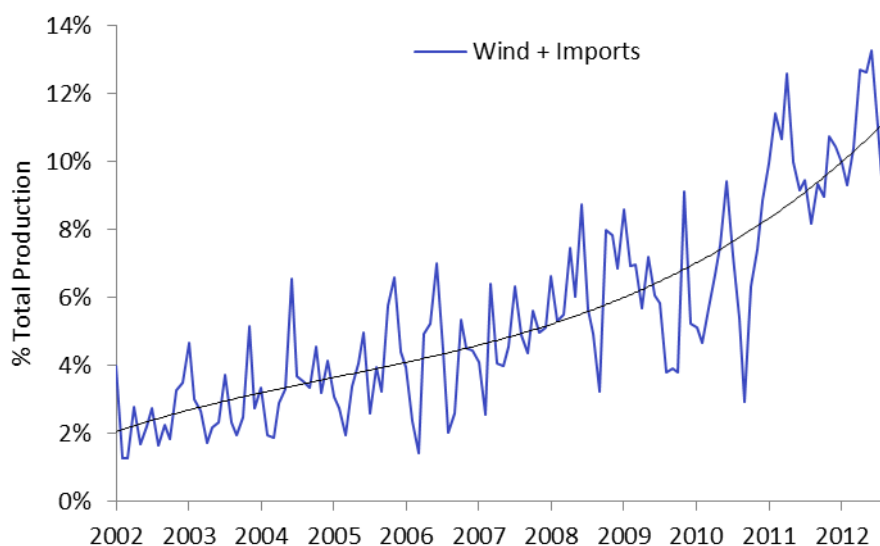
- Low natural gas prices resulting in lower offers from some generators and more intense competition between fuel types have resulted in lower off-peak prices. This shows up in some of our measures of dispersion;

**Figure 3.7: The price of natural gas has been falling**



- Low prices for imported energy from neighbouring markets resulting in large inflows even at modest prices and no additional capacity available for further imports as prices continue to rise.<sup>100</sup> Preliminary analysis suggests that the introduction of Load Shed Service interruptible (LSSi) in late 2011 may be contributing further to this;<sup>101</sup>
- Increased wind capacity and the variable nature of wind generation may be driving changes both in dispersion and velocity;

**Figure 3.8: Wind production and imports have been proportionally increasing**



- Some firms may be more likely to exercise market power following the introduction of the MSA's *Offer Behaviour Enforcement Guidelines*. Again this may drive difference both in dispersion and velocity;
- Unanticipated unit outages may have had an impact on different measures of volatility but only if outage rates have changed; and
- Dispersion and velocity are also a function of the supply/demand balance. For example, 2009 and 2010 both had weaker demand than anticipated, a larger supply surplus and as a consequence lower volatility.

### 3.2.2 Price received by different generating technologies

Another way at looking at the price signal is to look at the average price received by different generating technologies (as well as imports). A generating technology that runs at exactly the same level in every hour would receive the average annual price. A generating technology that could choose to run only in higher prices would receive more and a generating technology with little or no flexibility over production might receive substantially less. These average prices are shown in Table 3.1 and Figure 3.9.<sup>102</sup>

<sup>100</sup> See Section 2.3.3: Intertie participation

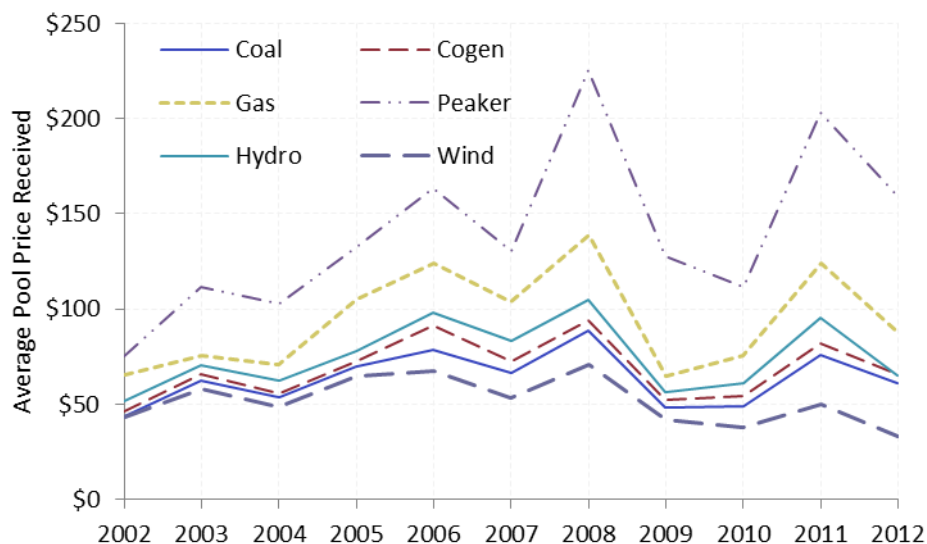
<sup>101</sup> See MSA *Quarterly Report: April - June 2012 (Q2/12)*.

