



## **Quarterly Report: July – September 2010**

November 5, 2010

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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# Executive Summary

## *General Market Outcomes*

Q3/10 Pool prices averaged \$35.77, low by historical standards for the third quarter of the year. Low natural gas prices were a contributing factor and the market heat rate was 10.7GJ/MWh. Pool price volatility was low through Q3/10 in large part due to the healthy supply surplus in the merit order.

## *Competition Analysis*

The evolution of the quarterly report series continues herein with a detailed presentation and analysis of the supply cushion metric, one that the MSA has been using for some time. Through careful collection, preparation and interpretation of the data, a historical baseline was established. Data for the current quarter was then reviewed in light of the baseline and hours were identified that did not appear to fit the general pattern.

Another metric that has been used for some time by the MSA is the price-duration curve. Herein, this metric is described in some detail for the reader including what features would be of interest and/or concern to the MSA.

The above methods, combined with the MSA's normal monitoring practices, yielded a number of 'events' for analysis. These were assessed in some detail in order to fully understand the main drivers of the price outcomes. This information will become part of the MSA's ongoing record of market events.

An analysis of these events is presented from the perspective of competition – is there evidence of healthy supplier-on-supplier competition that Alberta's energy-only market needs to function properly? While the MSA will continue to categorize and assess market outcomes for the long term implications on the *fair, efficient and openly competitive operation of the market*, the events reviewed in this quarter raise no immediate concerns.

## *Forward Market Liquidity*

The MSA heard concerns this quarter from more than one participant over the state of liquidity in the forward market. The data for Q3/10 shows a drop in trade volumes this past summer. The liquidity of Alberta's forward market has remained stubbornly low for some time and is worrisome to the MSA. The MSA has a concern that perhaps the lack of forward market liquidity is due to a shift in trading toward the increased use of direct bi-laterals. The MSA will continue to monitor the situation.

## *Operating Reserves Market – Move to (D-1) Procurement*

Starting on July 6, 2010, the AESO began procuring all its operating reserves (except hourly shaping products) through NGX on a one-day ahead basis. Previously the AESO bought over five days, denoted (D-5) through (D-1). A detailed analysis of the data for active reserves indicated that, by and large, the move has been successful. The relationship between market prices for operating reserves and Pool prices remained consistent from prior to the change. AESO was able to satisfy its demand and no complaints were received in respect of the change. On two occasions insufficient supply was offered on NGX and the balance was filled through the OTC market. The absence of a must-offer obligation and a concentrated

market in terms of sales, if not in potential supply, means it is difficult to know whether a true scarcity condition existed on those days.

On any days where the market liquidity on NGX is very low, the MSA will undertake a review of market conditions.

### *Compliance*

The trend to increasing levels of self-disclosure of ISO rule / reliability standard breaches by market participants has continued this quarter. By and large, the quality (completeness) of the reports has allowed the MSA to assess them in an expeditious manner and, in many cases, provide forbearance. There is no longer any significant back log of compliance files.

In Q3/10, 332 notices of specified penalty were sent to one market participant concerning a recurring contravention of ISO rule 6.3.3 yielding a record financial penalty of \$655,000.

### *ENMAX Electricity Services Agreement*

The MSA published its report into an allegation that a long-term Electricity Services Agreement between ENMAX and the City of Calgary contravened sections 5(c), 6 and/or 95(10) of the *Electric Utilities Act*. The complainant felt that the Agreement unduly supported ENMAX's interests in several wind farms. Following a detailed analysis, the MSA concluded that there was no basis for moving forward in regard to the complaint.

### *Stakeholder Consultation Process on Participants' Offer Behaviour*

Work on this MSA initiative, begun in Q1/10, continued through Q3/10. A roundtable discussion was held in September on some hypothetical examples of offer behaviour and how they might be interpreted. Subsequently, the MSA received several additional hypothetical examples from a market participant which have been published and will be reflected in a draft guideline for comment to be released in the 4<sup>th</sup> quarter.

## 1 General Comments on Market Outcomes

Pool prices in Q3/10 were exceptionally low, averaging just \$35.77/MWh (See Table A.1) – the lowest third quarter average since 2002. In part, this was due to low natural gas prices that averaged \$3.35/GJ which, combined with the average Pool price, yielded a market heat rate for Q3/10 of 10.7GJ/MWh. This market heat rate is not exceptionally low.

Pool price volatility levels were low in Q3/10 as indicated in Table A.1. This is a reflection in part of a healthy supply surplus such that forced outages did not cause the System Controllers to dispatch very high in the merit order. Figure A.3 shows that the proportion of time that coal units set price increased from last quarter to be more in line with the same quarter last year. More significant, perhaps is that the proportion of time that natural gas peaking units set price was similar to Q2/10, but the average price level was \$48.48/MWh compared with \$150.93 /MWh in Q2/10 (See Figure A.3).

Plant availability in Q3/10 was robust as noted in Table B.1 and, combined with an absence of any significant transmission-related constraints this quarter, put further downward pressure on Pool prices.

In the Operating Reserves market, the biggest change in Q3/10 was the switch to a one-day procurement process and this is discussed in Section 5. In the Q2/10 report, we commented that there appeared to be persistent high prices for the standby reserves with no evidence of general market tightness. Figure C.3 shows that the standby prices moderated in July and generally remained moderate through the balance of the quarter. The structure of this market and the prevailing market dynamics make it extremely difficult to comment on how competitive it is. The MSA looks forward to the implementation of the operating reserves market redesign, particularly regarding the standby market, in the hopes that a better market structure may lead to an improvement in market performance.

Alberta's market prices in Q3/10 were similar to those in adjacent markets making it more difficult than usual for importers/exporters to make stand-alone profitable transactions. The overall profitability of the net intertie flows was low and reflects this circumstance.

Forward market volumes (See Figure F.1) were down this past quarter and this is discussed in some detail in Section 4.

## 2 Competition Analysis

### 2.1 INTRODUCTION

In February 2010, the MSA began consulting with market participants on offer behaviour in the Alberta electricity market. This led to the release of two discussion papers, Foundational Elements and Analytical Framework. The MSA is continuing its stakeholder consultation process and expects to release a draft guideline in the near future. The Analytical Framework paper provided an overview of how the MSA intended to monitor and assess whether Alberta is enjoying the level of effective competition contemplated in the legislation. An important part of this approach is for the MSA to have effective methods for identifying events or patterns that would suggest problems with competition. Having identified an anomalous event or pattern the MSA would consider the event in more detail. In these cases the MSA would consider whether outcomes were consistent with a fair, efficient and openly competitive market (FEOC) or suggested a potential problem with market structure, rules or participant conduct.

The MSA expects that the quarterly report series will become the main vehicle for sharing further details of the MSA's evolving analytical framework and the conclusions it draws from this work. In cases where a particular analytical technique or issue warrants further consideration, the MSA would complement this approach with a special report.

During the consultation process on offer behaviour, a number of stakeholders expressed interest in the analytics used by the MSA. Consequently, the MSA is taking the step of explaining in detail the methodologies it is employing. In this quarterly report, the MSA considers two methods of identifying events of interest, firstly using a supply cushion metric and secondly observations around the price duration curve.

## 2.2 SUPPLY CUSHION ANALYSIS

In the Q2/10 report the MSA introduced the supply cushion metric as a measure of market tightness (Section 2.1, p. 3-5, Section 2.4, p.9-10). While the price in a given hour may be the result of a number of factors, including market participant offer behaviour, the MSA believes that in a well functioning energy only market price should generally be reflective of market tightness. Supply cushion is a direct measure of market tightness. A market that repeatedly yields low prices during scarcity and high prices during surplus is unlikely to be providing the correct incentive for investment. Thus, it should be expected that there is a relationship between hourly Pool price and corresponding supply cushion, a relationship such that Pool prices tend to be higher for lower values of supply cushion.

In this analysis, historical data on the supply cushion is used to establish the normal range of prices associated with a particular level of supply cushion. Observation of an event outside these norms would trigger further consideration of the event. As noted above, Supply Cushion analysis will be just one of a number of measures that the MSA uses to screen and identify events of interest.

### 2.2.1 Supply Cushion Definition and Estimation

The supply cushion measures the undispached energy offers in the merit order, more formally:

$$\text{Supply Cushion} = \sum_{i=1}^n (\text{Available MW} - \text{Dispatched MW}) \\ + \text{DDS dispatched} - \text{TMR dispatched}$$

where n is the number of offer blocks in the merit order

The energy merit order includes offers for MW currently dispatched for TMR – should these offers be reached the block is dispatched to energy instead of TMR but there is no change in generation. Consequently, we have reduced the supply cushion by the sum of TMR dispatched to more accurately reflect market tightness. The energy merit order does not contain offers that are currently dispatched for DDS, although these MW are available if price rises above reference price. Consequently, we have increased the supply cushion by the sum of DDS dispatched to more accurately reflect market tightness. In many hours the adjustments for DDS and TMR effectively offset one another but this is not always the e.g. whenever there is any constrained down generation or where SMP is above reference price.

The supply cushion in each hour is estimated using a snapshot of the merit order at approximately 30 minutes into the hour. The same snapshot data (for energy, DDS and ancillary services merit orders) are made public on the AESO's website 60 days after the offers are made to the power pool. Interested market participants can use this publicly available data to estimate the supply cushion. As an example, Table 2.1 shows the components of the supply cushion for August 1, 2010 HE1.

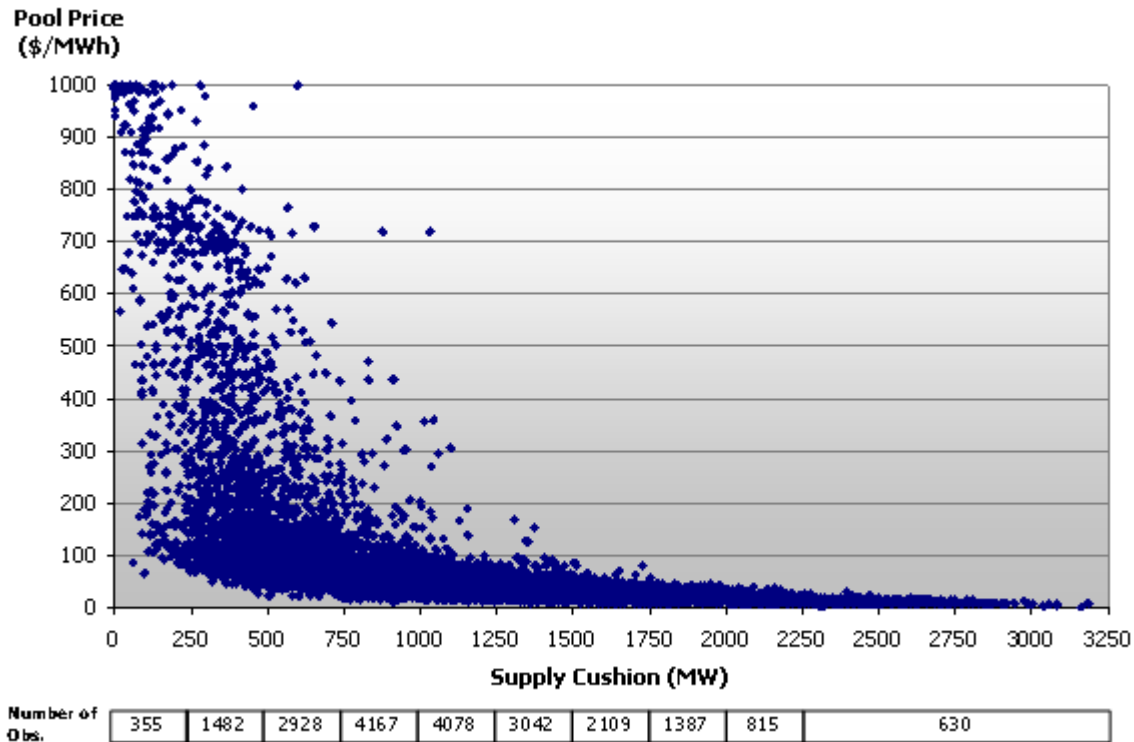
**Table 2.1: Supply Cushion Components for August 1, 2010 HE1**

<b>Supply Cushion</b>	<b>MW</b>
$\sum_{i=1}^n (\text{Available MW} - \text{Dispatched MW})$	1341
+ DDS Dispatched	76
- TMR dispatched	76
<b>Total</b>	<b>1341</b>

### 2.2.2 Supply Cushion Historical Relationship and Detection of Outliers

Figure 2.1 shows the historical relationship between supply cushion and Pool price using hourly data from February 1, 2008 to June 30, 2010. Prior to the implementation of Quick Hits (December 3, 2007) equivalent data is not available to construct an estimate of the supply cushion. Further, data issues prevent construction of reliable metrics for much of the period between December 3, 2007 and February 2008. Overall, the MSA has estimates of the supply cushion in 20,993 of 21,144 hours (99.3 %) for the period February 2008 to end of June 2010. Of the 151 hours that were 'missed', most were due to such matters as the dispatch tool being on maintenance and energy alert situations. Figure 2.1 also shows the number of observations within each supply cushion band, i.e.  $\leq 250$  MW,  $>250$  to  $\leq 500$  MW etc. Supply cushions  $>2250$  MW are relatively rare and have been grouped into a single band.

**Figure 2.1: Supply Cushion vs. Pool Price**



The MSA considered a number of methodologies for identifying outlying observations and selected a simple methodology of considering the mean and standard deviation within each of the supply bands shown in the data table accompanying Figure 2.1. The supply bands were selected to ensure a reasonable number of observations within each band.

From examination of the scatter plot of Figure 2.1, there is an observable non-linear relationship between supply cushion and price. Further, the data does not appear to be normally distributed (for example, there are more values above the mean than below the mean). By taking the logarithm of the price data the distribution around the mean is approximately normal, such that outcomes within two standard deviations of a mean represent something close to a 95% confidence interval. Figure 2.2 shows supply cushion plotted against price using a logarithmic scale, along with the mean and +/- 1, 2 and 3 standard deviations. Figure 2.3 also shows these same means and standard deviation bands plotted against price – note that the construction of the standard deviation bands around logarithm of price results in the bands being wider above the mean than below.

Figure 2.2: Supply Cushion vs. Logarithm of Pool Price

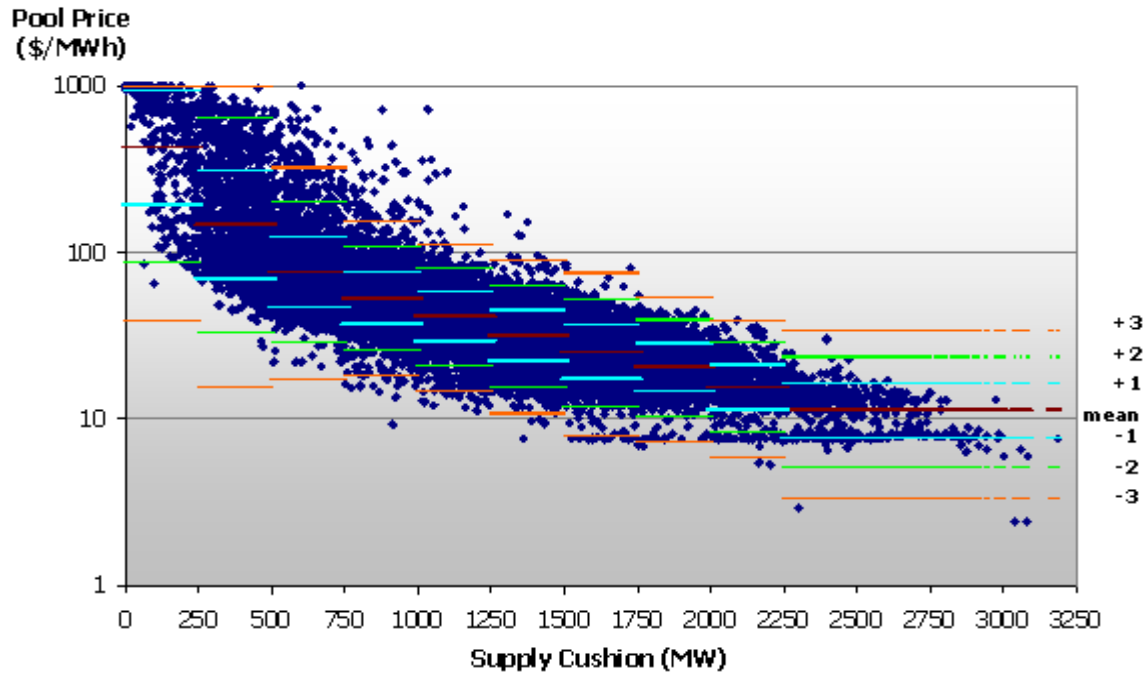
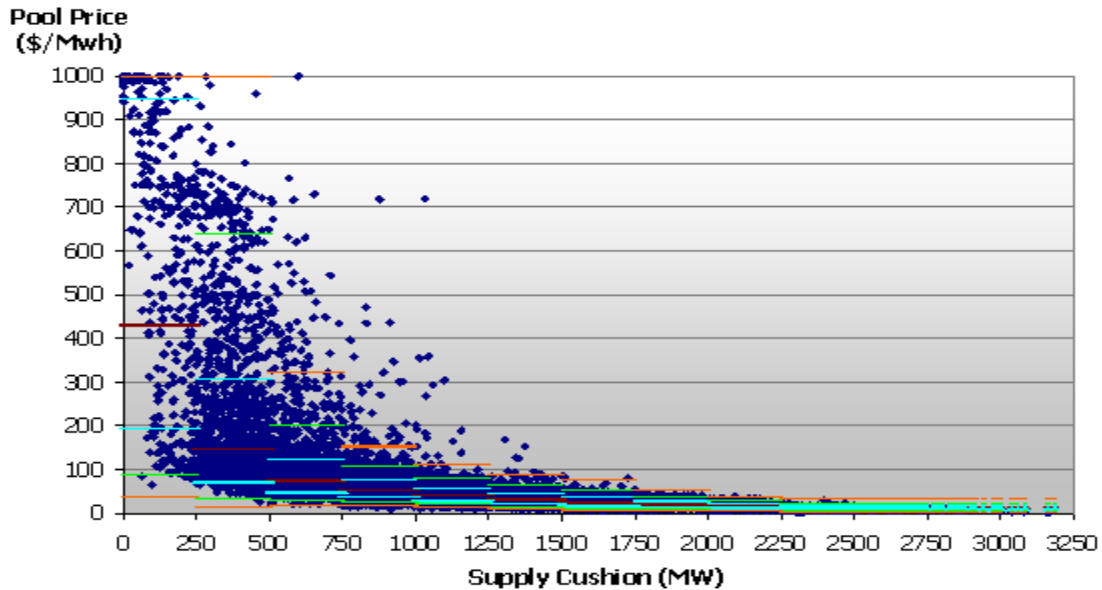


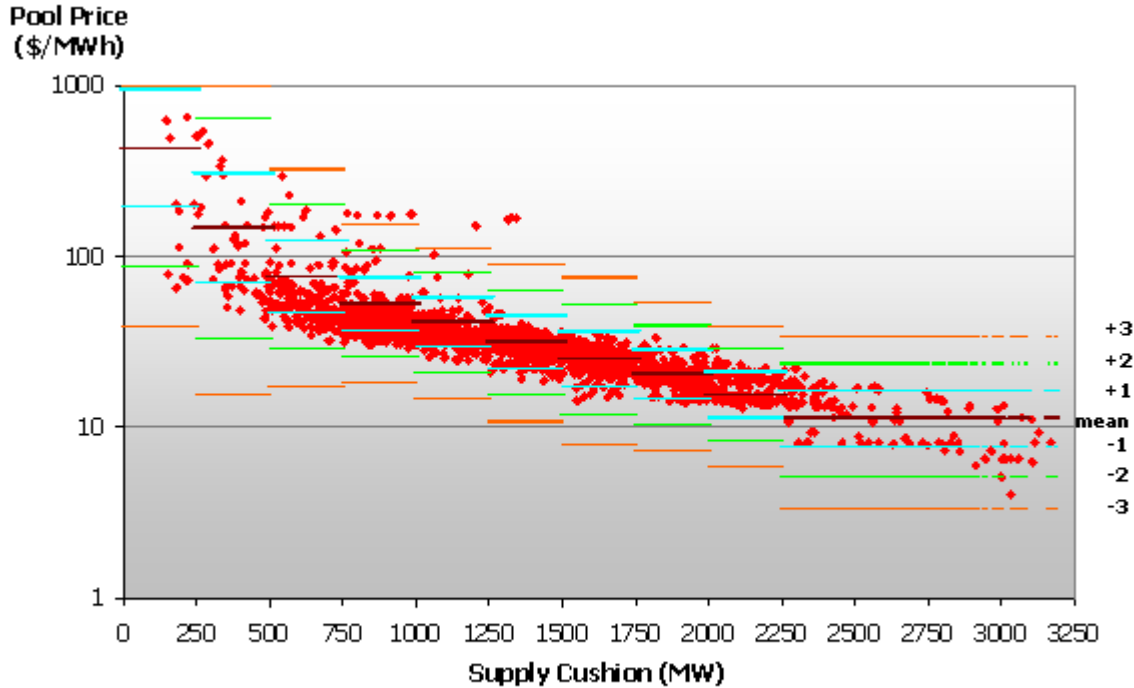
Figure 2.3: Supply Cushion vs. Pool Price and Confidence Bands



Having established the standard deviation bands using historical data, Figure 2.4 shows a scatter plot of the Q3/10 data (July 1, 2010 – September 30, 2010). The data table below the graph shows the number of

observations within each supply band and the dispersion from the mean. Estimates were obtained for 2204 data points out of 2208 hours in Q3/10, a capture rate of 99.8%. The remaining 4 hours consisted of 3 hours where no data was available and one hour (July 4, 2010, HE7) where Pool price was \$0 and is not shown on the Figure 2.4. Events where Pool price (or SMP) is at either the price cap or the floor will typically be events of interest regardless of the relationship with supply cushion since reaching these levels may mean that price is determined by administrative rather than market mechanisms.