<sup>102</sup> Note that pool prices here are weighted by the load in each hour. Therefore the 'All' category is higher than the annual average price since more MWh are generated in hours with high demand and higher than average prices.

**Table 3.1: Wind generation occurred in hours with lower pool prices**

Fuel type	Coal	Cogen	Gas	Peaker	Hydro	Wind	Other	Imports	Total
2012 *	61.03	65.51	87.89	159.52	64.93	33.13	73.56	62.19	67.13

\*January to September, inclusive.

**Figure 3.9: Natural gas and peaking plants have earned the highest average prices**

Peaking generators are operated so as to run in a small number of hours and are, to that end, offered into the market at relatively high prices (relative to average pool prices). As a result, such generators only operate when pool prices are relatively high and therefore receive relatively high prices, on average, when they run.

Coal-fuelled generators, on the other hand, tend to be run in all hours in which they are available and so tend to receive average prices approximately in line with average pool prices. However, given their importance in providing baseload electricity to the market, reductions in output from coal-fuelled generators (either due to outages or economic withholding) can result in either higher pool prices directly (by reducing supply) or indirectly (by enhancing the ability of a market participant to profitably exercise market power). As a result, greater output from coal-fuelled generators tends to be associated with lower pool prices.

As a group wind generators receive the lowest average price. There is a lack of geographic diversity in the location of wind generators and the resulting correlation in wind production between these facilities tends to result in lower prices when they run and higher prices when they do not.<sup>103</sup> Wind generators located in other areas receive considerably more.

The same analysis at a unit level can check an important property of the Alberta market design. Part of the competitive counterbalance to the exercise of market power through economic withholding, is that generators not withholding (those seeking to maximise dispatch) receive more revenue per MW of capacity than those withholding.<sup>104</sup> Empirically, if we classify certain coal generation assets into a group of those who engage in economic withholding and those who do not, we find those who do not have

<sup>103</sup> The MSA first made this observation in its 2008 *Annual Report*.

<sup>104</sup> See Section 2.5.4: What limits the ability of a generator to exercise market power?

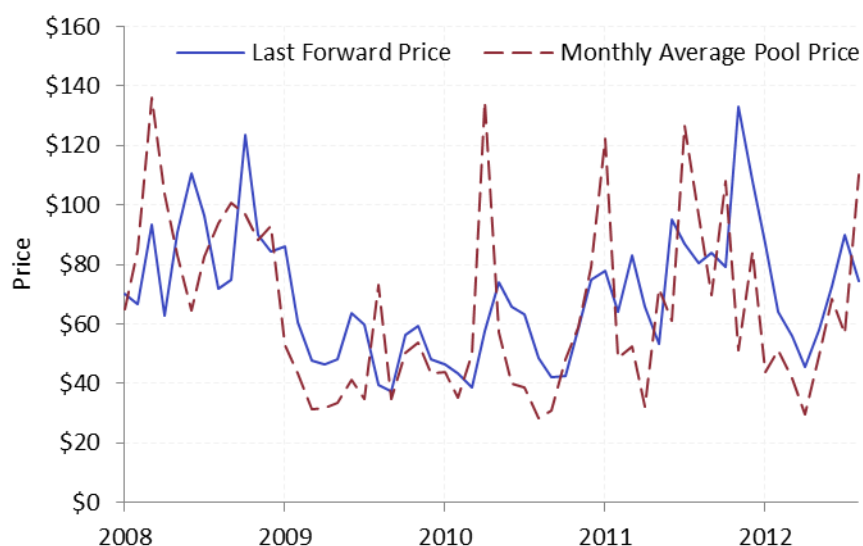
made between \$5 and \$7 per MW of capacity more than those who have withheld. The MSA believes costs between the two groups are comparable so most of the difference would accrue as additional profits. The calculation is for the period 2005 – September 30, 2012.