Figure 2.4: Q3/10 Supply Cushion v. Pool Price, and Confidence Bands Based on Historic Data



	$\leq 250$	$>250$ $\leq 500$	$>500$ $\leq 750$	$>750$ $\leq 1000$	$>1000$ $\leq 1250$	$>1250$ $\leq 1500$	$>1500$ $\leq 1750$	$>1750$ $\leq 2000$	$>2000$ $\leq 2250$	$>2250$	Total
$\geq +3$	N/A	N/A	0	5	1	3	0	0	0	0	9
$< +3$ & $\geq +2$	N/A	0	2	3	1	0	0	0	2	0	8
$< +2$ & $\geq +1$	0	4	8	9	3	3	0	6	14	25	72
$< +1$ & $\geq \text{mean}$	4	9	9	20	37	120	136	111	78	55	579
$< \text{mean}$ & $\geq -1$	2	20	85	192	325	199	168	118	75	33	1217
$< -1$ & $\geq -2$	3	19	78	126	31	20	11	11	0	13	312
$< -2$ & $\geq -3$	5	0	0	0	0	0	0	0	0	2	
$< -3$	0	0	0	0	0	0	0	0	0	0	0
Total	14	52	182	355	398	345	315	246	169	128	2204

In determining events of interest, the MSA is intending to take a flexible approach noting that events further away from the mean are more likely to be candidates for further analysis. Even events a long way from the mean may not be considered if the MSA is of the view that the limitations of the supply cushion



approach are responsible for the event being flagged an outlier. Given this flexible approach, the MSA is not intending to re-estimate the mean and standard deviation bounds each quarter but does intend to revisit both the estimates and the methodology for determining outliers as it gains greater experience in using this analytical tool.

### **2.2.3 Limitations on the Analysis**

In the Q2/10 report, a number of limitations were noted concerning the calculation of the supply cushion. The supply cushion metric as calculated at the mid point of the hour may not be representative of the hour as a whole. The metric also does not capture resources that might be available in future hours (e.g. long lead time units and unused import capacity). As noted above, the selection of bands for calculation of the means and standard deviations (e.  $\leq 250$ ,  $>250$  &  $\leq 500$  etc.) were chosen to achieve a reasonable number of historic observations in each band. Within each band, a constant mean and standard deviation is assumed, whereas a negative relationship between price and supply cushion is evident. Because of this the MSA is less likely to consider events with high standard deviations that are close to the lower bound of each band (or events with lower standard deviations that are close to the upper bound).

### **2.2.4 Possible Refinements of the Supply Cushion Analysis**

The MSA has considered whether the relationship between Pool price and supply cushion should be adjusted for changes in gas prices. Alberta natural gas prices averaged \$7.56/GJ in Q1/08 compared to \$3.69/GJ in Q2/10. Gas price has been observed to influence the offer behaviour of some, but by no means all, market participants. This influence on offers may be direct, e.g. related to plant efficiency and fuel costs, or indirect e.g. offers are influenced by the 'price stickiness' associated with the reference price set at a 12.5 heat rate. The MSA has considered whether the relationship between price and supply cushion can be refined within some band where gas price could be expected to have most influence, e.g. between a 6 and 12.5 heat rate. Further work is needed to assess whether this refinement, or any others, would provide an enhancement for detecting outliers.

### **2.2.5 Q3/10 Anomalous Hours Based on the Supply Cushion**

For the current quarter the MSA has decided to examine a relatively large number of hours to illustrate the different types that are detected by the supply cushion analysis. Consequently, the MSA examined all hours outside 2 and 3 standard deviations of the mean – some 24 hours in total. This is approximately 1% of hours in Q3/10. Note that, based on the historical data set one might expect about 5% of the hours to lie outside  $\pm 2$  standard deviations.

Two hours were examined but not analyzed in depth since both represented events just above two standard deviations from the mean and close to the left hand of the applicable supply cushion band – hence only marginal outliers. This left some 22 hours, of which 7 were low prices and 15 were high prices.

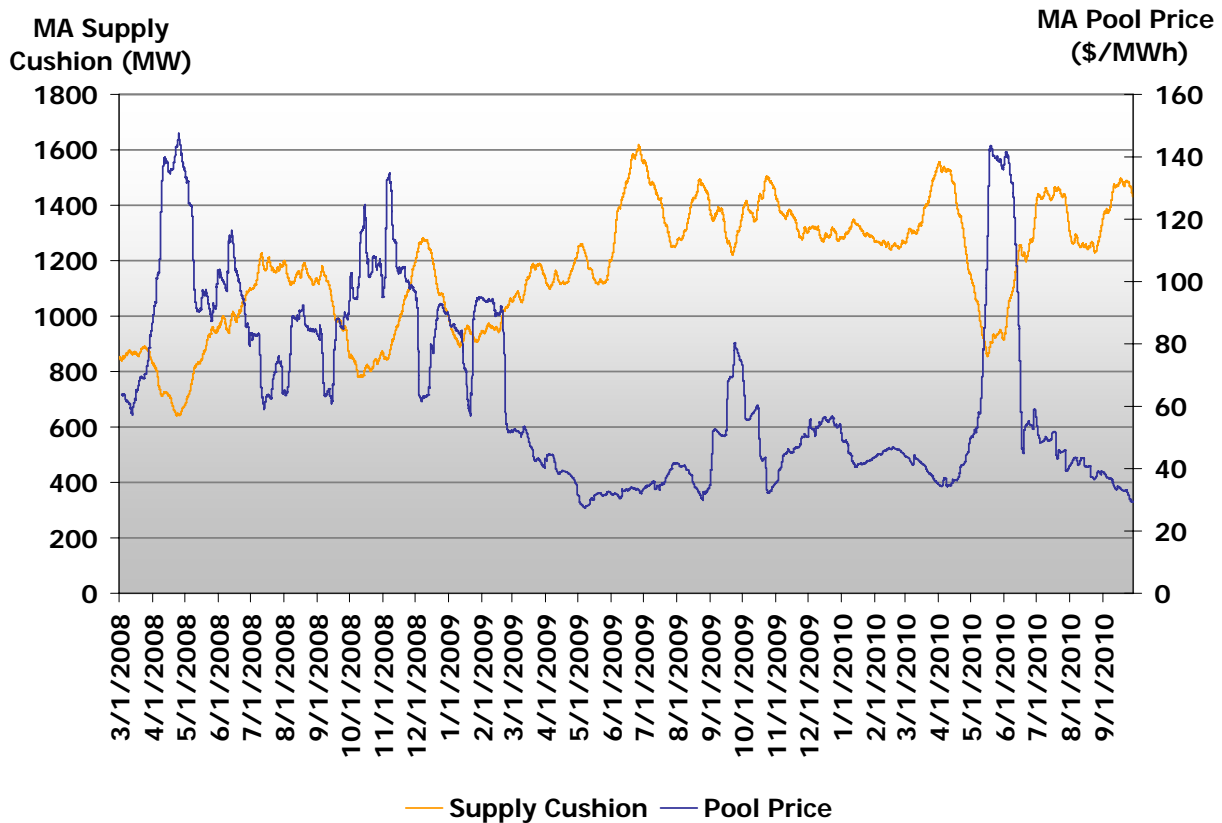
In future quarters the MSA expects to report in detail on a smaller number of hours. Hours similar to those reported on in the past will be recorded and reporting will be limited to a high level.

### 2.2.6 Supply Cushion Trend

In addition to looking at the relationship between hourly supply cushion and Pool price the MSA intends to track trends over time as part of monitoring the overall health of the market. Figure 2.5 shows simple monthly moving averages of supply cushion (plotted on the left axis) and pool price (right axis). The figure clearly shows the impact of the transmission related constraints during May 2010 (see the MSA’s report for Q2 /10).

The trend of Figure 2.5 also shows that the supply cushion from mid 2009 onwards has been about 400MW higher than in the period before mid 2009. Ignoring the influence of other factors, this would suggest the cushion would need to shrink significantly (through some combination of lower supply and higher demand) to return to the fundamentals that persisted in 2008. Recent evidence (ignoring the impact of the May 2010 events) would suggest the supply cushion remains at historically high levels but has not increased since mid 2009.

**Figure 2.5: Supply Cushion and Pool Price Trend (monthly rolling averages)**

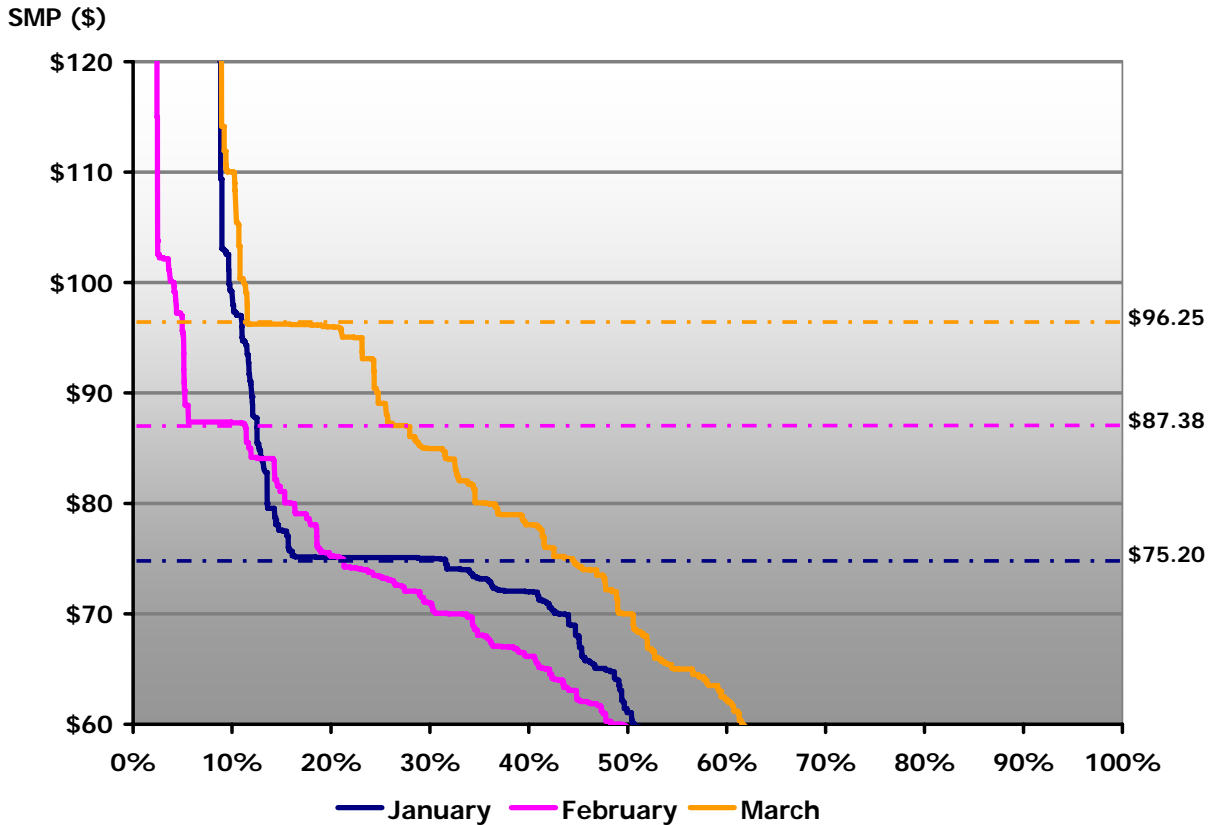


### 2.3 PRICE DURATION CURVE ANALYSIS

The MSA has regularly published Pool Price and Heat Rate duration curves, and will continue to feature these in our quarterly reporting. During the MSA’s work on assessing the impact of the introduction of dispatch down service, observation of the price duration curve was found to be a simple and effective

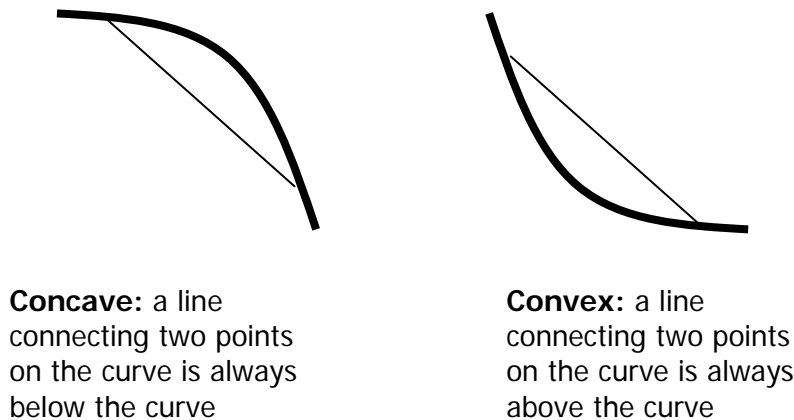
method of tracking ‘price stickiness’. Figure 2.6 is reproduced from the MSA’s ‘Quick Hits Review: Dispatch Down Service’ report. During the three months of 2008 shown in the figure, SMP was observed to be within a narrow band around reference price and led the MSA to be concerned that the introduction of the reference price was influencing market outcomes.<sup>1</sup>

Figure 2.6: SMP Duration Curve (Jan – Mar 2008)



In each month the observed shape of the price duration curve around reference price is bent outwards (concave) rather than the typical shape of a price duration curve of bent inwards (convex). Formally a portion of curve is said to be concave (convex) if a line connecting any two points along that curve lies entirely above (below) the curve, as illustrated in Figure 2.7. In the case of the reference price, the concave portion of the price duration curve corresponded to a disjoint in dispatch probability. More generally a concave portion of the duration curve indicates a repeated outcome that is more likely than outcomes at slightly higher or lower prices. This could be caused by market rules (as in the case of the reference price), by structural factors (e.g. related to a fuel cost of a particular generation technology) or it could indicate a repeated outcome that is not subject to effective competition. Consequently, the MSA believes concave portions of the price duration curve are worthy of further consideration.

<sup>1</sup> For further discussion see ‘Quick Hits Review: Dispatch Down Service’, p.6-8.

**Figure 2.7: Concave and Convex**

## 2.4 QUARTERLY POOL PRICE DURATION CURVES IN 2010

Duration curves can be constructed on a Pool price, or SMP basis. Both curves show the same general patterns, however, the SMP duration curve produces more exaggerated concavities than the Pool price duration curve. This is due to the fact that within a given concavity there will be more ‘events’ that make up the concavity.

For example, Figure 2.8 plots the quarterly Pool price duration curves for 2010. The highlighted area in Figure 2.8 that contributes significantly to the observed concavity is comprised entirely of hours from May 13 – May 15, a period of time, as described in the Q2/10 report, where a market participant unilaterally engaged in a withholding strategy that was largely uncontested by competitors.

The same concavity, on the SMP Duration curve is comprised of not just observations from the May13-May 15<sup>th</sup> period, but also of other points in time, unrelated to that particular event. Accordingly the concavity should be more pronounced, because it is composed of all occasions when price (in this case SMP) was at a particular level.

Figure 2.9 presents the quarterly SMP duration curves for 2010. Figure 2.9 also highlights a local concavity in Q3/10, between \$100 and \$200/MWh. The concavity identified in the Q3/10 duration curve totals 1487 minutes (approximately 25 hours), or about 1.1% of the quarter. The concavity in the Q3/10 SMP duration curve is relatively small by comparison to Q2/10 and much less than the historical observations in Figure 2.6.

When the concavity extends further out from the connecting line, particularly via horizontal or near horizontal segments of the curve, there is greater cause for concern. Horizontal portions of the duration curve indicate that SMP was repeatedly being set at a level observable to un-dispatched units. At any price above cost, an un-dispatched unit can do better by capturing dispatch just below the horizontal segment. Hence horizontal line segments should be competed away. The obvious exception to this is horizontal segments at the price cap, where there are no units left to compete, or line segments around

cost thresholds, such as those displayed in Figure 2.10 below. The enlarged view of the tail of the Q3/2010 SMP duration curve shows several horizontal segments associated with production cost where the ability of un-dispatched units to undercut is no longer available.

This metric is useful for identifying competitive outcomes at a high level, and the MSA will employ it as one element of its suite of market screening tools to identify, analyze and comment on the state of competition in the market. Whilst this metric does not have the diagnostic power of the supply cushion analysis it does work to complement that analysis. As the MSA develops more metrics to help identify anomalous hours, the strongest candidates will be hours which are 'flagged' by several metrics. The use of price duration curves in this quarter did not yield any new hours of interest beyond what was identified by the supply cushion analysis, but it did flag many of the same hours.

**Figure 2.8: 2010 Price Duration Curves**

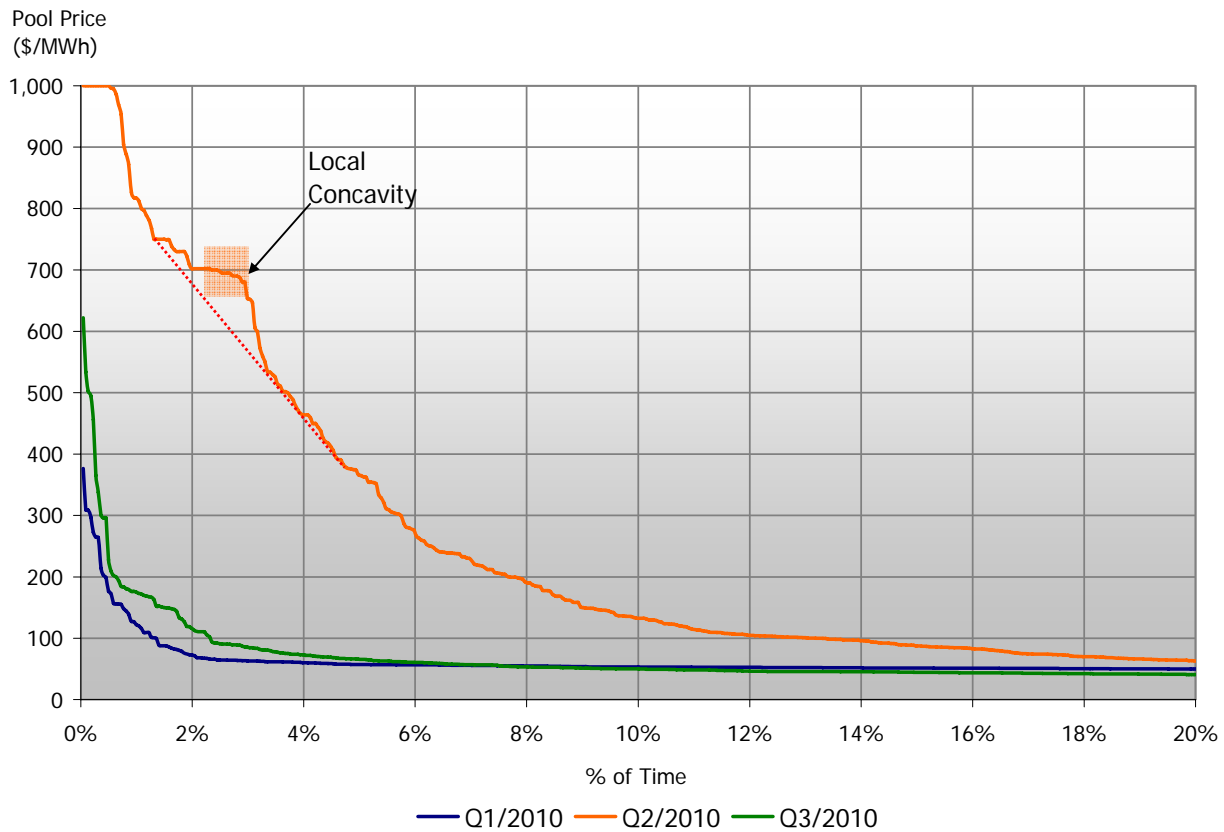


Figure 2.9: 2010 Quarterly SMP Duration Curves

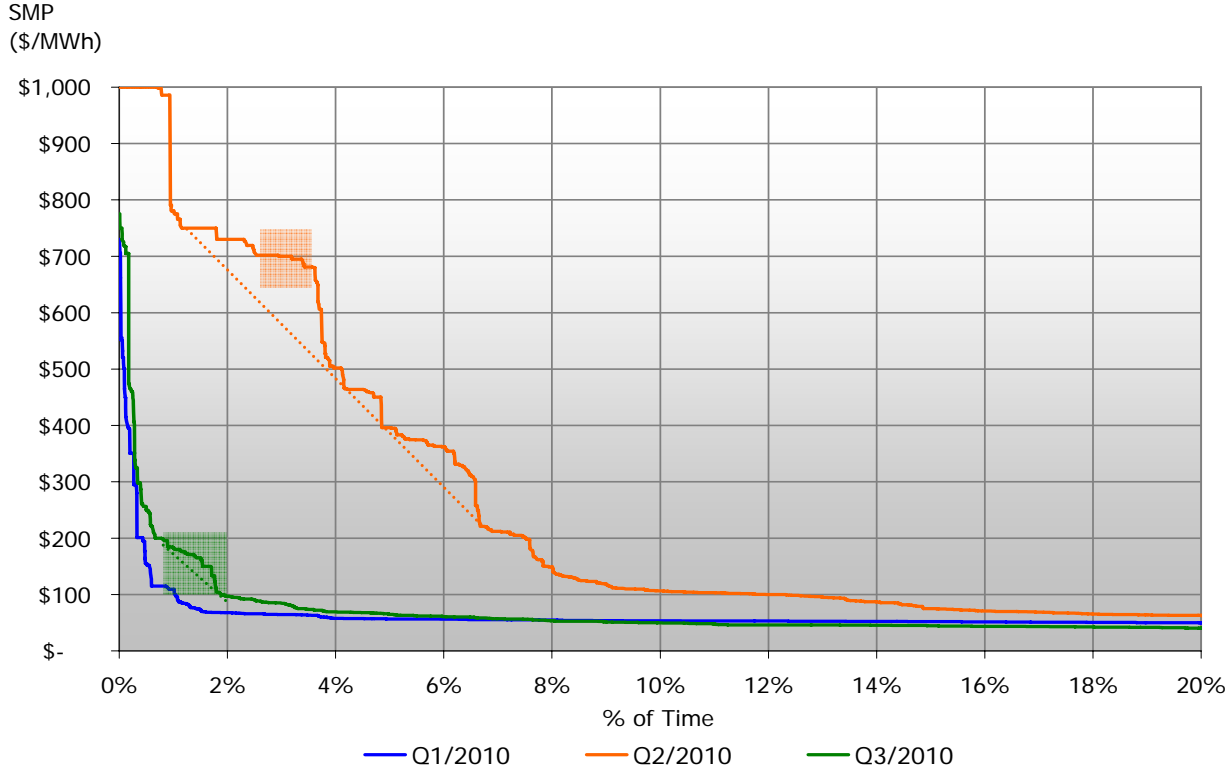
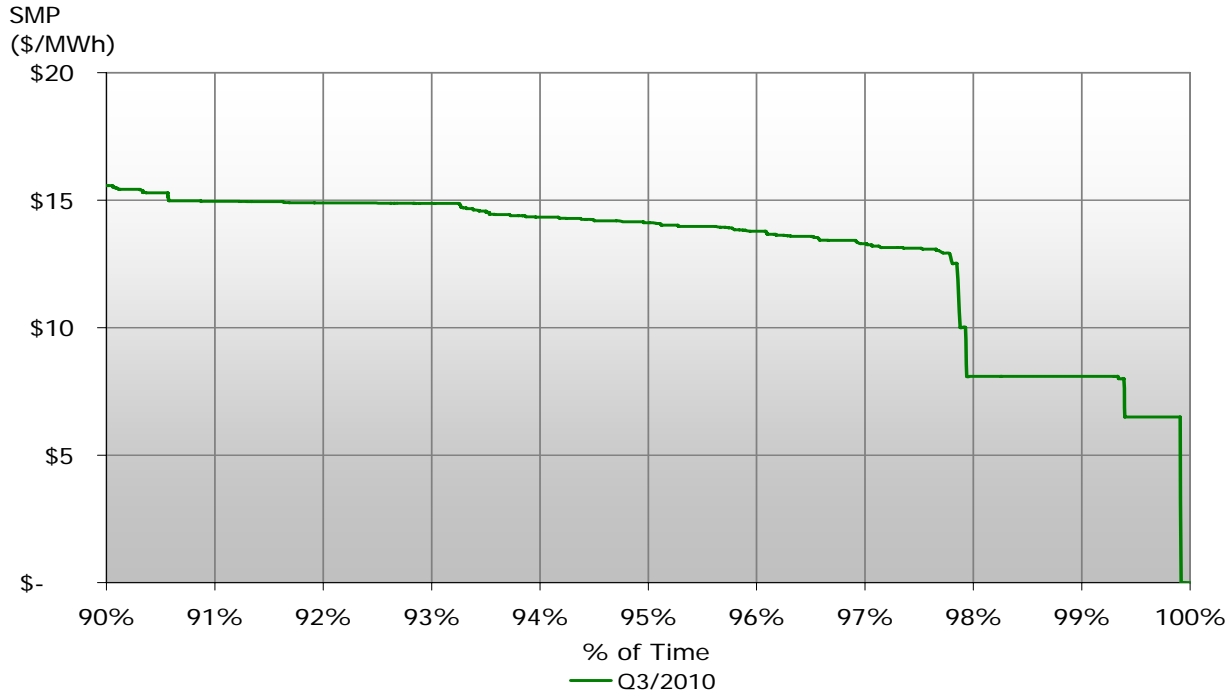


Figure 2.10: Q3/10 Duration Curve Tail



## 2.5 FUTURE ANALYSIS

In the next quarterly report the MSA expects to be able to share more of its analytical framework with market participants, looking at the applicability of two more metrics: a pivotal supplier analysis and an output-gap analysis.

## 3 Event Analysis

Table 3.1 shows 22 hours of interest identified from the supply cushion analysis and the price duration curve analysis. Normally, other sources of the MSA monitoring or analysis will yield additional hours of interest. Almost all hours of interest identified in the routine monitoring are included already in Table 3.1. One zero dollar Pool Price hour was added to the list to yield a total of 23 hours for analysis. In examining these hours, the MSA is seeking to understand the drivers behind them in order to detect unusual occurrences due to:

- Unilateral conduct
- Possible coordinated behaviour
- Influence of ISO rules or procedures
- Other factors

This process is to enable the MSA to build a catalogue of events and the factors that influenced them. In general, isolated examples of any influence are immaterial to the market, and to the MSA. However, repeated, and persistent, examples would be cause for review. For example, if the MSA found that there were many examples where the (T-2) lockdown rule was interfering with competition in the market, the MSA would prepare a detailed, fact-based assessment and propose options to remedy the situation. Clearly, in the process of cataloguing events, if it becomes apparent that the event has been misdiagnosed by whatever screening techniques are being used (perhaps due to matters such as data errors) these events will be discarded from any further consideration.

Table 3.1 organizes the hours into events, consisting of one or more hours related to one another. The table groups the events as being over or under the mean (indicating that the event was a high or low price outlier), and sorts them by date.

In interpreting these events from a competition perspective, the fact that the vast majority of them have been identified on the basis of supply cushion analysis has important implications. Supply cushion itself deals with the amount of supply relative to the demand for the hour in question. Hence, when very similar supply cushions yield dramatically different prices, the hypothesis is that, in many cases, the differences are primarily attributable to the suppliers' offers to the market. In very low price hours load is almost always light, but generally to push the price down to the floor (\$0/MWh) takes some amount of imports and/or increase in \$0 priced energy from, say, a baseload unit returning from maintenance or needing to raise its minimum level of generation. Higher in the merit order, where offers are generally not based on short run costs, the differences in price for the same level of supply cushion can be influenced by portfolio offering.

**Table 3.1: Q3/10 Events of Interest**

Event No.	Date	HE	Supply Cushion (MW)	Pool Price (\$/MWh)	Standard Deviation	SMP Duration Curve Concavity	Market Conditions and Preliminary Conclusions
1	8/18/2010	17	877	111.14	>+2	No	A single market participant offered a number of blocks of energy between \$160 and \$180. SMP set by these offers for 14 minutes at the start of HE17 when the supply cushion was smaller. A similar offer strategy was employed in HE16 and set the Pool price for the hour with a supply cushion of <750 MW. The market participant pursued a different offer strategy outside this 2 hour period, suggesting that the T-2 lockdown may have contributed to price formation in these hours.
2	8/26/2010	16	765	179.50	>+3	Yes	During HE 16, three market participants offered a number of blocks of energy between \$179.50 and \$280. Price was set at the lower end of this range for the hour. In HE17, supply cushion increased and two of those participants offered energy at lower prices. The MSA finds no evidence to suggest coordinated behaviour.
	8/26/2010	17	805	119.33	>+2	Yes	
3	8/27/2010	18	852	110.71	>+2	Yes	Starting in HE14 a single market participant offered approximately 300 MW of energy between \$198 and \$230 with SMP set in this range from HE15. In HE18, the supply cushion increased but the offered energy that had previously set price was shadowed by 128 MW of offers from a second participant setting price at \$195.96 for the first 26 minutes of the hour. The MSA finds no evidence to suggest coordinated behaviour.
4	8/30/2010	12	914	171.93	>+2	Yes	From HE12 through HE18 a single participant offered approximately 730 MW between \$165 and \$211. Price was set within this range despite the large fluctuation in supply cushion. In later hours there was evidence that these offers were shadowed closely by other market participants, leading to slightly lower prices. Evidence of competitive response, possibly muted by T-2 lockdown.
	8/30/2010	13	983	176.05	>+2	Yes	
	8/30/2010	14	1326	169.63	>+3	Yes	
	8/30/2010	15	867	175.13	>+3	Yes	
	8/30/2010	16	1205	150.97	>+3	Yes	
	8/30/2010	17	1341	166.54	>+3	Yes	
	8/30/2010	18	1312	162.87	>+3	Yes	
5	9/8/2010	12	1060	102.24	>+3	Yes	Unilateral action by one market participant resulted in several hundred MW of generation falling out of merit. The applicable assets were coal units with slower ramping rates than the assets that became in merit at that time. ACE and TTC violations were experienced due to ramp mismatches. Implications on reliability and price fidelity from such strategies.
6	9/10/2010	11	798	173.02	>+3	Yes	Multiple market participants moved offers from HE10 to HE11 to within a band between \$170 and \$215. SMP was set for 56 minutes by the low end



							of this range. Similar offer strategies persisted through to HE14 but did not set price. The MSA finds no evidence to suggest coordinated behaviour
7	9/14/2010	7	565	227.76	>+2	No	SMP set under \$50 for the first 19 minutes of the hour, but rose quickly to \$465 as the morning ramp progressed. Merit Order featured few offers in the range \$50 to \$500, and nearly 1000 MW of offers near the cap, including 183 MW of exports, SMP in HE08 fell back below \$50 as the result of price responsive load near the end of HE07, and decreased exports and increased imports in HE08. The MSA concludes that this event was driven by a steep merit order rather than the actions of any one (or group of) market participant(s).
8	9/14/2010	18	541	296.00	>+3	No	Single participant offering approximately 400 MW over a broad range from \$200 to \$400. These set SMP through the hour. SMP fell to below \$100 in the subsequent hour as offers within the \$200 to \$400 range reduced and imports increased.
9	7/2/2010	6	2999	5.10	<-2	No	SMP set at \$0 for some portion of these hours. Merit Order featured ~5500 MW of energy priced at \$0, and system demand was at its lowest through these hours. The analysis did not indicate the price was the result of the unilateral action of any one (or group of) market participant(s).
	7/4/2010	6	3032	4.01	<-2	No	
	7/4/2010	7	3123	0.00	N/A	No	
10	8/10/2010	13	218	72.00	<-2	No	SMP was set at \$72 for all of HE13, and in the \$70-\$85 range in HE17. Market conditions from HE13 through HE17 were similar, except that HE13 and HE17 produced much lower prices. Merit order had few offers between \$70 and \$700, and in HE13 and HE17 the market cleared just on the low side. The MSA concludes that this event was driven by a steep merit order rather than the actions of any one (or group of) market participant(s).
	8/10/2010	17	204	75.08	<-2	No	
11	8/11/2010	14	181	65.53	<-2	No	Merit order had almost no offers between \$75 and \$700, and ~8500 MW of the ~8700 MW total were offered under \$75. The market cleared just under the steep portion of the merit order. In HE17, a single participant priced up 73 MW above \$700, which brought up SMP in HE17. The MSA concludes that this event was driven by a steep merit order rather than the actions of any one (or group of) market participant(s).
	8/11/2010	15	153	78.60	<-2	No	
	8/11/2010	16	220	72.96	<-2	No	

In total, there are 11 events in Table 3.1, 8 related to elevated prices and 3 to depressed prices relative to the applicable supply cushion.

Of the 8 events that refer to elevated prices, 7 appear to be driven by offer strategies by one or more participants. A common feature of these events is that at least the lower end of the withheld shelf/tranche of energy is dispatched for at least a portion of the hour.

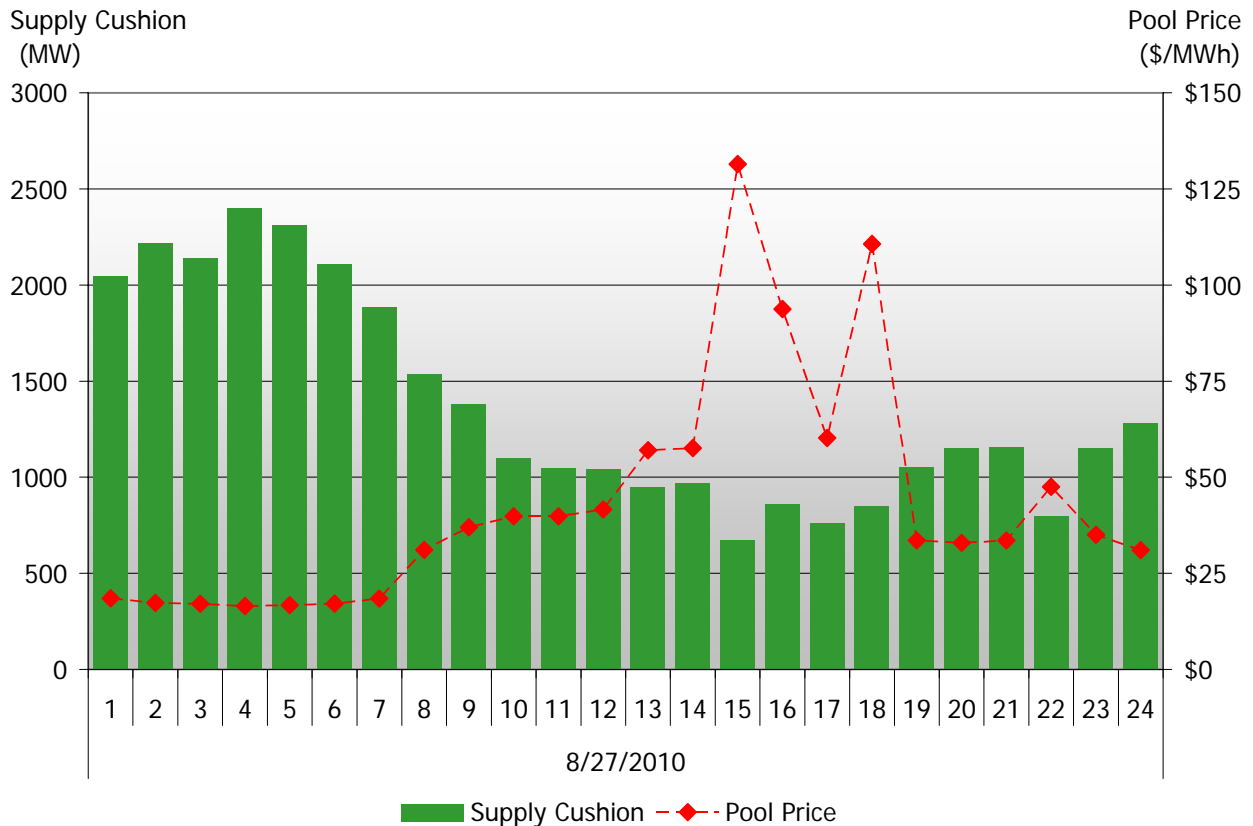
For the three events related to lower than expected Pool prices, the MSA could discern no evidence of any unilateral action by a market participant that was a major factor.

In the following sections, more details are provided on several of the events in Table 3.1. Events have been left out that were either not very significant or were essentially repetitions of other events in the table.

### 3.1 UNILATERAL ACTION BY TWO PARTICIPANTS – AUGUST 27<sup>TH</sup> HE18 (#3 IN TABLE 3.1)

August 27<sup>th</sup>, HE18 the market had a supply cushion of 852 MW, and produced a relatively high price of \$110.71/MWh. This particular event was illustrative of an offer strategy adopted in parallel by two market participants, to which there was no apparent competitive response. Figure 3.1 plots the Pool Price and Supply Cushion outcomes for the day in question.

Figure 3.1: 27-Aug-2010 Pool Price and Supply Cushion



#### 3.1.1 Fact Pattern

In HE14 to HE18 a single participant offered volumes ranging from 280 to 430 MW, at prices from \$198 to \$230/MWh. This strategy was instrumental in producing a daily high price of \$131.48/MWh in HE15, and generally elevated prices throughout the offer period.

The market outcome in HE18 is noteworthy because of the involvement of a second market participant who shadowed the shelf/tranche created by the first. In HE18, three blocks of energy, totaling 128 MW, were priced ~\$3 below the existing shelf. Of the re-priced energy, 91 MW was in merit and priced below \$60, and hence was priced up. The remaining 37 MW were out of merit and priced down from ~\$250/MWh.