### 3.2.3 Forward market convergence

In most commodities it is usually expected that as the delivery month for a forward contract approaches the price of the forward contract and the spot price will converge. The mechanism for this in most markets is that speculators can profit by arbitraging differences between the two. With low levels of liquidity in the forward market (particularly for financial players) convergence may be weaker.

In Figure 3.10 we look at the last traded forward price in advance of the delivery month and the spot price.<sup>105</sup> We use the last traded forward price (rather than an average or some other measure) since this should best reflect the information available to the market (i.e., all the information other than shocks that occur within the month). The evidence for convergence in 2012 looks weak, as shown in Table 3.2. The MSA believes some further work may be needed to understand the implications of this. One possible explanation is that speculators, who lack the ability to influence market outcomes through offer behaviour will not take the risk of a short position (i.e., selling forward) to settle at pool price.<sup>106</sup>

**Figure 3.10: Weak evidence of convergence between forward and spot prices**



<sup>105</sup> Only flat monthly contracts are considered.

<sup>106</sup> See Section 2.4.2.4 for further discussion on liquidity.

**Table 3.2: Average difference between spot prices is particularly high in 2012**

Year	Forward Contract minus Monthly Pool Price (\$/MWh)
2008	-4.37
2009	9.55
2010	1.58
2011	4.82
2012*	13.38
Average	4.71

\*January to September, inclusive.

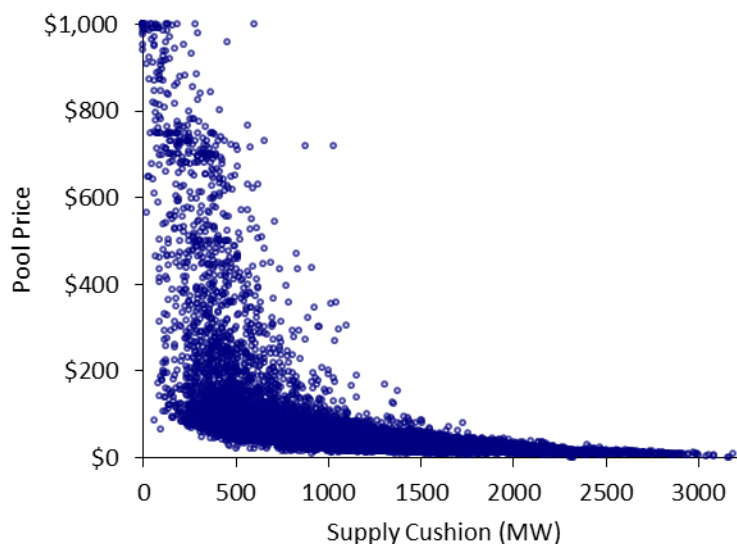
### 3.3 Relationship between scarcity and price

Since 2010 the MSA has been reporting on the relationship between the energy market ‘supply cushion’ and pool price. The supply cushion is calculated hourly and illustrates the number of available but un-dispatched MW in the merit order. More simply, this can be thought of as a representation of the balance between supply and demand in a given hour, or a measure of scarcity. A large supply cushion illustrates that the market’s supply of energy is high relative to the prevailing level of demand. In contrast, lower values of the supply cushion illustrate that the market’s available supply is low relative to the market demand. Therefore, a robust negative relationship exists between the market supply cushion and pool price, (i.e., prices are higher when the market is tighter).

To examine whether the relationship between scarcity and market prices was changing over time the MSA established a based period using data from February 2008 through June 2010. This sample period was chosen to ensure that a sufficient variety of supply cushion values and a sufficient number of observations were used in order to accurately estimate the underlying relationship at the time. The supply cushion data was divided into 250 MW bands and the standard deviation of pool price within each band was used to identify outliers, events of interest, for further examination.<sup>107</sup>

<sup>107</sup> The MSA considered a variety of alternate methods for the supply cushion analysis. That detailed work can be found in *Supply Cushion Methodology and Detection of Events of Interest*.

**Figure 3.11: Supply cushion and pool price have shown a strong, non-linear relationship**



Fundamentally, outliers are indicative of instances in which pool price does not reflect the balance between supply and demand observed in the base period. Outliers thus may represent a change in behaviour of market participants or they could indicate a change in the composition of supply that in turn drives different outcomes. We note that wind generation, imports and cogeneration have all increased in recent years and natural gas prices have declined significantly from levels observed in early 2008.

Table 3.3 and Figure 3.12 illustrate the trend in the number of outliers identified within each supply cushion band since February 2008. Here outliers are shown as those observations two standard deviations from the mean.<sup>108</sup> There is a notable increase in the number of upper outliers (more than two standard deviations above the mean) in 2011 and this increase was most notable at smaller supply cushions (250 – 1,000 MW). The number of upper outliers in 2012 is somewhat lower overall but with a larger number at higher supply cushion levels. Many of the outlier events have been examined in the MSA's *Quarterly Reports* and most of these events represent instances of economic withholding. For lower outliers (more than two standard deviations below the mean) there is a significant increase in the number of outliers in 2012, (mostly in the supply cushion range 500 – 1,500 MW).<sup>109</sup> In many of these hours we again find a behavioural cause with most generators offering at close to variable costs.

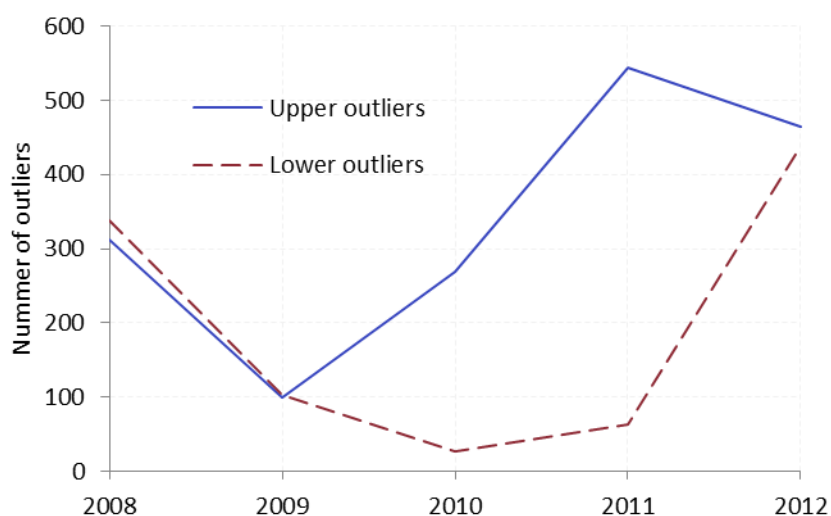
<sup>108</sup> To adjust for the skewness or asymmetry in pool price data the mean and standard deviations are estimated after taking logarithms. For further details and discussion on methodology see the MSA's *Supply Cushion Methodology and Detection of Events of Interest*.

<sup>109</sup> Most of the outliers are very high supply cushion levels correspond to instances of \$0/MWh prices observed in mid-2012. Some of these were situations of supply surplus (supply greater than demand).

**Table 3.3: There have been more upper outliers at larger supply cushions recently**

	Year	Supply Cushion				Total
		<250	250-1000	1000-1750	1750+	
Upper Outliers	2008*	0	190	95	27	312
	2009	0	77	16	6	99
	2010	0	154	77	38	269
	2011	0	492	53	0	545
	2012**	0	298	165	1	464
Lower Outliers	2008*	13	71	201	53	338
	2009	0	13	71	19	103
	2010	5	4	9	8	26
	2011	4	23	25	11	63
	2012**	0	169	194	75	438

\* Excludes January, \*\* YTD, Q1- Q3

**Figure 3.12: The number of upper outliers has climbed since 2009<sup>110</sup>**

A behavioural cause to outliers is not unexpected. Some market participants have market power and are thus able to influence market outcomes, sometimes higher and sometimes lower than the simple balance between supply and demand would suggest. A behavioural cause to prices in general is not a concern unless it represents a strategic barrier to entry (or of course it stems from the explicitly anticompetitive unilateral or coordinated conduct identified in the *Offer Behaviour Enforcement Guidelines*<sup>111</sup>). Survey work conducted on behalf of the MSA did not indicate that was a concern<sup>112</sup> but other commentators have

<sup>110</sup> Note that 2012 only contains Q1 through Q3, and for this reason is lower than the final figure.