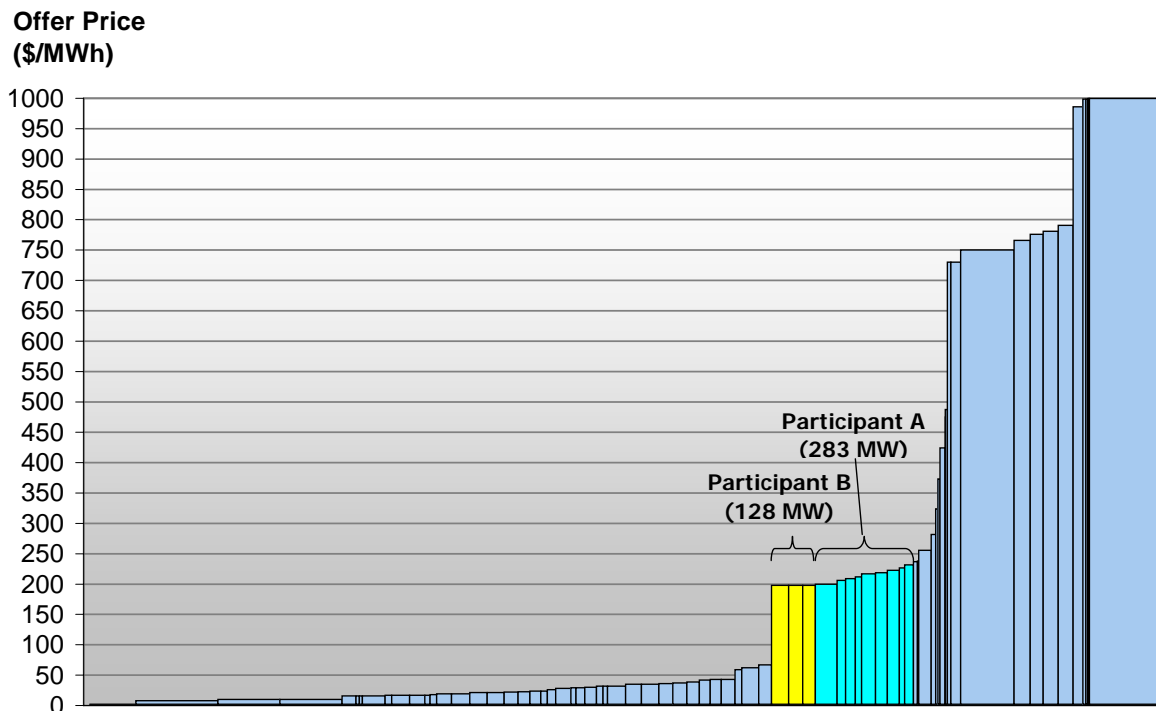
In this case, only the second participant captured dispatch in HE18, and set SMP at \$195.96/MWh for the first 26 minutes of the hour.

### 3.1.2 MSA Interpretation

It is noteworthy that the precision with which a participant was able to shadow price is enabled to some degree by the public information that the AESO makes available – in particular the anonymous merit order that becomes available immediately after the end of the hour.

Figure 3.2 presents a plot of the energy market supply curve in HE18, and illustrates examples of merit order offer shelves, and large discontinuities in the supply curve, where the price of the next unit of energy is dramatically higher than the previous, creating a ‘break’ in the curve.

Figure 3.2: 27-Aug-2010 HE18 Supply Curve



## 3.2 UNILATERAL ACTION – AUGUST 30<sup>TH</sup> HE12 TO HE18 (#4 IN TABLE 3.1)

On August 30<sup>th</sup>, there was a period of seven continuous hours in which one participant offered a significant tranche of energy out of merit and had a significant effect on corresponding Pool prices. Given the duration of the event there was opportunity for response from competitors.

### 3.2.1 Fact Pattern

Hours ending 12 through 18 on Monday August 30<sup>th</sup>, were identified as an event in Table 3.1, with supply cushions ranging from 867 MW to 1341 MW, and prices from \$150.97/MWh and \$176.05/MWh. During this period, a single participant priced up 731 MW into a price range of \$165 to \$190/MWh. This created a significant tranche in the merit order over a relatively narrow price range. The strategy was effective in setting SMP almost continuously through hours ending 12, 13, 14 and 15. In HE13, a second participant shadow priced the 'tranche' of the first participant. By HE16, other participant offers began to cluster around the bottom of the tranche, and at times set price.

### 3.2.2 MSA Interpretation

The MSA considers the response of competitors to strategies of offering large volumes out of merit to be an important indicator of the health of the market. Accordingly, events such as this one wherein the strategy persisted for 7 hours provide an ideal opportunity for the MSA to analyze the response of competitors. Despite the two-hour lockdown imposed through ISO rules, by the second hour of a persistent strategy any alert market participant is aware of what is happening in the real-time market. In the first hour, the strategy is observed in real time as a significant change to SMP and unusual changes in generator output. In the second hour, the anonymous merit orders are observed, and the competitive action can then take place in another two hours. If the belief is that the offer strategy will persist several more hours, the response by competitors can be affected in the fifth hour. For this particular event, the fifth hour was HE16 which is indeed when significant competitive response was initiated.

The competitive response time can be reduced significantly, though with greater risk, if the initial strategy can be identified in the ISO's price forecast. This forecast reflects an estimate of price based on all available offers that are locked down. In this case, the initial strategy could be 'observed' in the forecast immediately after the applicable offers are locked down at T-2. Some form of response could then be incorporated into the next hour's offers for effect one hour later than the initial event.

The initiating participant, A, created a 731 MW tranche in the merit order in HE12. In subsequent hours of the event, three other participants, B, C, and D responded to the strategy in different ways, and at different times.

Participant B appeared to be the first to respond in HE13, one hour after the start of A's offer strategy, by pricing 30 MW from a cogeneration asset at \$165.00/MWh. The MSA believes the timing of this re-pricing was enabled by the ISO's price forecast which showed a price increase for HE12, at the time of B's price restatement. Participant B's offers for this asset changed substantially between HE12 and HE13. The MSA's interpretation is that 30 MW were re-priced to \$165/MWh, 25 MW were priced up from a lower price, while the other 5 MW were priced down from a large block priced above \$700/MWh.

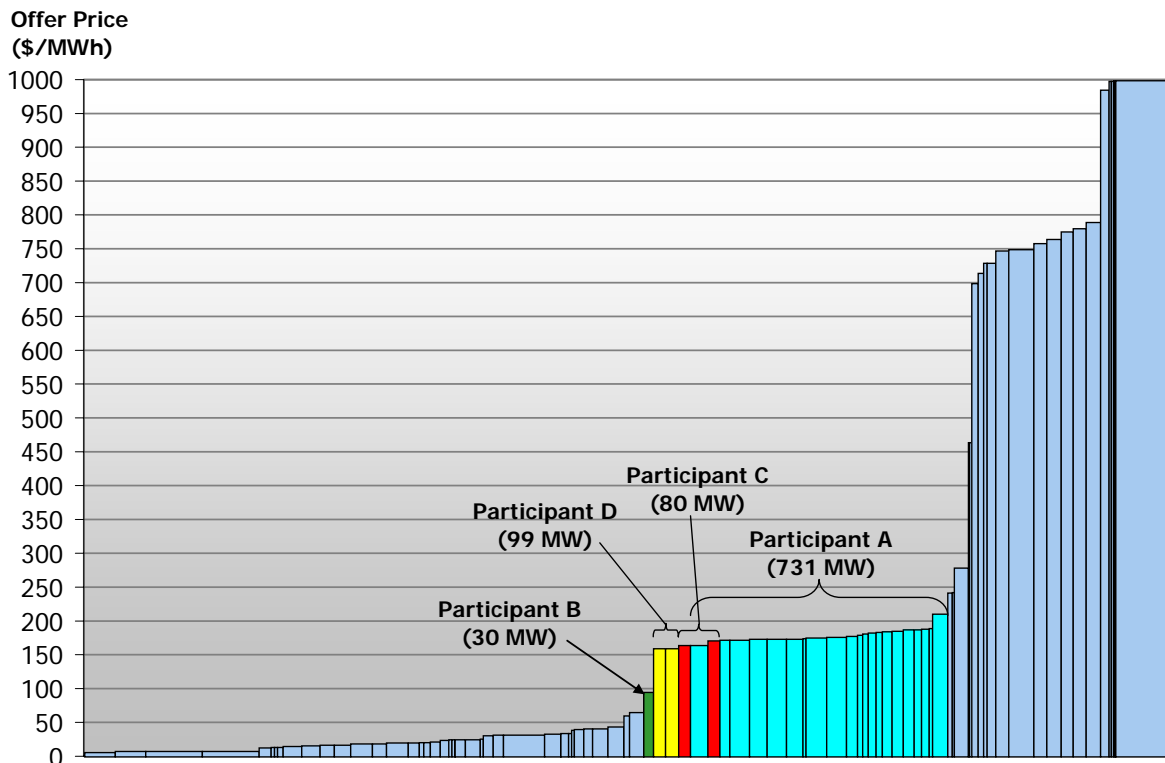
This was the only observable generator response during the first four hours of A's strategy.

However, in HE16 other offers began to coalesce around the bottom end of A's tranche. Participant C repriced two 40 MW blocks from above \$700/MWh down to \$165.05/MWh and \$171.00/MWh. At the time of the price restatement, the anonymous after-the-hour merit order for HE12 was available to the market, which showed a 53 MW block priced at \$165.07/MWh, the first (lowest price) block in A's tranche. Participant A's 53 MW block at \$165.07/MWh set price for 42 minutes over the course of HE16, HE17, and HE18 leaving C's \$171.00 block out of merit.

In HE17, participant D priced down 48 MW to \$160/MWh from more than \$200/MWh, undercutting participant's A, B, and C, and capturing dispatch. Then in HE18, participant D priced up 51 MW from \$0 to \$160/MWh, further extending its 'shelf', supporting price, and managed to retain dispatch.

Also in HE17, participant B reduced the price of its 30 MW offer from \$165/MWh to \$95.80/MWh, undercutting Participant D. Figure 3.3 presents the supply curve for HE17, which illustrates the shelf created in the merit order by the four participants.

**Figure 3.3 August 30<sup>th</sup> HE17 Supply Curve**



Overall, there is evidence of competitive response to the original price excursion initiated by participant A. However, it appears that the response may have been muted by the (T-2) rule.

### 3.3 UNILATERAL ACTION – SEPTEMBER 8<sup>TH</sup> HE 12 (#5 IN TABLE 3.1)

The Pool Price in HE12 on September 8th was \$102.24/MWh; unusually high given the supply cushion was 1060 MW. The offer behavior that drove this outcome was a strategy by a single market participant to move several hundred MW out of merit, not much different from several of the events identified in Table 3.1. However, the change in offers was a precipitating factor of an Area Control Error (ACE) and Path 1 Total Transfer Capability (TTC) violation, followed by a Remedial Action Scheme (RAS) curtailment on wind generation.

#### 3.3.1 Fact Pattern

Beginning in HE12, a market participant increased the price on 563 MW of coal assets to between approximately \$221/MWh and \$244/MWh. The pricing strategy was in effect for 5 hours, HE12 to HE16 inclusive, and beginning in HE17, all of this energy was re-priced into merit under \$30/MWh.

At the onset of HE12, 173 MW of the re-priced energy were already out of merit and hence only 390 MW were dispatched down. The top-of-the-hour dispatches to compensate for the removal of the 390 MW from energy production entailed dispatching 9 units totaling 401 MW.<sup>2</sup>

Table 3.2 displays the breakdown of fuel type called on at the start of HE12 to replace the out-of-merit coal energy.

**Table 3.2: Fuel Type of Capacity Dispatched at Start of HE12**

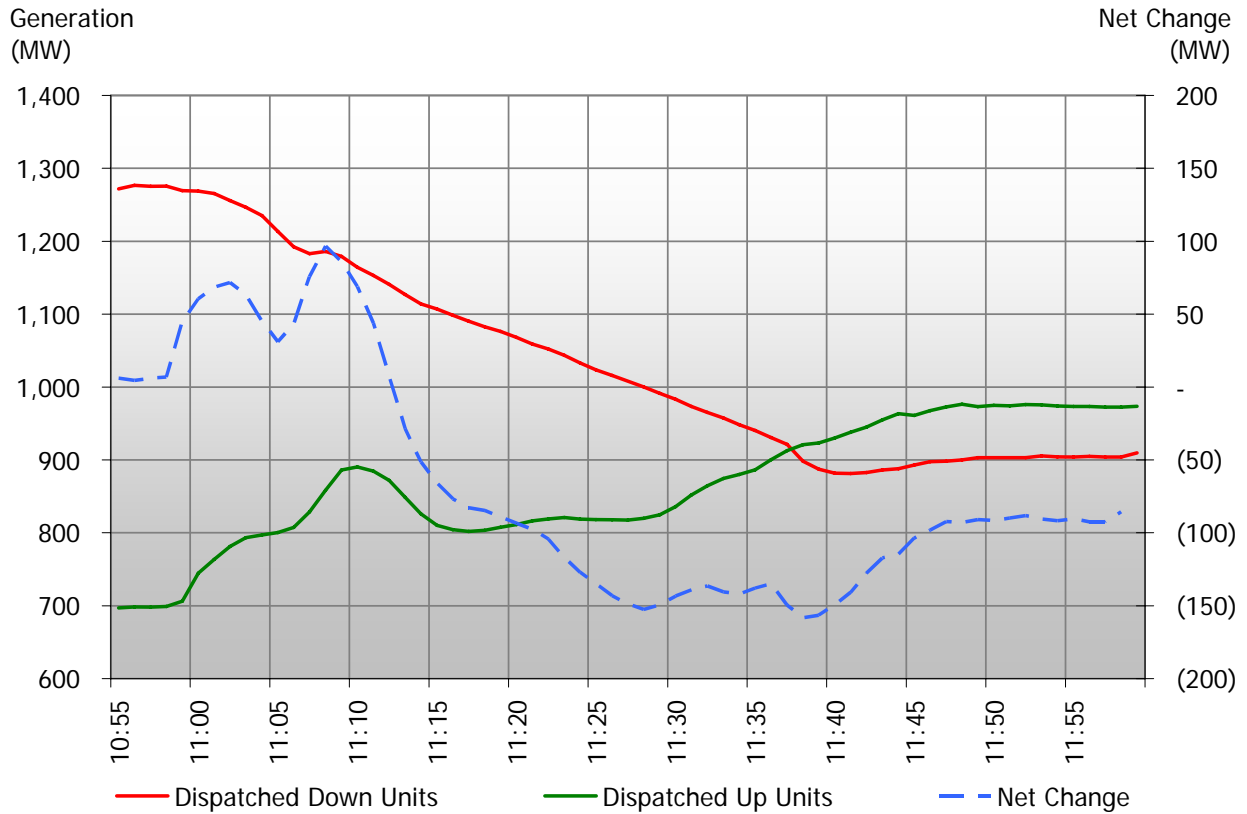
Gen Type	Gas	Co-Gen	Hydro	Total
MW Dispatched	335	54	12	401

As the 401 MW of replacement energy quickly ramped online, the 390 MW of coal began slowly ramping down. Figure 3.4 plots the combined generation levels of the coal units, the replacement energy, and the net difference.

Through the first 10 minutes of HE12, the units ramping online incrementally produced 191 MW, while the units ramping off decreased by only 105 MW, for a net gain to the system of 86 MW. While all of the units operated within their required ramp rates, the inherent mismatch of the ramp rates between generation types contributed to a system imbalance.

<sup>2</sup> Note that the total level of energy dispatched in the merit order at the onset of HE12 actually decreased from 8695 MW to 8689 MW, but due to other AC restatements in the merit order, the total incremental volume dispatched exceeded the amount removed from production. Note there were no changes in intertie schedule between HE11 and HE12.

**Figure 3.4: HE12 Generation Increases at Units Dispatched Up, Dispatched Down and Net Change**

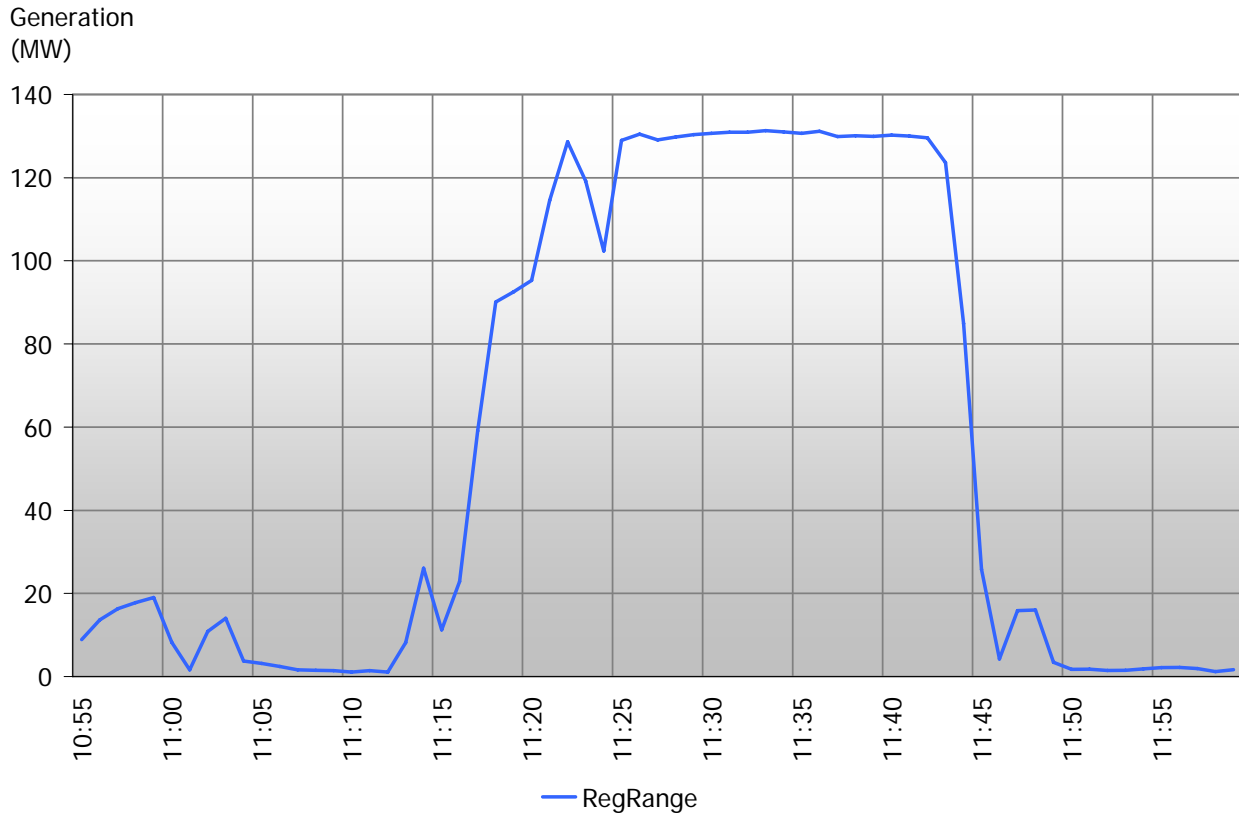


Additional factors contributed to the system imbalance, included:

- At 11:02 a known price responsive load decreased consumption by 30 MW.
- Instantaneous system load decreased by as much as 25 MW over the first 10 minutes of HE12, beyond what was accounted for by price responsive load.
- By 11:12, an additional ~10 MW of small gas units known to self dispatch within the 5 MW dead-band of Rule 6.6 had come online and by 11:20 were producing an additional 30 MW.

Finally, coming into HE12, the System Controller was positioned towards the low end of the Regulating Range, so the available regulating range was less able to accommodate the mismatched ramps and the other contributing factors listed above. Figure 3.5 plots the system regulating range during the relevant period.

**Figure 3.5: Regulating Range in HE12**



This combination of factors contributed to a situation of system over generation which pushed the Area Control Error (ACE) as high as 166 MW, well beyond the allowable limit.

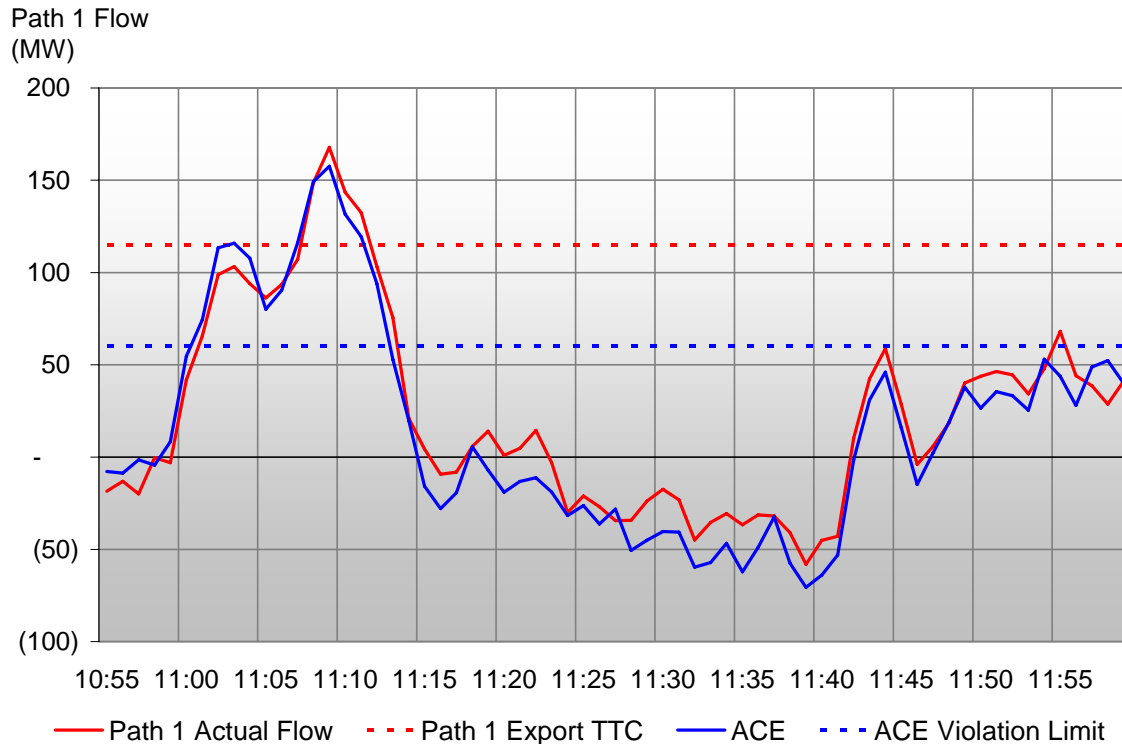
The system reliability effects of this over-supply situation were compounded by the fact that the main 500 kV element of Path 1 connecting Alberta with WECC was out of service for maintenance, leaving only the two lesser elements, 138 kV lines. Accordingly, the Total Transfer Capacity (TTC) of Path 1 was significantly decreased.

The positive ACE excursion resulted in energy being pushed out to WECC in such volume as to cause a TTC violation<sup>3</sup> on the remaining elements of Path 1. Figure 3.6 plots the system ACE and Path 1 actual flow against their respective high-side limits for the relevant time period.

<sup>3</sup> OPP 304 – Table 4 Summer Season Transfer Limits: Load on September 8<sup>th</sup> less than 8600 MW, therefore TTC was 115 MW. Export TRM was 65 MW, which gave 50 MW of export ATC.



Figure 3.6: Path 1 Actual Flow and Area Control Error



The TTC violation also appears to have contributed to the RAS curtailment of wind generation during this time period.

### 3.3.2 MSA Interpretation

There were multiple factors at play that contributed to the system events on Wednesday September 8<sup>th</sup>. The precipitating factor was the mismatch in ramp rates between coal units being priced out of merit, and the gas and hydro units replacing them. The out of merit coal energy increased Pool Price, triggering a decrease in consumption from price responsive load and an increase in generation at some small self-dispatching units. Further exacerbating the problem for the system controller was a general decrease in instantaneous load, regulating range that was not ideally positioned at the start of the hour, and the main 500 kV line of Path 1 being out of service.

This event illustrates some of the system complications that can arise when large volumes of energy, with different ramp rates, pass each other going into or out of merit, as may be caused by changing offer strategies. Since the September 8<sup>th</sup> event, the MSA has observed several other ACE excursions associated with substantial volumes of energy moving into or out of merit with mismatched ramp rates.

Going forward, the system controller will need to adopt the tools and methods necessary to manage the mismatch of ramps in the merit order induced by large offer changes. Large ACE excursions have the potential to negatively impact other parts of WECC, which could result in WECC Reliability Coordinator directives to Alberta to mitigate the excursion. In the immediate future, the system controller's primary

tool to respond to these directives, should they occur, would be to procure additional regulating reserve to meet the ramps. The increased use of regulating reserve has cost implications for load (who pay for such reserves) and has obvious implications for price fidelity. To this end, the MSA will continue to monitor and where necessary comment on the impacts to system security and/or price fidelity caused by ramp issues associated with participant offers.

### 3.4 ZERO DOLLAR SMP – JULY 2<sup>ND</sup> TO JULY 4<sup>TH</sup> (#9 IN TABLE 3.1)

In early July, the market produced three hours that were flagged in Table 3.1 and are considered herein as one event. The associated Pool prices were very low (zero in one hour) and were flagged as being low for the associated supply cushion.

#### 3.4.1 Fact Pattern

From Friday July 2<sup>nd</sup> through Sunday July 4<sup>th</sup>, the market produced three periods of \$0 SMP. Table 3.3 shows the date and time the \$0 SMP occurred.

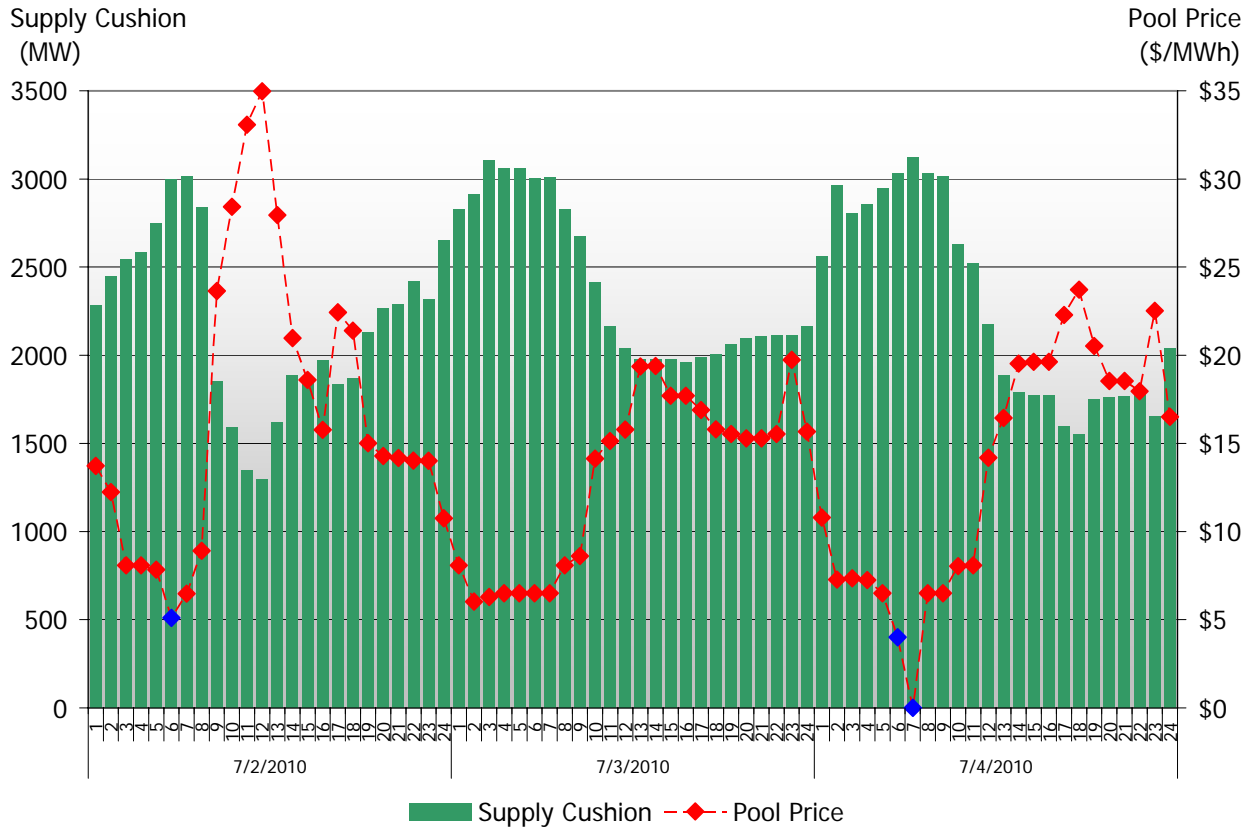
**Table 3.3: Periods in Early July when SMP was \$0/MWh**

Date	Start Time	End Time	Duration
Friday July 2 <sup>nd</sup>	5:48 (HE06)	6:12 (HE07)	24 minutes
Saturday July 3 <sup>rd</sup>	1:49 (HE02)	2:01 (HE03)	12 minutes
Sunday July 4 <sup>th</sup>	5:39 (HE06)	7:00 (HE08)	82 minutes

The first two events were relatively short lived, and ended at the start of the next hour, and HE07 on Sunday produced a \$0/MWh Pool Price. Three of the low-side outliers identified in Table 3.1 occurred within these \$0 SMP periods. As mentioned earlier, any prices at the floor or the cap are automatically candidates for analysis.

Figure 3.7 plots the Pool Price and Supply Cushion for the three days of interest, with the anomalous hours highlighted in blue. It can be seen that the three outlying hours are the three lowest prices of that period. It is possible that given the large range of supply cushions included in the supply cushion band of largest values, that the measurement of standard deviations could be distorted. It is clear that under a very high supply cushion, the market generally produces low prices, though there appeared to be little to distinguish the 'outlier' hours from other nearby hours with similar supply cushions.

**Figure 3.7: Pool Price and Supply Cushion**



During these three days, the system was dispatched subject to OPP 103 (Dispatching Multiple \$0 Offers) three times. On Friday and Saturday, import schedules for the next hour were curtailed in the hour(s) following the \$0 SMP. However, on Sunday the import schedules were curtailed in advance of the system producing a \$0 SMP, in accordance with section 5.1 of OPP 103. Table 3.4 summarizes the import schedule curtailments enacted during this time.

**Table 3.4: Import Curtailments**

Date	\$0 SMP First Observed	Imports Curtailed
Friday July 2 <sup>nd</sup>	HE06	HE07
Saturday July 3 <sup>rd</sup>	HE02	HE03 to HE08
Sunday July 4 <sup>th</sup>	HE06	HE03 to HE08

### 3.4.2 MSA Interpretation

The MSA examined restatement data to see if suppliers were competing for dispatch by pricing down to \$0 but found no evidence. Wind generation was light on the morning of July 2, but more robust on July 3

and 4. By contrast, July 2 being a Friday and hence a work day had a higher load than the weekend days. This tended to net out in terms of the supply cushion.

What was somewhat unusual was the relatively high plant availability of the coal fleet – often times, a portion of the coal plants go on forced maintenance on weekends to make minor repairs. The absence of one large coal unit to maintenance would likely have resulted in no \$0 SMP values.

The MSA was unable to detect any unilateral or coordinated action that was instrumental in the low prices of this period. Similarly, there appeared to be no influence from ISO rules or procedures.

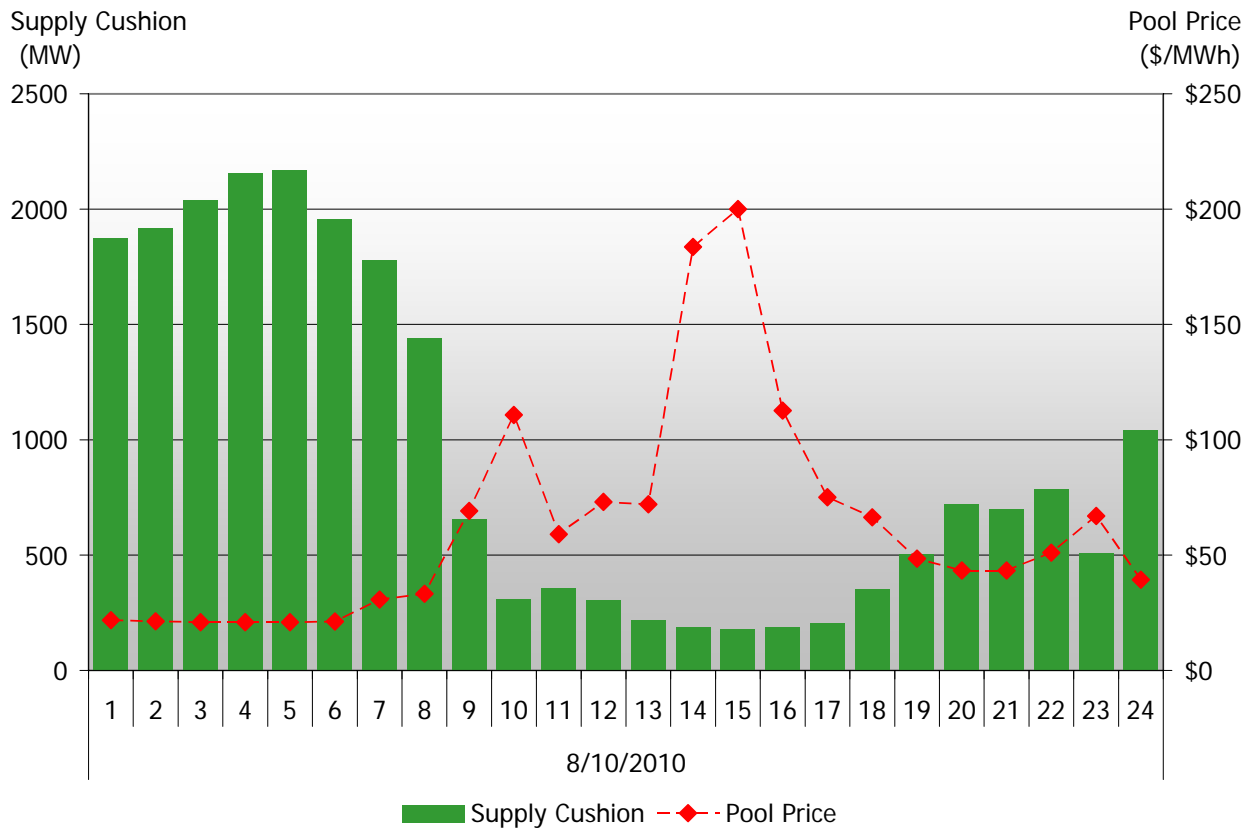
### **3.5 LOW CUSHION, LOW PRICE – AUGUST 10<sup>TH</sup>, HE 13 AND HE 17 (#10 IN TABLE 3.1)**

This second example shows how the supply curve can generate exceptionally low prices. The supply cushion screening identified both HE13 and HE17 on August 10<sup>th</sup>, as hours where the price was low given the market supply cushion.

#### **3.5.1 Fact Pattern**

Figure 3.8 plots the Pool Price and Supply Cushion outcomes for the day in question. Hours Ending 13 through 17 all had particularly low Supply Cushions which were reflected somewhat in the Pool Price for hours ending 14 through 16, which had prices between \$100 and \$200/MWh. By comparison with the baseline period however, the average price for the supply cushion band between 0 and 250 MW is ~\$400/MWh. While the price outcomes for HE14 to HE16 were not flagged by the supply cushion analysis, their price outcomes were on the low side of the range. However, subtle changes in the shape of the supply curve between hours led the price outcomes for HE13 and HE17 to be lower, and to be flagged in the supply cushion screening analysis.

**Figure 3.8: 10-Aug-2010 Pool Price and Supply Cushion**



### 3.5.2 MSA Interpretation

The merit order assumed a fairly extreme shape through this period, with a large volume of low priced offers, a small volume of very high priced offers, very little in between, conforming to the hockey stick analogy. When the market is clearing near the ‘break’ in the supply curve, small changes in MW can have large impacts on price.

In comparing HE17 with HE15, the merit order had increased some 260 MW in supply, with offers between \$0 and \$40/MWh almost matched by the load increase. This resulted in very similar supply cushions for these hours. However, the rightward shift in the supply curve was not quite equaled by the rightward shift in the demand curve. Given the market was clearing near the break in the merit order, the small relative shift in the curves led to a large price impact.

Over the hours HE13 through HE17 price was set in a relatively small band of MW but the associated prices of the energy were much different. In looking at offer data and restatements, the MSA was unable to detect any behaviour by an individual market participant, or group of participants, that drove the price outcomes. Similarly, the MSA could find no evidence that ISO rules or procedures contributed to the outcome.

It would be very concerning to the MSA if the market was unable to send the correct scarcity signal on a sustained basis. Overall, this event (HE13 through HE17, inclusive) appears to be statistically unusual. In the absence of any behaviour that appears inappropriate, the MSA will continue to examine and document similar events.

## 4 Forward Market Liquidity

In Q3/10, there was a notable decrease in market liquidity (Figure F.1). Although the trading volumes in the 3<sup>rd</sup> quarter of the two previous years were lower than other quarters, the drop in Q3/10 was more pronounced. Declining market liquidity is of concern to the MSA, as the levels in Alberta are already quite low compared with other electricity market jurisdictions. A highly liquid forward market provides opportunities for both suppliers and consumers to hedge against the risks associated with the real-time market. It also provides a forward view of market prices that can assist new entrants in making investment decisions.

In 2009 the total electricity volume traded on Natural Gas Exchange (NGX) and through brokers was 81% of the underlying demand in Alberta, whereas in other jurisdictions, forward trading volumes are typically more than twice the underlying demand.<sup>4</sup> Table 4.1 illustrates this fact using 2009 data.

**Table 4.1: Liquidity of International Electricity Markets (2009 Data)**

Market	% of Demand
Alberta	81
France	180
UK	390
Germany	960
Netherlands	340
Nordpool	760
Australia	260

In Q3/10, it was apparent that trade volumes were well below the size of the underlying demand (indicated by the red dots in Figure F.1). Further examination of the trading data revealed that the decline in trading volumes was primarily driven by reduced activities of the banks/funds and reduced trading in longer term products.

Figure 4.1 shows the market share by three different types of participants: those who own generating assets in the province (Generators), those who do not own generating assets but may or may not have loads (Marketers/Loads), and financial institutions or hedge funds (Banks/Funds). The market share of banks/funds has fluctuated over the period of the data presented, but clearly has been sliding throughout 2010. Two existing participants from this category didn't trade at all in Q3/10, one of whom has not traded since February.

<sup>4</sup> Ofgem, 'GB wholesale electricity market liquidity: summer 2010 assessment', July 29, 2010. Australian Energy Regulator, 'State of the Energy Market 2009', December 8, 2009.

Figure 4.2 shows the proportion of different length of contract terms in the total trading volumes. It is evident that the proportion of the longer term contracts, Quarterly and Calendar Year, started to decline since the beginning of the year and remained at low levels in Q3/10.

The MSA has had informal discussions with some of the trading entities to better understand the drivers behind the declining market liquidity. Some of the market participants perceive increased uncertainty in the forward market. Specifically, some participants are inclined to stay 'on the side line' in order to better gauge the potential impacts of the forthcoming MSA offer guidance that is in development. Consequently, they reduced their trading activities and, in particular, were less inclined to take longer term positions. Figure 4.3 shows that the percentage of the total volumes of the contracts that have delivery beyond 12 months shrank. No contracts with delivery more than 24 months out were traded in the past two quarters. The MSA understands these concerns and expects to finalize and publish the offer guideline by the end of the year. Hopefully, this will alleviate any uncertainty and dampening effects this may have had on trade volumes.