<sup>111</sup> See the MSA's *Offer Behaviour Enforcement Guidelines*, p. 9-12.

<sup>112</sup> See Investor Perspectives on the Attractiveness of Alberta's Electricity Generation Market.

indicated a perception that the market is dominated by a few firms with significant ability to influence price.<sup>113</sup> As such it remains an area where the MSA will continue to monitor market outcomes.

### 3.4 Static efficiency

Static efficiency is a characteristic associated with market outcomes in the short run. It is comprised of two components: productive efficiency and allocative efficiency:<sup>114</sup>

- Productive efficiency – at a given point in time if a given level of output is produced consuming the least amounts of inputs then the outcome is said to be productively efficient; and
- Allocative efficiency – at a given point in time if resources are allocated such that the net benefit attained through their use is maximized, then a market is said to be allocatively efficient. The role of price is key in achieving allocative efficiency since it serves as a signal to:
  - consumers to consume until the price rises above their willingness to pay; and
  - producers to produce until the price is insufficient to cover the costs of production.

If it is possible for both a producer and a consumer to gain through additional trade then the market is not allocatively efficient.

A market outcome that satisfies productive and allocative efficiency is one in which the total economic surplus obtained by consumers and producers is collectively maximized. Departures from such outcomes constitute static inefficiencies and may be either productive, allocative, or both in nature. Achieving static efficiency is not a sufficient goal in itself since it does not imply anything about whether there will be improvements over time. Instead our definition of *effective competition* accepts static efficiency losses as a trade-off for efficiency gains over time. Static efficiency losses might be expected to result in Alberta's electricity market for a number of reasons. In instances where generators exercise market power through economic withholding productive or allocative losses (or both) could result but this is conduct that is likely necessary in a market with a price cap.<sup>115</sup> The higher prices that result from economic withholding help recover fixed costs and signal further investment over time that may bring dynamic efficiency gains.

As part of the 2012 *State of the Market Report*, the MSA has undertaken an analysis of static efficiency losses in Alberta's wholesale electricity market.<sup>116</sup> Table 3.4 summarizes the findings of efficiency loss for the period 2008 to 2011, inclusive. Average hourly productive efficiency losses range from approximately \$3,067 to \$4,443. Dividing the losses by the volume of electricity traded in the wholesale market, productive losses range from \$0.46/MWh to \$0.68/MWh. Given that average annual pool prices have ranged from approximately \$50/MWh to \$90/MWh over the same four-years, productive efficiency losses are estimated to be less than 1%. Preliminary estimates for allocative efficiency losses suggest they constitute an even smaller fraction. Moreover, as the results in Table 3.4 indicate, there is no discernible trend to the either of the efficiency losses across the set of years subject to consideration. Losses in 2011 do not seem to have increased following the release of the MSA's *Offer Behaviour Enforcement Guidelines*.

<sup>113</sup> Comments made at the recent *Alberta Power Summit*, November 27, 2012.

<sup>114</sup> These definitions are consistent with those used in MSA's *Offer Behaviour Enforcement Guidelines* (OBEGs), p. 8.

<sup>115</sup> See Section 2.5.5: The exercise of market power in practice.

<sup>116</sup> For further details on the methodology see MSA's *Static Efficiency Losses in the Alberta Wholesale Market – An assessment undertaken as part of the 2012 State of the Market Report*.