**Figure 4.1: Monthly Market Share by Participant Type**

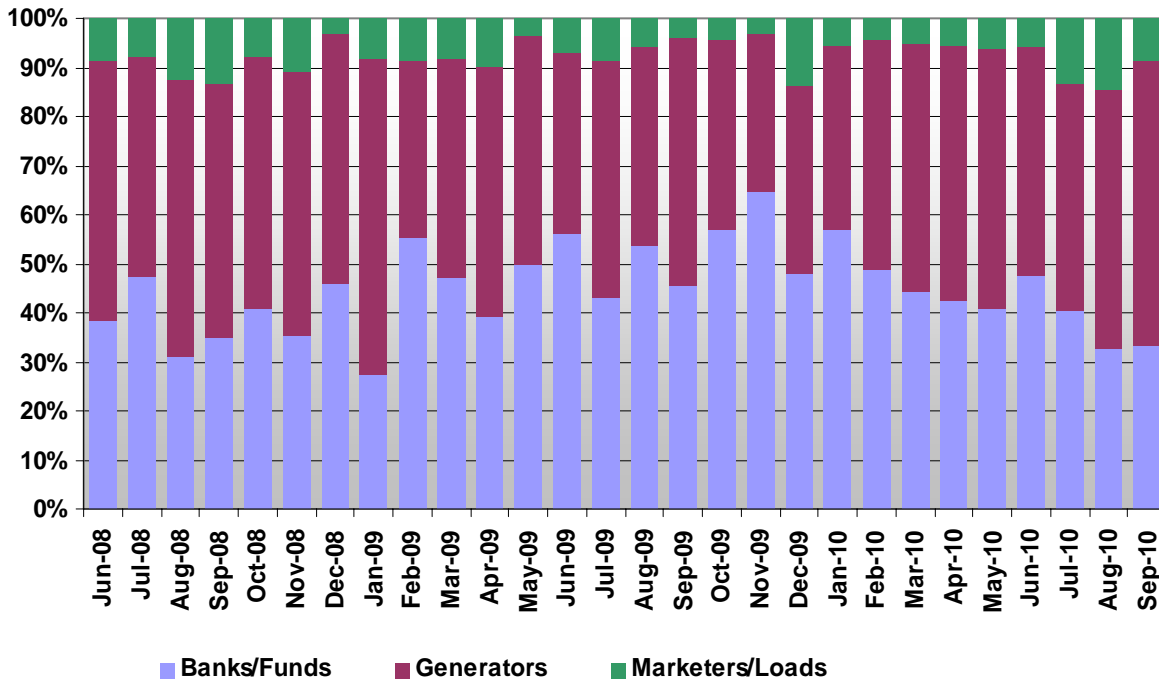


Figure 4.2: Market Share by Contract Term (Volume)

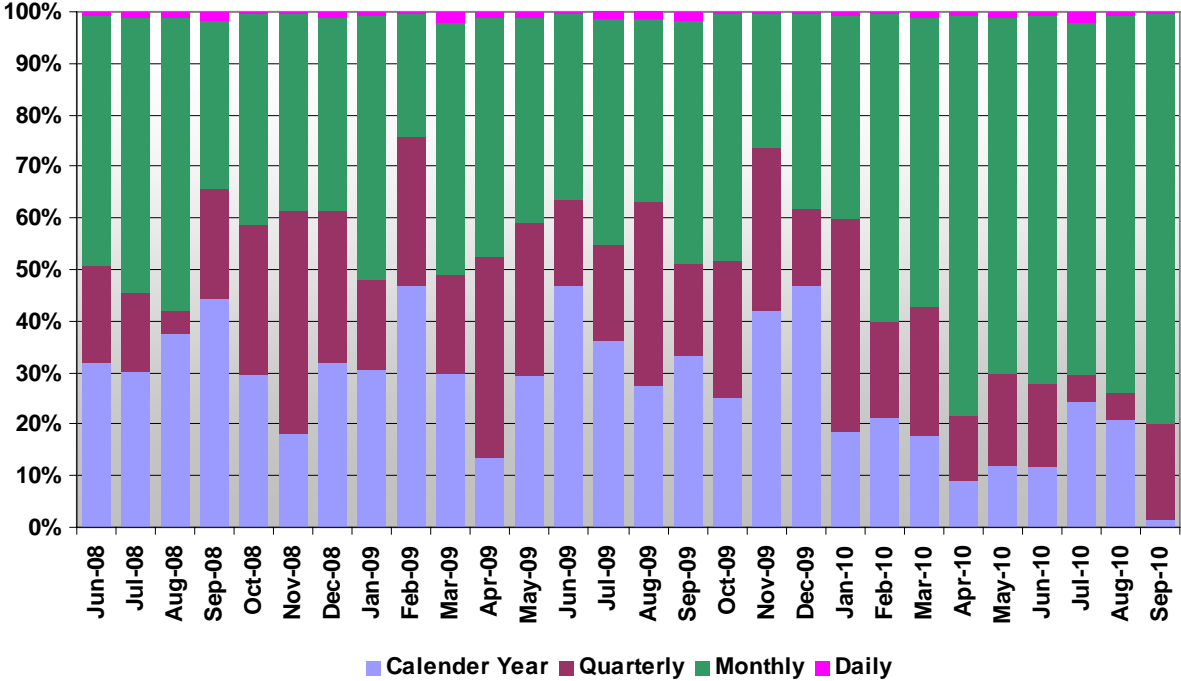
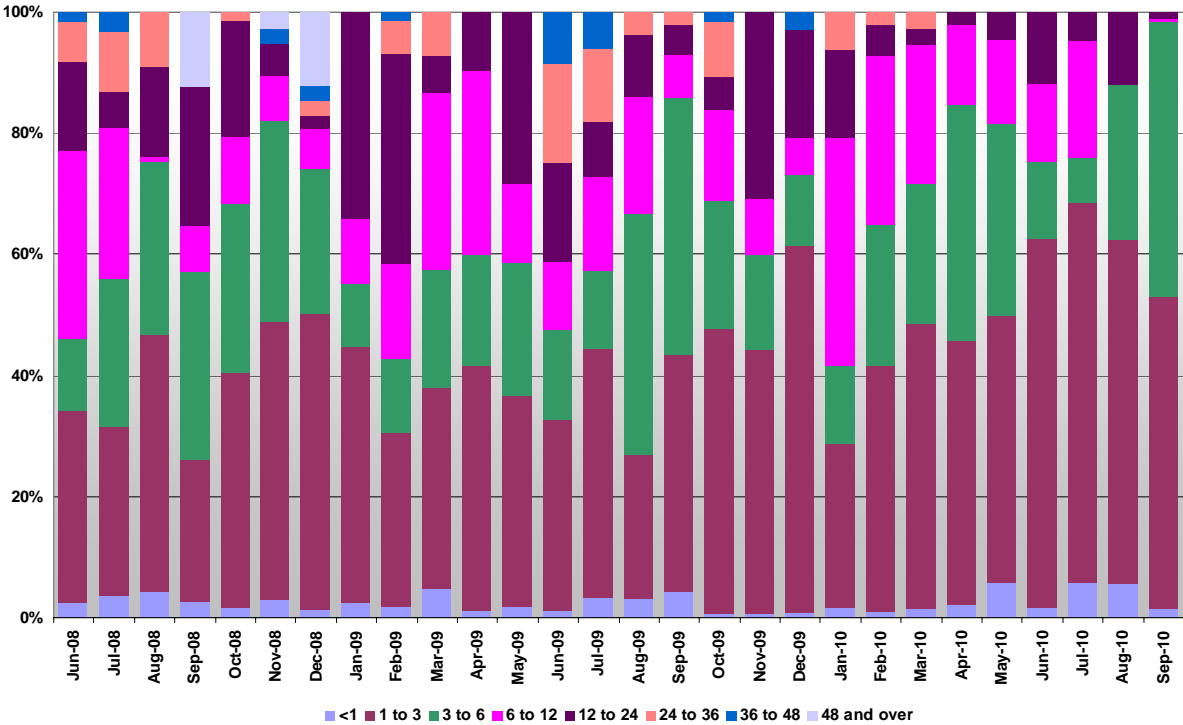


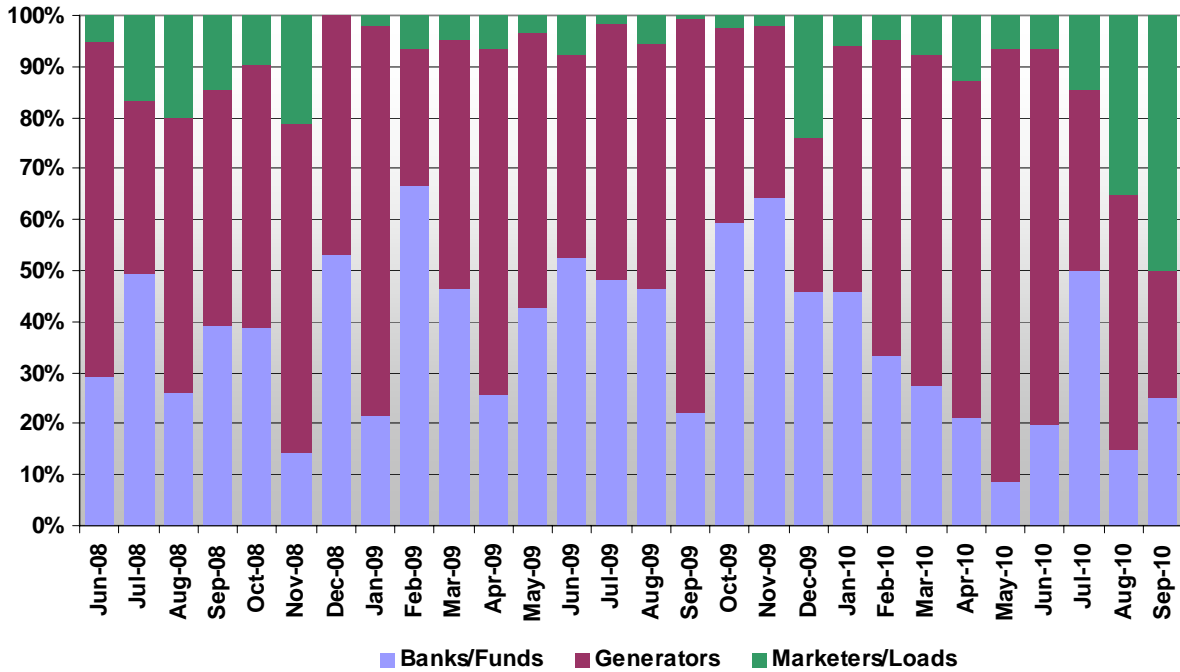
Figure 4.3: Percentage of Contracts by "Months Out"





In the midst of the reduced liquidity, a couple of bright spots existed in the forward market in Q3/10. First, while the market share of banks/funds declined, that of loads increased. The weaker forward prices appeared to have been viewed by some loads as a good opportunity to hedge, particularly for long term power demand. Figure 4.4 depicts the market share of the Calendar Year contracts and demonstrates a significant increase in the market share of marketers/loads. Secondly, there was an increased proportion of volume traded on NGX, which, compared with the over the counter markets, offers better transparency. Figure 4.5 shows the percentage of volumes traded on NGX and an obvious upward trend can be identified since the summer of 2009. Although this trend was partly driven by the increased Regulated Rate Option (RRO) indexed volumes, Figure 4.5 suggests that this is not just a ‘monthly contract phenomenon’, as the same type of increases with the quarterly and calendar year contracts are also detectable.

**Figure 4.4: Calendar Year Contract Monthly Market Share by Participant Type**



**Figure 4.5: Percentage of Volume Traded on NGX by Contract Term**

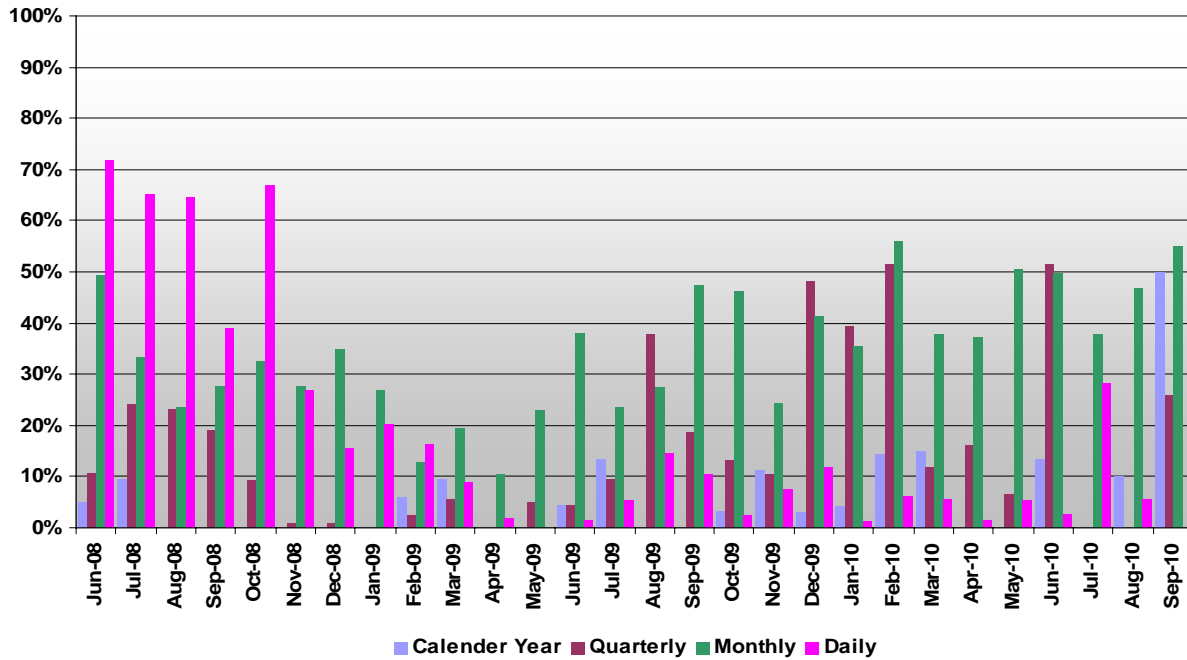
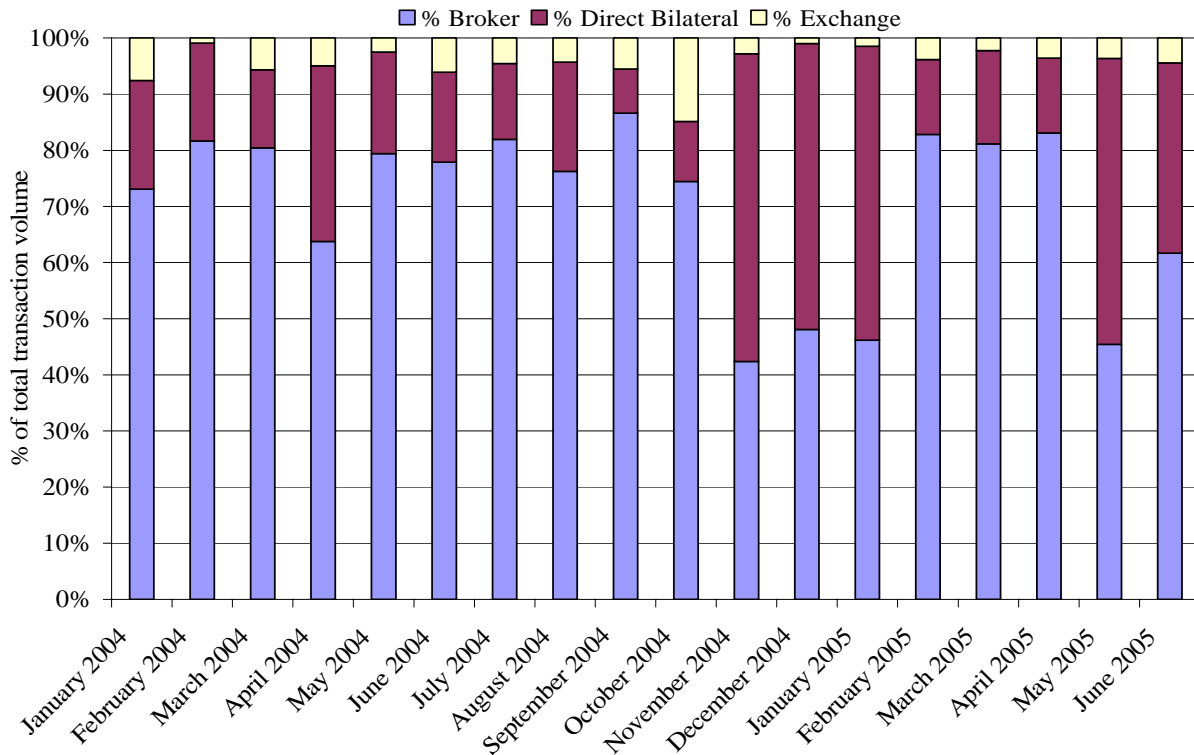


Figure F.1 (See Appendix F) shows a modest up tick in trade volumes in September 2010. However, this recovery has not continued and, as of late October, trade volumes have again slid back to low levels, similar to those observed in the summer months.

Currently, the MSA receives regular weekly reports from NGX and all of the OTC brokers. However, data on straight bi-lateral transactions is not collected. There exists the possibility that the drop in liquidity is actually one of migration from platforms that provide data to the MSA to bi-lateral transactions which are not visible to the MSA. This is not to say that the lack of visibility by the MSA would be a driver of such migration. In 2005, the MSA did an informal survey of forward trading as part of its assessment of the efficacy of the Trading Practices Guideline and associated Information Disclosure Procedure. In that assessment, the data was assessed according to the form of transaction and Figure 4.6 below is taken from that report. It can be seen that in the period 2004 through June 2005, the volume of transactions that were bi-lateral fluctuated from month to month – but in some months represented as much as 50% of total volume. It is not possible to know at the present time whether the drop in market liquidity observable by the MSA is in fact a move to more direct bi-laterals. The MSA will continue to monitor the situation.

**Figure 4.6: Total Transaction Volumes by Broker, Direct Bilateral and Exchange<sup>5</sup>**



## 5 Operating Reserves Redesign – Move to (D-1) Procurement

### 5.1 BACKGROUND

On July 5, 2010 the AESO implemented the most recent phase of the Operating Reserve market redesign and concentrated procurement of all operating reserves on NGX (except hourly shaping volumes) to a day-ahead (D-1) basis. This means that AESO procures all the operating reserves on the business day immediately prior to the delivery day. The existing market structure allows AESO to buy its volumes over five business days, denoted (D-5) through (D-1). About two years ago, AESO began to increase its buying of operating reserves on (D-1) to see if participants were willing to focus the market closer to real time. On average, about 70% of the Operating Reserves were bought on (D-1) with the balance scattered over the other 4 procurement days. The apparent success in moving the majority of the procurement to (D-1) gave the AESO some comfort in undertaking the incremental change to 100%. Note that the AESO still retains the ability to procure Operating Reserves through the over the counter (OTC) process in the event that it is unable to fully meet its needs via NGX.

<sup>5</sup> MSA, One Year On: Assessment of the Impact of the Trading Practices Guideline and Information Disclosure Procedure, 2005, Figure 3.5 on p10.

The primary objectives were to simplify the procurement process and to further reduce unnecessary influence in the market by AESO. Concerns by AESO were only that participants might respond by withdrawing from the market, or find ways to take undue advantage of the new procurement strategy. Some market participants were concerned about the lack of ability to lock in sales further ahead of real time (that is, on one of the four trade days that AESO no longer posted a bid).

In terms of the mechanics of market operation, the AESO simply does not post a bid volume/price on the days (D-5) through (D-2). The bid volume posted on (D-1) is based on the forecasted requirements and the bid price is set high for each product as shown in Table 5.1. These bid prices have been in place for some time, and have not changed throughout the April to September, 2010 period.

**Table 5.1: AESO Active Operating Reserve Bid Prices**

Product	Bid Price (Discount to Pool Price, \$/MWh)
On-Peak Regulating Reserve	-10
Off-Peak Regulating Reserve	+100
On-Peak Spinning Reserve	0
Off-Peak Spinning Reserve	+40
On-Peak Supplemental Reserve	-15
Off-Peak Supplemental Reserve	+5

The following assessment is to establish whether all the desired outcomes of this market change have materialized and whether there are any significant concerns that are evident. The analysis only examined the active reserve market. Although the standby market was also transitioned to a one-day procurement schedule, the change was not as significant as for the active market.

## 5.2 MARKET LIQUIDITY

With no change in demand or supply (only the distribution of the procurement across the five days) and only a modest change in procurement process [from 70% to 100% on (D-1)], it was felt that market liquidity should remain essentially unchanged absent some change in behaviour by market participants.