**Table 3.4: Losses are small in comparison to overall pool price**

Efficiency loss	Units	Year 2008	Year 2009	Year 2010	Year 2011
Allocative efficiency loss	\$/hour	1,326.27	482.94	659.67	1,951.53
Productive efficiency loss	\$/hour	4,442.85	3,067.20	4,086.76	3,617.37
Normalized allocative efficiency loss	\$/MWh	0.17	0.06	0.09	0.25
Normalized productive efficiency loss	\$/MWh	0.68	0.46	0.61	0.55

The detailed report on static efficiency losses sets out the methodology used to estimate these losses and the methodology is important. The MSA believes some further refinement of the methodology is possible, but that it would not change the overall assessment that losses as a proportion of the average pool price are small. While the MSA cannot state that they are the lowest possible, as strictly required by our definition of *effective competition* in Section 3.1, they are low and a consequence we are close to the required benchmark. The small size of static efficiency losses also implies that to be sure there are gains overall, the improvements over time do not necessarily need to be particularly large. We turn to consider these in the next section.

The results on static efficiency can also be interpreted in terms of the efficiency of transfers. More simply, consumers as a group would be better off if they only paid the short run marginal costs of production but a sustainable market requires generators to recover fixed costs. This implies more money must go to generators than simply short run marginal costs. As noted elsewhere in the Report different electricity markets tackle the problem of transferring enough to cover fixed costs in different ways.<sup>117</sup> Some restrict generator offers through mitigation schemes but transfer the additional amounts through capacity markets. Alberta's energy-only market relies on all of the required transfer coming through the price of energy. Low static efficiency losses in the Alberta market imply that the transfer is efficient and as consequence alternative market designs are unlikely to be better and quite possibly worse.

### 3.5 Dynamic efficiency

Dynamic efficiency is a characteristic associated with market outcomes in the long run and as such it contrasts with the concept of static efficiency discussed in the previous section. More formally it is defined as:<sup>118</sup>

Dynamic efficiency – dynamic efficiency recognizes that over time there is the ability to innovate and invest leading to superior allocative and productive outcomes. In a market economy the forces of competition are seen as key in providing the correct incentives to innovate and adapt.

There may be many dimensions to dynamic efficiency: new product offerings, new technologies, and new ways of organising operations. Obtaining a good quantitative measure of dynamic efficiency is difficult. Instead we have a number of qualitative indicators that support the idea the market results in efficient investment, part of our test for *effective competition*.

Prior to deregulation the Alberta electricity market was dominated by large coal facilities built by a small number of firms. Deregulation has brought a different dynamic. The choices of the many have replaced the choices of the few, changing the resource mix substantially. Particularly striking is the increase in wind generation and cogeneration.<sup>119</sup> Diversification is not in itself an indicator of dynamic efficiency but the change is evidence that the market has created opportunities that previously were not available.

<sup>117</sup> See Section 2.5.1: Market power and the Alberta market design.

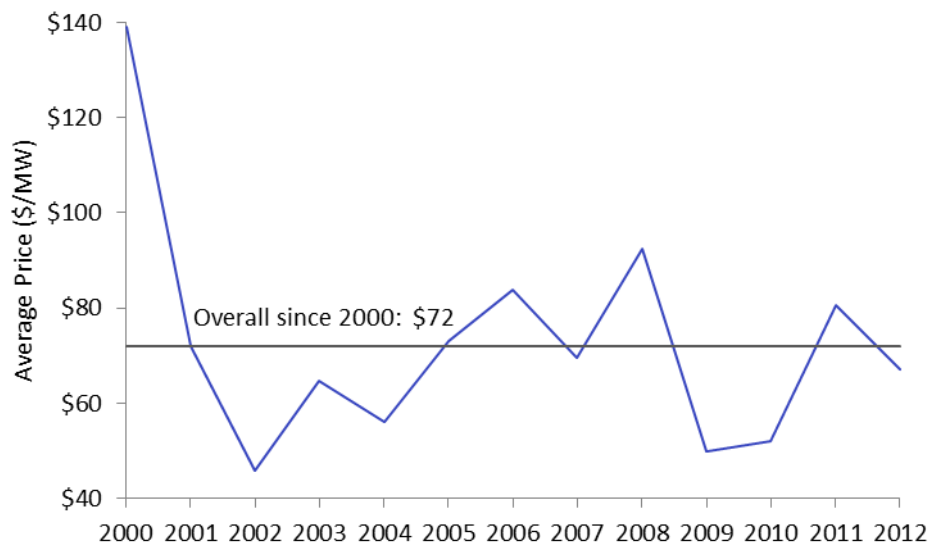
<sup>118</sup> This definition is consistent with that used in MSA's *Offer Behaviour Enforcement Guidelines* (OBEGs), p. 8.

<sup>119</sup> See Section 2.6: Investment.

Further, risk is borne solely by investors rather than consumers, and arguably investors are more capable of managing these risks.

Dynamic efficiency is about the process through which investment takes place as well as the investments that are chosen. Imprudent investments might suppress prices for long periods whereas other failures in the market may fail to attract investment and lead to long periods of high prices. In Figure 3.13 below we show the average pool price from 2000 to 2012, while there is some cyclical pattern observable (partly as a consequence of lumpy investments) there are no sustained periods of low or high prices. Neither have we observed periods where prices have been too low to attract investment but scarcity has occurred.<sup>120</sup>

**Figure 3.13: Since 2010 there have not been sustained periods of high or low prices**



As well as generation additions from new investment the market has seen a substantial amount of capacity being retired. The capacity retired has been older coal units with relatively high emissions and older natural gas-fired units with low thermal efficiency (high heat rates). Again retirements do not directly prove dynamic efficiency gains (retirements could be too early or too late) but they are a useful indicator. The reason for this is there have been concerns in some other electricity markets with separate payments for capacity that the market design keeps older capacity online and dampens the signals for new investment.<sup>121</sup> In some regulated electric systems old capacity can be maintained to provide an additional layer of reserve but doing so involves a considerable ongoing cost.

Dynamic efficiency is not limited to generation investment. Demand-side participation in supplying operating reserves or through price responsive loads needs to compete with investment in generation. Electricity markets often open up new possibilities for this sort of investment and in the Alberta electricity market loads participate in a number of ways.<sup>122</sup> With further refinement of market rules it appears these opportunities can be expanded further.

<sup>120</sup> This is sometimes referred to as the 'missing money' problem.

<sup>121</sup> See for example: Platts (2012).

<sup>122</sup> See 2.3.2: Load participation.

## 3.6 Long run marginal cost

The final part of our test for *effective competition* set out in Section 3.1 is that we need to ensure that price outcomes over the medium term are no higher than they need to be to ensure the market is sustainable (new investment occurs when it is profitable). The MSA is of the view that the medium term is the appropriate timeframe in that markets must demonstrate benefits to consumers over a number of years, not just some distant future point.

To answer the question as to what price outcomes are needed to ensure the market is sustainable we draw on the economic concept of the long run marginal costs of investment (LRMC). LRMC is way of capturing how much of a transfer needs to occur from consumers to producers in order to allow a full recovery of fixed costs and sufficient profits to incentivise new investment. At any given point in time prices may be higher or lower than the LRMC but a well-functioning market should not see that persist over time. Simply put, if prices are expected to be lower than the LRMC of investment, investment will be cancelled or postponed until prices rise. If prices are expected to be higher than the LRMC of investment, then investment of some type should occur. Absence of that investment would suggest a problem, for example barriers to entry.

As part of the work leading to this report the MSA has undertaken to establish a methodology to measure LRMC and test whether the price level is sufficiently attractive to warrant further investment.<sup>123</sup> Moreover the test developed is a check that the price level is not too high. Persistent prices above LRMC should attract new investment (or some other market reaction that would reduce prices). If this does not occur the MSA would be increasingly concerned about barriers to entry or other competition issues.<sup>124</sup>

In principle, the relevant comparison is one of future costs and future prices, i.e., a forward-looking comparison rather than a backward-looking comparison. However neither future costs nor future prices are known with certainty. The major purpose of the MSA's work has been to establish an appropriate and practical methodology. There are three parts to this: first, estimating LRMC; second, estimating relevant prices; and third, making a comparison. We provide a brief summary of the work conducted here:

### 3.6.1.1 Estimating LRMC

The MSA considered various methodologies for calculating LRMC. A standard economic technique is to calculate LRMC as the minimum present value of meeting a permanent increment of demand. This methodology requires that a variety of assumptions be made in relation to future demand, future technological developments, and other relevant economic variables. Obtaining these inputs is not a trivial task and some may not be known. Other variants of this approach were considered but the MSA adopted a relative simple approach rooted in the levelised unit electricity cost (LUEC) methodology. The MSA considers that this provides a useful proxy of LRMC and requires less in the way of input assumptions but does need additional care when interpreting the results.