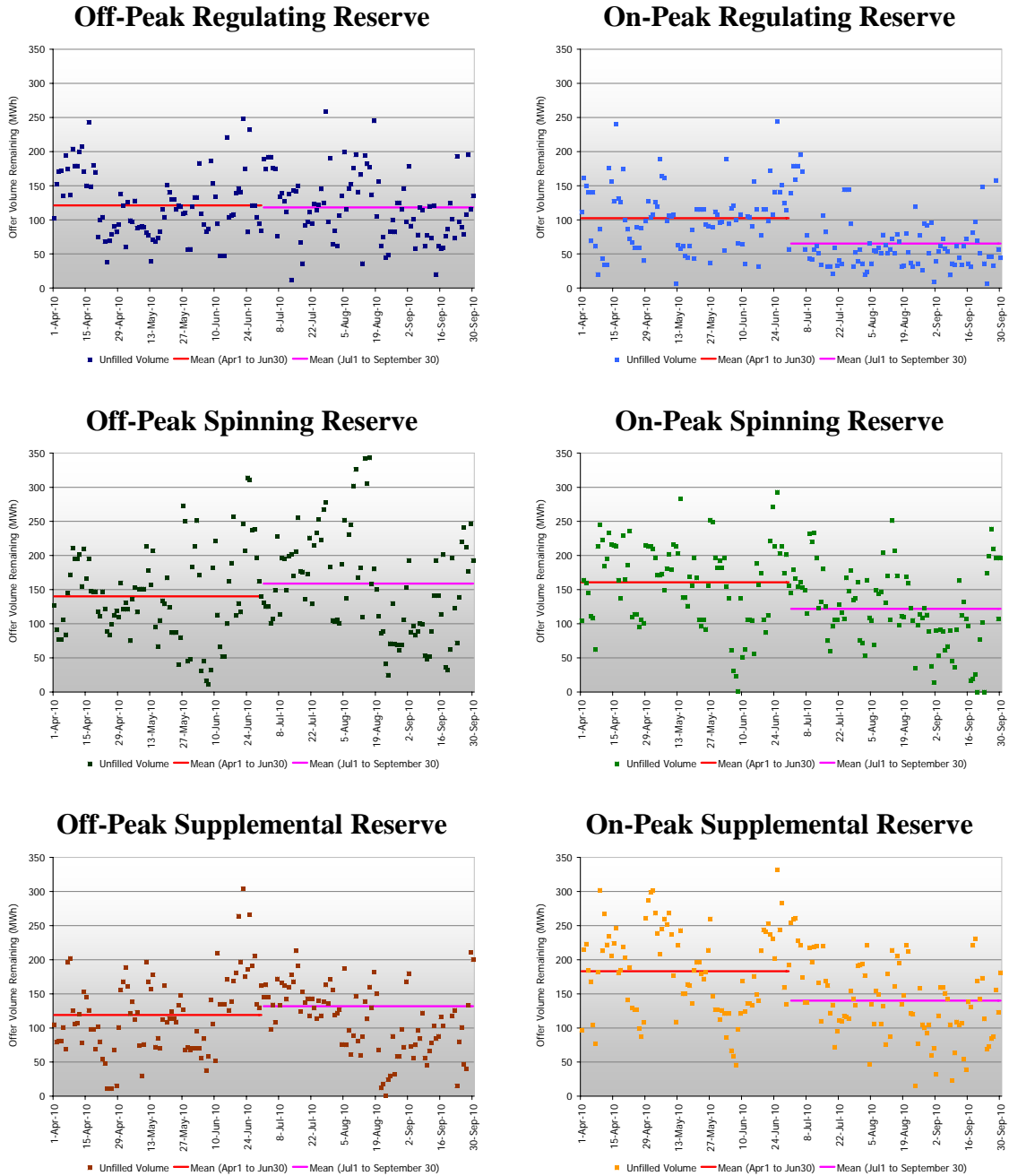
Figure 5.1 shows the offered but unsold volumes offered to the market on (D-1) including the mean levels for the pre and post (D-1) periods. There is a notable decrease in market liquidity observable for some products. Specifically, in the cases of the on-peak products the liquidity went down while for off-peak products the liquidity was flat or improved. Some of the reduction for spinning reserve and supplemental reserve is attributable to a maintenance outage of the BC intertie for 10 days in September which precluded any participation by Powerex in these markets. Maintenance of generating units may have played a part but the MSA has not looked into this at the present time. In the case of a procurement process such as that for operating reserves, healthy liquidity is a hallmark of robust competition. The MSA will continue to monitor the liquidity of the operating reserves market.

There were two occasions in Q3/10 when the offered volume was less than AESO's demand. They were for delivery day August 23 for active off-peak supplemental reserve and also delivery day September 23 for active on-peak spinning reserve. These shortages of offer volumes were caused when a few market participants decreased their offered volume from 'usual' levels on nearby days. In both instances, the trade price cleared at AESO's bid price (the price cap, in effect) and AESO added the missing volume to its hourly shaping product and bought on OTC. Notably, the OTC prices for these products were higher than the AESO's NGX bid price. The high trade prices of these two events attracted increased volumes to the operating reserve market on subsequent trading days. Prior to the single day procurement, the AESO had experienced infrequent occurrences of similar supply shortages when procuring reserves on NGX, although there were no instances in the three months prior to (D-1) implementation.

These two events raise a number of questions:

- Are the bid prices that AESO posts to NGX high enough to attract sufficient volumes in all situations?
- With no 'must offer' requirement in the operating reserves market and where often the full demand is met by just a few providers, how is it possible to know if true scarcity is occurring? Some suppliers may perceive there to be no market opportunity.
- Are these two days examples of strategic behaviour to drive up prices or simply a reflection of operational circumstances on the days in question?

Figure 5.1: Unfilled Offer Volumes – April 1 through September 30, 2010



### 5.3 MARKET SHARES AND PRICES

Figure 5.2 shows the market shares of sales for each product over the past six months. Whilst there are some fluctuations evident from one day to another, there is no evidence of withdrawal from the market by participants, nor a major shift in market shares.

Figure 5.2: Active Operating Reserve Market Share by Product (NGX)

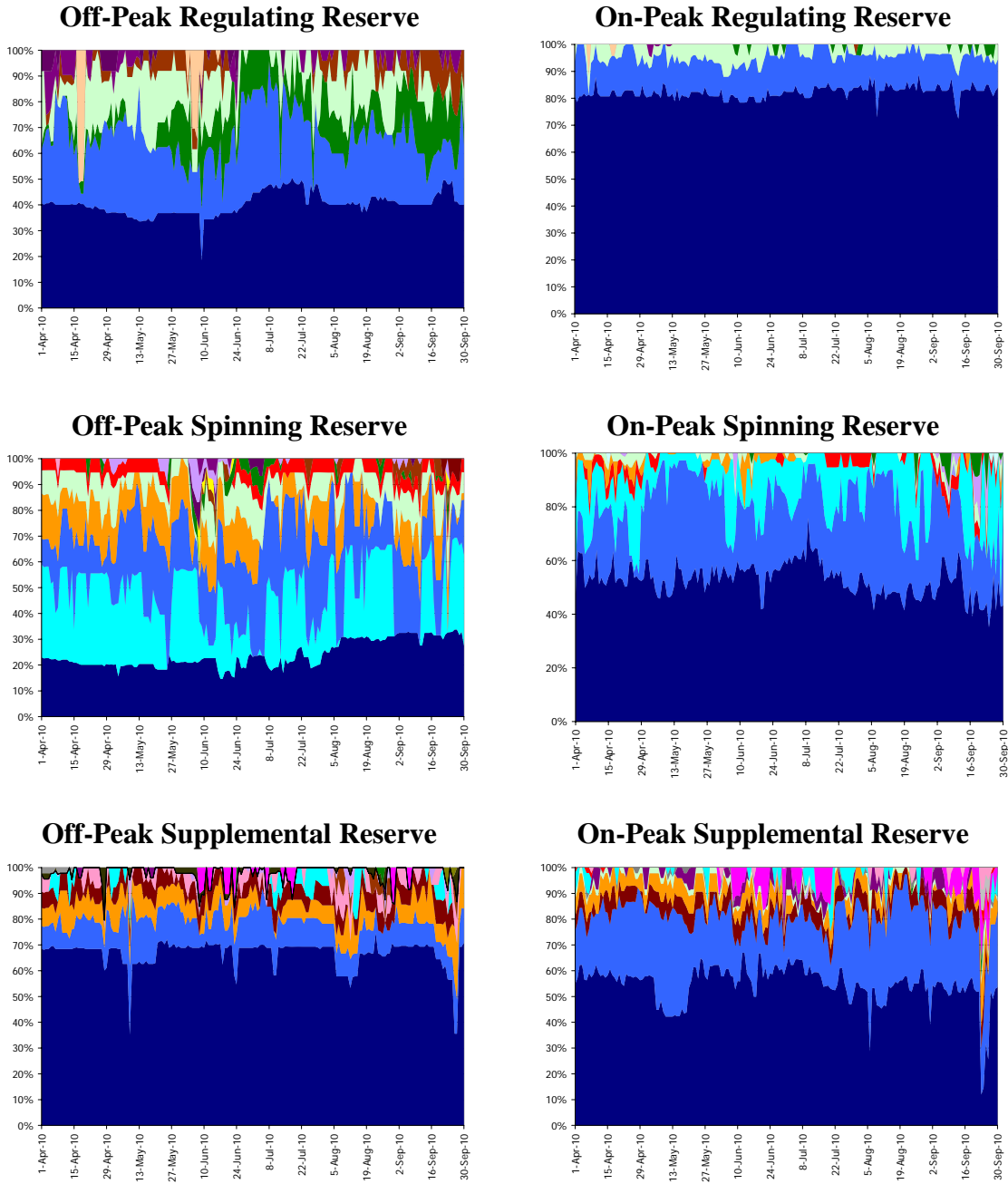
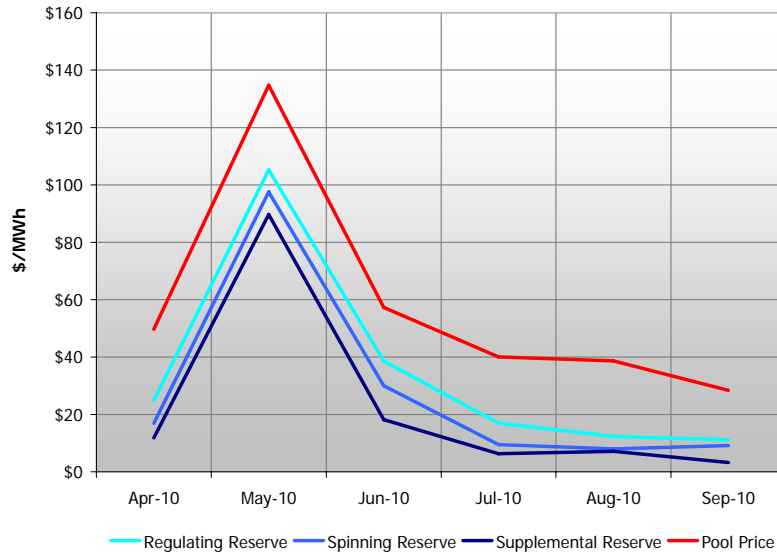


Figure 5.3 shows average monthly settlement prices for active operating reserves along with average monthly Pool price. The directional relationship seen in Figure 5.3 between average settlement price and average Pool price has continued since the advent of the one-day procurement. There appears to be no significant impact on the AESO's overall operating reserve cost upon the discontinuation of multi-day procurement.

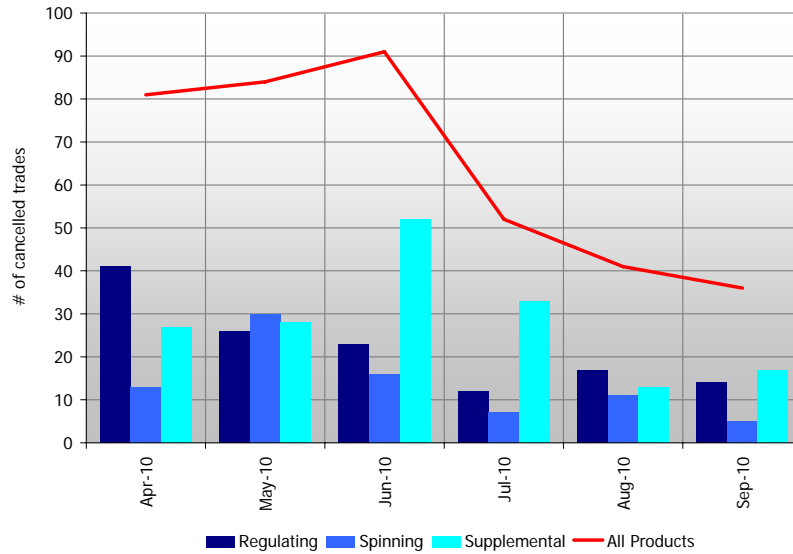
**Figure 5.3: Active Operating Reserve Average Monthly Settlement Prices**



#### 5.4 CANCELLED TRADES AND RESTATEMENTS

Figure 5.4 shows the average number of cancelled trades each month by product and in total. Trades are cancelled for two main reasons. One is that a trading error has occurred – usually human error. The other reason is when a seller has not sold a total of 5 MW the trade(s) must be cancelled. With the change to one-day procurement, it was expected that this second reason would occur less frequently. The expected reduction in the number of cancelled trades is clearly evident in the data.

**Figure 5.4: Monthly Sum of Cancelled Operating Reserve Trades**

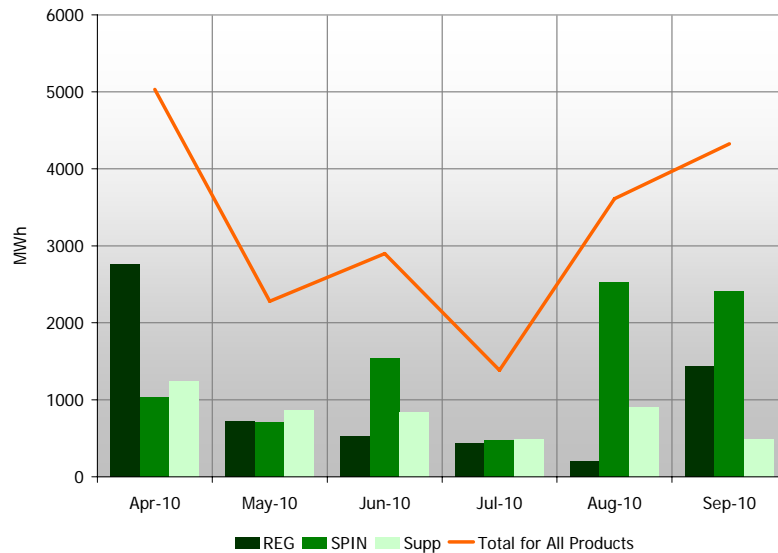


Restatements by sellers are primarily due to operational changes that occur between when the seller contracts to sell and delivery day. Prior to the change to (D-1) procurement, a seller might be making



commitments to sell a week ahead of delivery. With the shortened time frame with (D-1) procurement there should be less need for these restatements. Figure 5.5 shows the relevant data. There does not appear to be any obvious change in the number of restatements. This may be due to the fact that the primary sellers on (D-5) to (D-2) have sufficient flexibility in their portfolios that restatements were generally not required. Most sellers participated in the market only on (D-1) prior to the change so their situation did not change.

**Figure 5.5: Active Operating Reserves Restated Volume**



## 5.5 SUMMARY AND NEXT STEPS

Overall, the change to (D-1) procurement has gone reasonably well. There is a concern over the few occasions when supply has been insufficient to meet demand although that has happened in the past on occasion. Perhaps more worrisome is the lower level of market liquidity in the on-peak reserves. With no must offer requirement it is not possible to know whether a true scarcity situation exists. The MSA will continue to closely monitor market liquidity and will make enquiries on any occasions when liquidity is at a low level. There are many participants who are able to provide these operating reserve products and generally scarcity in these products should only occur when the energy market itself is scarce. At some point in the redesign, AESO intends to remove the bid price and the market will clear at the price of the marginal seller, as occurs in the energy market. Prior to making that change, the AESO will have to satisfy itself that it can manage without implementing a must offer obligation on sellers. At a minimum, it must assure itself that participation is simplified by such mechanisms as standing offers.

The AESO is continuing to evolve the Operating Reserves market in an incremental fashion. Based on recent discussions with AESO, the next steps in this process will be discussed with stakeholders in Q4/10 with a view to implementation in early 2011.

## 6 Compliance Update

### 6.1 ISO RULES COMPLIANCE

Table 6.1 provides an update of the MSA's ISO rules compliance activities for the first nine months of 2010. From the beginning of 2010, 33 notices of specified penalty have been issued. In 45 other cases, the MSA chose to forbear, while 6 other matters remained under review. Additionally, 9 referrals have been addressed through negotiated settlements between the MSA and participants. This number is a reduction compared with last quarter due to the AUC returning a settlement back to the MSA.

For comparison, for the first nine months of 2009, the MSA had issued 34 notices of specified penalty, 22 forbearances and had 25 files under review.

**Table 6.1: Compliance Files (as of end of Q3/10)**

	Under Review	Notice of Specified Penalty	AUC Administrative Proceedings	Forbearance
6.6	1	11		20
3.5.3	2	5		8
3.5.5		1		2
6.3.3	3	16		11
6.5.3			8	2
OPP 102			1	1
OPP 606				1
<b>Total</b>	<b>6</b>	<b>33</b>	<b>9</b>	<b>45</b>

Table 6.2 presents the contravention dates of the notices of specified penalty, forbearances and the files under review for all ISO Rules compliance files looked at by the MSA in 2010. Contravention dates for the 33 notices of specified penalty for the first 9 months of 2010 ranged from August 2009 through to May 2010. Sixteen of these contraventions were for ISO rule 6.3.3, while another 11 were for ISO 6.6. All of the notices of specified penalty issued during Q3/10 related to matters referred to the MSA by the AESO.

Table 6.2 further segments the second, third and fifth columns of Table 6.1 by month of the contravention date. The MSA is wondering about the value to market participants of the information in Table 6.2 and asks stakeholders to provide their thoughts on the proposal to remove it from the quarterly reports, whilst retaining it for any annual review that the MSA undertakes.

**Table 6.2: Q3/10 Compliance Files by Month of Contravention**

	Rule	2009					2010									Total
		Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Under Review	6.6														1	1
	3.5.3														1	1
	3.5.5															
	6.3.3										2	1			1	4
	6.5.3															
	OPP 102															
	OPP 606															
<b>Total</b>										2	1				3	6
NSP	6.6		4	1		1	3	1		1						11
	3.5.3					1		2	1	1						5
	3.5.5			1												1
	6.3.3	2	1		1	5		1		2	4					16
	6.5.3															
	OPP 102															
	OPP 606															
<b>Total</b>	2	5	2	1	7	3	4	1	2	6						33
Forbearance	6.6					3		2	6	1	2	2		2	2	20
	3.5.3									4	1					8
	3.5.5							1						1		2
	6.3.3							1	2	2	2		1	3		11
	6.5.3	1							1							2
	OPP 102									1						1
	OPP 606								1							1
<b>Total</b>	1				3		4	10	4	8	3	3	6	3		45

**6.1.1 Record Financial Penalty**

Also noteworthy during Q3/10 was the issuance by the MSA of a record financial penalty comprised of 332 notices of specified penalty to one market participant for recurring contravention of ISO rule 6.3.3 in 2008 and 2009. Further details regarding this penalty are contained in the MSA’s August 16, 2010 news release which is available on the MSA website. This collection of specified penalties was omitted from Tables 6.1 and 6.2 due to the extraordinary nature of this penalty and to facilitate comparability of current compliance statistics with prior periods.

**6.1.2 Emerging Trends**

Participants continued to take advantage of incentives provided to self report their compliance issues. In Q3/10, 16 ISO rules compliance related issues were self reported to the MSA. Overall, the quality of self reports received has been high and in most cases, met the criteria included in the MSA compliance process document, resulting in a high degree of forbearance being granted in those cases.

One issue of note in regards to ISO rule 6.3.3 is to clarify that if a participant is unable to secure transmission rights in order to implement their intended import/export schedule, this circumstance qualifies as an acceptable operational reason to restate offers within T-2 in order to align e-tag and offer

quantities as required by rule 6.3.3. In some cases, participants have been unable to secure transmission and have not restated their energy offer and fall afoul of the rule.

## **6.2 RELIABILITY STANDARDS**

As of the end of Q3/10, the MSA has received 14 self reported compliance matters relating to reliability standards with 13 of them including a mitigation plan and all using the MSA's standard reporting forms. Two matters self reported for Reliability Standard EOP-003-AB-1 were deemed not to be breaches of the standard as the two registered entities were in compliance. In some cases self reported during Q3/10, it appeared that the self report was delayed until the related mitigation plan had been successfully executed. The MSA encourages registered entities to self report matters as soon as they are aware of the contravention and to include mitigation plans as appropriate. A registered entity can proceed with best efforts to mitigate the situation but need not delay self reporting until mitigation steps are completed.

Self certifications continued in Q3/10 with registered market participants in Cycle 3 of the AESO self certification schedule required to self certify by July 31/10. Cycle 4 registered participants are due to self certify to the AESO by October 31/10. The AESO is also subject to self certification and is required to self certify to the MSA via WECC. While the AESO has been subject to a preliminary self certification in Cycle 3, it will self certify on a Cycle 2 schedule going forward.

Also of relevance to reliability standards, the AUC consultation process continued during Q3/10 on the development of a specified penalties rule (Rule 027) for contravention of reliability standards. In July, the AUC released Bulletin 2010-21 which included a re-drafted rule and invitation for a second round of stakeholder comment. Those comments were posted to the AUC website on August 23/10. On October 6/10, the AUC released Bulletin 2010-27 approving Rule 027 for effect on November 1/10.