### 3.6.1.2 Relevant prices

Various methodologies for estimating relevant prices were considered. There are a number of practical issues associated with projecting into the future, for example, the forward market has little in the way of long term activity and hence there are few price observations for contracts extending more than a couple

<sup>123</sup> For further details see the MSA's *A Comparison of the Long-Run Marginal Cost and Price of Electricity in Alberta*.

<sup>124</sup> Prices below LRMC might also be an issue, particularly for generation adequacy. The AESO has for some years monitored for generation adequacy in regular quarterly reports; see for example *Long Term Adequacy Metrics – November 2012*.

of years into the future. Given the limitations the MSA has used prices within a five year window, combining known historical prices with available data regarding forward prices of various shapes, e.g., for all hours, on-peak hours, and off-peak hours.

### 3.6.1.3 Comparison

In making a comparison of costs and prices the methodology used recognises that for some generation technologies firms can offer in the market so as to avoid running in hours when prices are low.<sup>125</sup> The comparison made between costs for these technologies is thus a comparison of levelised unit costs and a conditional average price; both vary by the number of hours in which the generator chooses to run (a capacity factor).

The conclusion reached is that the level and distribution of prices is sufficient to indicate incremental investment in gas-fired peaking plants, but are unlikely to be sufficient for incremental generation of other types.<sup>126</sup> The MSA has two expectations. Either:

- The price signals that appear to make this investment profitable cease (perhaps in response to other changes such as increased price responsive load); or
- Investment occurs.

In the event that seemingly profitable investment does not take place the MSA would initiate a further enquiry into whether barriers to entry or other factors were impeding competitive outcomes in the market. Confirming this conclusion will be the subject of further work by the MSA, for example, refinements are possible in terms of cost inputs, and other assumptions deriving the calculation of LUEC.

In any event, there are some important points worth noting:

- Part of our test for *effective competition* was to ensure that price outcomes over the medium term are no higher than they need to be to ensure the market is sustainable (new investment occurs when it is profitable). That means we do not expect that price will equal LRMC in every hour. Rather, this is a relationship that is expected to hold on average over lengthy periods of time. While generation projects must be economic over much longer periods the MSA believes the market must demonstrate *effective competition* over a shorter timeframe. The MSA believes the comparison over a five-year window appropriately balances the two;
- The methodology the MSA has developed has not been used to specifically assess whether prices were no higher than they needed to be in the past in order to ensure generation investment. As noted elsewhere in this report, prices over the last ten years have not seen sustained periods of high prices and there has been considerable generation investment in different technologies. The MSA considers that these are indicative that price outcomes over the period were no higher than they needed to be to ensure the market is sustainable, i.e., part of our test for *effective competition*;
- Prices signal the value to the market of a competitive response (from either supply, say in the form of new generation, or demand, say in the form of enhanced price responsiveness). The impact of such a response will create a feedback effect that alters pool prices. For instance, a highly volatile price might be interpreted as the market signalling the value of a generator that can change its output relatively quickly. The entrance of such a generator would serve to

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<sup>125</sup> There may be some constraints on choosing which hours to run for example during periods of planned maintenance or forced outages.

<sup>126</sup> This does not imply that projects already under construction or that the market expects to be developed would be uneconomic since the impact of these facilities is already reflected in forward prices.

mitigate the price volatility that signalled the value of its entrance in the first instance, a result that must (and will be) considered by any market participant.



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As part of the work undertaken for the State of the Market Report the MSA produced a series of reports to examine some issues in more detail. The report titled 'Alberta Wholesale Market' provides some background information on the intrinsic structure of the electricity market. Some of the other reports are more technical in nature and a result may be less accessible to readers unfamiliar with the electricity market and the assessment of competition.

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The Market Surveillance Administrator is an independent enforcement agency that protects and promotes the fair, efficient and openly competitive operation of Alberta's wholesale electricity markets and its retail electricity and natural gas markets. The MSA also works to ensure that market participants comply with the Alberta Reliability Standards and the Independent System Operator's rules.

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