# **7 MSA Activities**

## **7.1 STAKEHOLDER CONSULTATION PROCESS ON PARTICIPANTS' OFFER BEHAVIOUR**

In Q1/10, the MSA initiated a stakeholder consultation process on participants' offer behaviour. Following the publication of two discussion papers, the MSA developed some hypothetical examples to illustrate some of the finer points of the MSA's intended approach to enforcement. This was published in early September and a roundtable was held later in the month to discuss the examples. Subsequently, the MSA received several additional hypothetical examples from a market participant and published both the examples and its assessment of them. The MSA's plan continues to move through the stakeholder consultation process to develop a Guideline on offer behaviour by the end of 2010.

## **7.2 COMPLIANCE PROCESS DOCUMENT CONSULTATION**

This MSA consultation process was initiated in Q2/10 with the publication of a strawdog draft process covering both ISO rules and Alberta reliability standards. The draft was revised and posted to the web site in late June. On July 20, 2010 the MSA posted responses to the comments that were received from six

stakeholders on the revised draft process. The final process was posted on August 11, 2010 as well as minor consequential amendments to the MSA Investigation Procedures.

The final Compliance Process document can be found on the MSA's web site in the 'Process' section. Similarly, interested readers can find all MSA documents and stakeholder comments on this consultation in the 'Consultations' section.

### **7.3 WEB SITE REDESIGN AND STYLING OF PUBLICATION MATERIALS**

As the report reader will have noticed already, the style of the MSA's reports have changed since the publication of the Q2/10 report. In early September, the MSA freshened up the look of its web site and public report formats. The Mt Rushmore visuals (ouch) were replaced with more picturesque scenes of Alberta and a new more intuitive layout was adopted. All of the old materials are still archived on the new site and the web URL remains the same: [www.albertamsa.ca](http://www.albertamsa.ca)

### **7.4 ENMAX ELECTRICITY SERVICES AGREEMENT**

In June 2009 a market participant complained that the Electricity Services Agreement between ENMAX and the City of Calgary contravened sections 5(c), 6 and/or 95(10) of the *Electric Utilities Act*. The Agreement is an exclusive long term arrangement for the sale of 'green' energy from ENMAX to the City. The complainant alleged that the Agreement unfairly supported ENMAX's interest in the McBride Lake, Taber and Kettles Hill wind farms and undermined the fair, efficient and openly competitive nature of the Alberta electricity market. Subsequent to receiving the complaint, a second market participant wrote the MSA in support of these allegations.

The MSA initiated an investigation after reviewing the specifics of the complaint and the observation that that there is a widely held belief amongst market participants that the alleged unfair advantages ENMAX receives as a wholly owned subsidiary of the City distorts competition in the Alberta electricity market. The MSA developed an analytical framework to critically assess and test this proposition. The analysis focused on the acquisition of the Kettles Hill Wind Farm in 2008 as the most promising set of facts to test the allegations and whether there was a contravention of section 5(c), 6 and/or 95(10).

The assessment of the evidence relative to section 6 centered on whether the actions of ENMAX and its arrangements with the City materially foreclosed competition in either the wholesale market or the smaller market for 'green' energy. It considered the evidence related to section 95 centered on applying the facts to a reasonable interpretation of the terms "benefits" or "advantages" as described in the provision. However, subsequent to completing the investigation, the Alberta Court of Appeal released a decision (*Maxim Power Corp. v. Alberta (Utilities Commission)*, 2010 ABCA 213) in a separate matter which, by the application of similar reasoning, limited the MSA's jurisdiction. Accordingly the MSA did not comment on the independent assessor's assessment concerning the acquisition of the Kettles Hill Wind Farm. The analysis did not consider the evidence related to section 5 as this provision describes the purposes of the legislation and is not itself capable of contravention. Neither the complainant nor the market participant who supported the complaint provided information concerning competitive harm past, present or future, nor was any evidence of such harm uncovered in the analysis.

After completing an extensive investigation, the MSA concluded that the supply arrangement does not breach the Electric Utilities because: (1) ENMAX's participation in the relevant generating units was approved by the Minister of Energy as required pursuant to section 95; (2) the Agreement does not contravene section 6 as it did not give ENMAX an unfair advantage in acquiring generation units; and (3) the Agreement does not diminish competition in either the wholesale electricity market or the green energy market. The analysis determined that ENMAX's Agreement with the City represents a relatively small share of Alberta's conventional and green energy markets and there remain significant opportunities for competitors to expand in these markets. ENMAX's market participation as measured by its current market share and the relative ease of entry does not raise concerns about market power.

The MSA published an investigation report concerning this matter on September 28, 2010.<sup>6</sup> The report also contains several important observations on the state of the law affecting market participation and conduct and the enforcement policy to be pursued by the MSA. Several key observations include:

- The Alberta electricity market is protected from distortions caused by the possibility of unfair advantages for government-owned participants by a two stage process: in the first instance by the section 95 review and authorization, and secondly through the continuing responsibility of the MSA to enforce the section 6 obligations. The detailed report of the investigation provides clear guidance to stakeholders about how it discharges this responsibility.
- The MSA enforces the section 6 obligations in matters involving municipalities just as it would if the case involved a privately funded market participant.
- A breach of section 6 by a single market participant ('unilateral effects') requires at the minimum evidence of significant market power and exclusionary practices.
- It is of assistance to the MSA if market participants alleging anti-competitive behaviour by one of their rivals can show evidence of competitive harm resulting from the alleged wrongful behaviour.

## 7.5 WHOLESALE ENERGY MARKET 101 REPORT

Late in Q3/10, the MSA published a report describing the general structure of Alberta's wholesale energy market.<sup>7</sup> Over the past several years, the MSA has published a number of reports covering the various sub markets that collectively constitute the Alberta electricity market. This most recent report completes that series. All the reports are available on the MSA's web site in the archive.

## 7.6 ASSOCIATION OF MARKET MONITORS

At the end of September, 2010, the MSA participated in the semi-annual meeting of EISG (Energy Inter-Market Surveillance Group) wherein matters of mutual interest are discussed. The MSA has found this to be a very effective organization to be involved with as it allows us to share experiences and learn from each other. Representatives cover all the North American electricity markets plus several off-shore markets including New Zealand, Australia and Singapore.

<sup>6</sup> MSA, 'Electricity Services Agreement. A Report into Alleged Violations of Sections 6 and 95 of the Electric Utilities Act'.

<sup>7</sup> MSA, 'Alberta Wholesale Electricity Market', 2010.

# Appendix A: Wholesale Energy Market Metrics

**Table A.1: Pool Price Statistics**

Month	Average Price <sup>1</sup>	On-Pk Price <sup>2</sup>	Off-Pk Price <sup>3</sup>	Std Dev <sup>4</sup>	Coeff. Variation <sup>5</sup>
Jul-10	40.01	51.83	23.64	52.54	131%
Aug-10	38.64	49.41	24.98	30.50	79%
Sep-10	28.42	33.10	22.02	17.94	63%
<b>Q3-10</b>	<b>35.77</b>	<b>44.87</b>	<b>23.59</b>	<b>37.07</b>	<b>104%</b>
Apr-10	49.71	61.51	33.57	53.32	107%
May-10	134.69	193.55	60.03	223.19	166%
Jun-10	57.27	79.44	26.93	100.43	175%
<b>Q2-10</b>	<b>81.15</b>	<b>111.50</b>	<b>40.69</b>	<b>150.68</b>	<b>186%</b>
Jul-09	41.39	53.98	23.94	42.29	102%
Aug-09	34.60	45.45	20.85	36.91	107%
Sep-09	73.25	113.27	18.48	168.40	230%
<b>Q3-09</b>	<b>49.49</b>	<b>70.68</b>	<b>21.11</b>	<b>102.86</b>	<b>208%</b>

1 - \$/MWh

2 - On-peak hours in Alberta include HE08 through HE23, Monday through Saturday

3 - Off-peak hours in Alberta include HE01 through HE07 and HE24 Monday through Saturday, and HE01 through HE24 on Sundays

4 - Standard Deviation of hourly pool prices for the period

5 - Coefficient of Variation for the period (standard deviation/mean)

**Figure A.1: Pool Price Duration Curves**

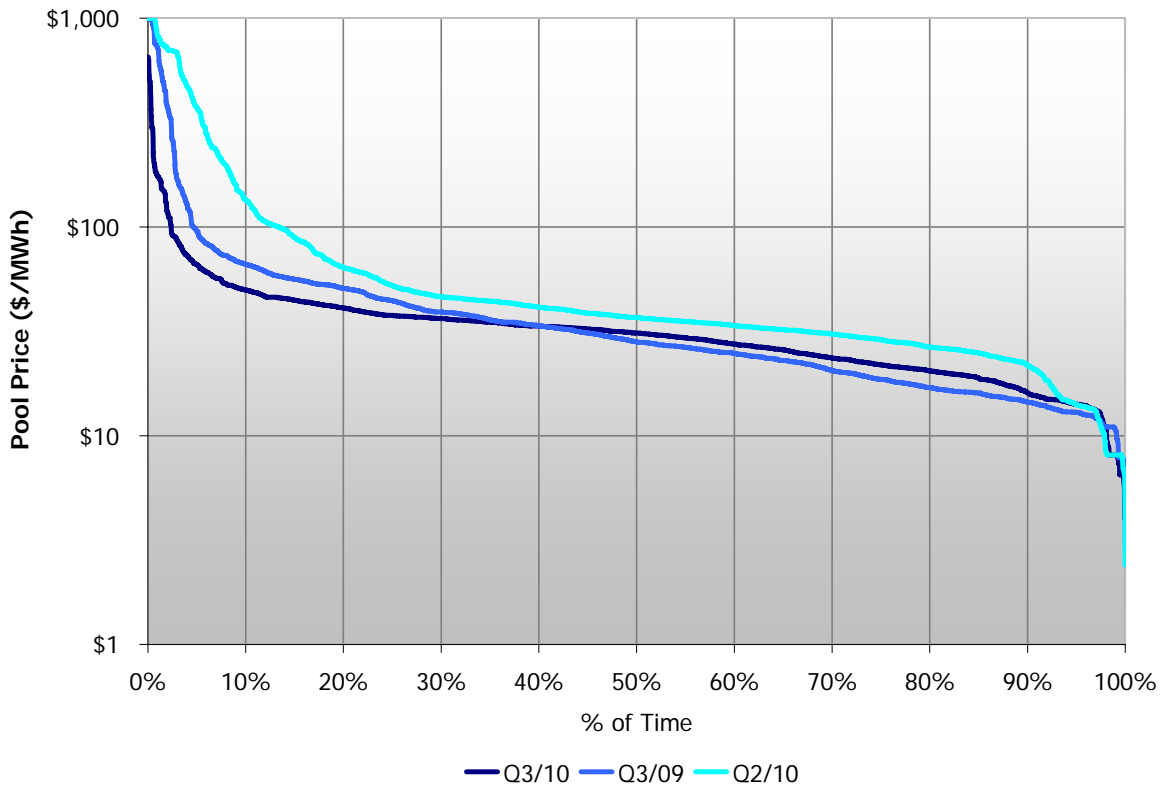


Figure A.2: Pool Price and AECO Gas price

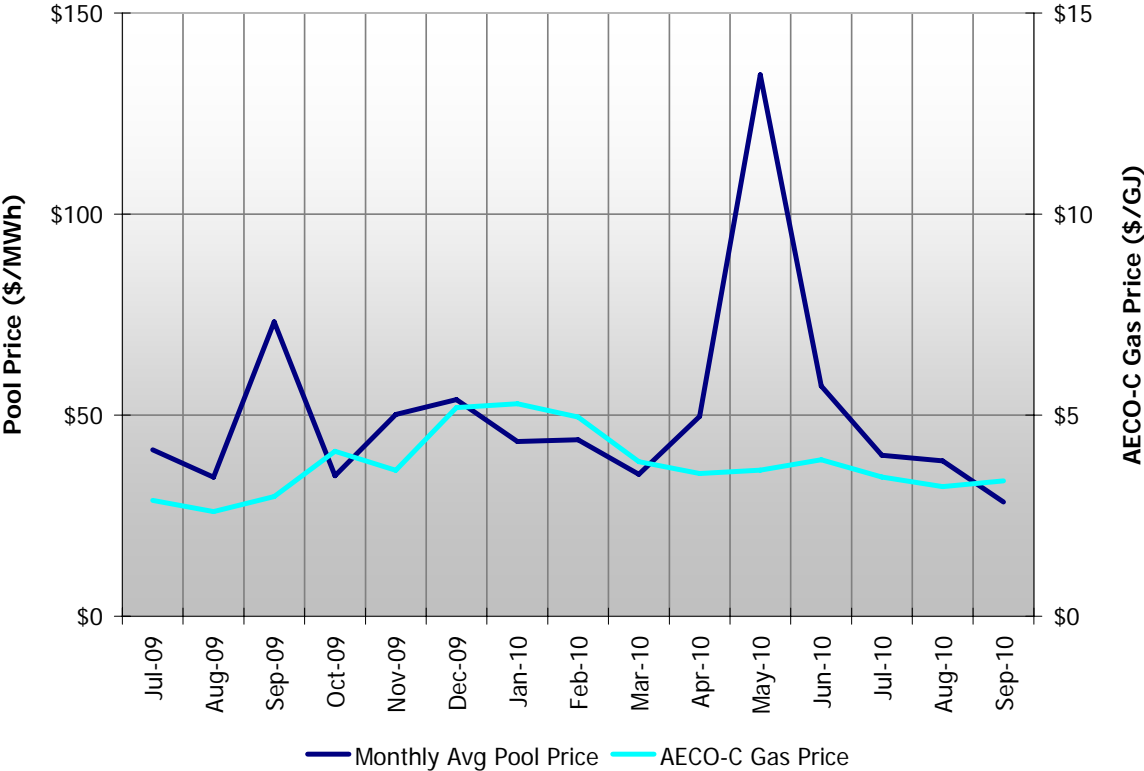
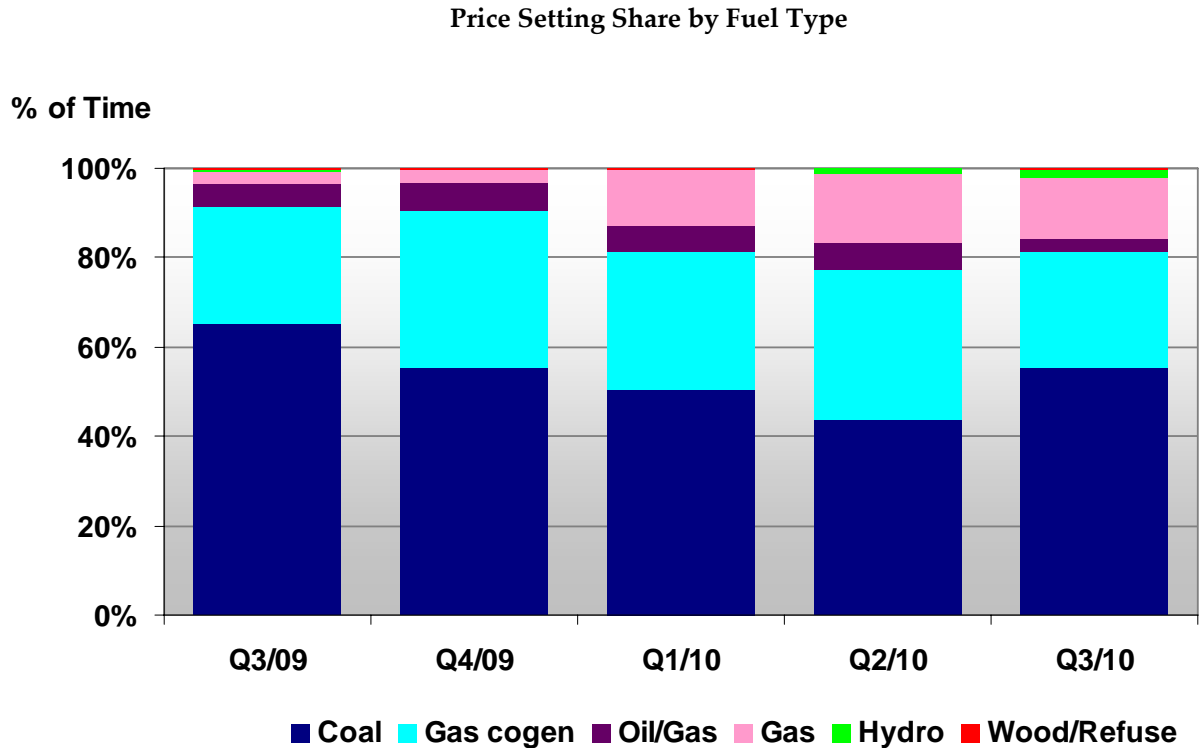




Figure A.3: Price Setting and Average System Marginal Price Level by Fuel and by Quarter



**Average System Marginal Price by Fuel Type (\$/MWh)**

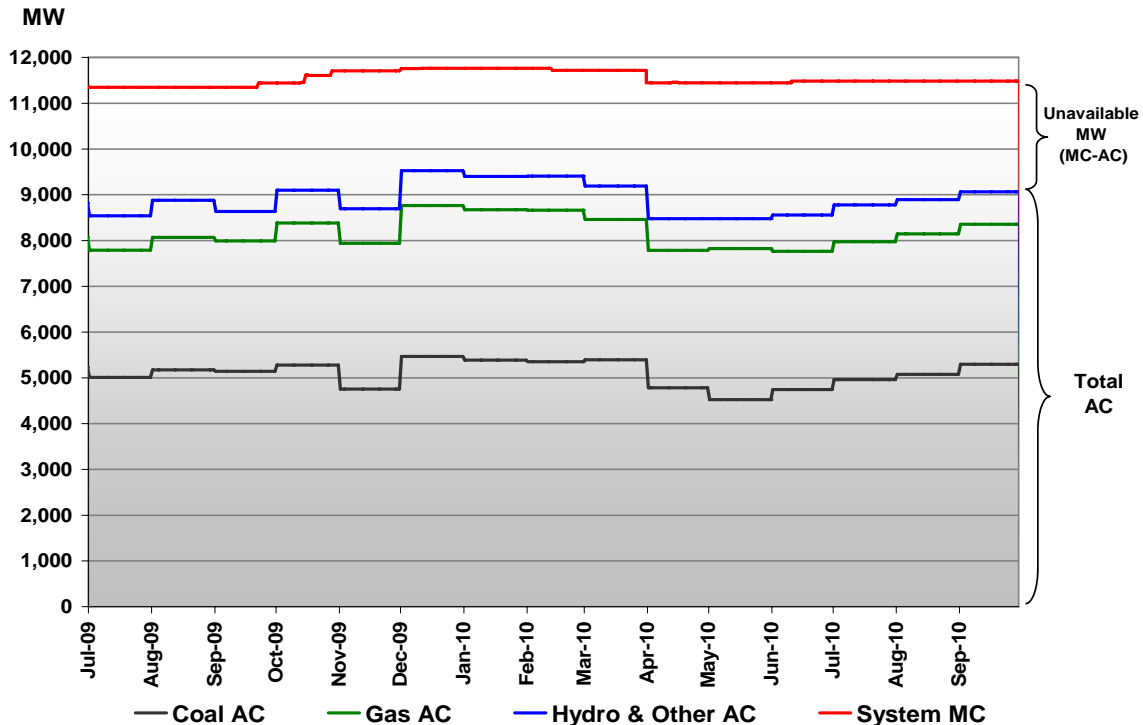
Fuel Type	Q3/09	Q4/09	Q1/10	Q2/10	Q3/10
Coal	32.93	37.61	33.18	36.17	31.10
Gas	182.06	151.95	55.34	150.93	48.48
Gas cogen	63.47	48.96	45.40	89.97	36.23
Hydro	198.44	288.10	283.18	198.58	66.09
Oil/Gas	100.27	49.21	46.56	151.62	41.89
Wood/Refuse	160.57	69.15	25.00	843.72	-

## Appendix B: Supply Availability Metrics

Table B.1: Availability and Capacity Factors

Fuel Type	Quarter	Average MC	Average AC	Availability Factor	Generation	Capacity Factor
		[A]	[B] MW	[C]=[B]/[A]	[D]	[E] = ([D]x1000)/([A]xhrs)
		(MW)	(MW)	(%)	(GWh)	(%)
<b>All Fuels</b> <i>(excl. Wind)</i>	Q3/10	11,484	8,910	78%	15,254	60%
	Q2/10	11,454	8,505	74%	14,687	59%
	Q3/09	11,357	8,686	76%	15,330	61%
<b>Coal</b>	Q3/10	5,782	5,110	88%	10,183	80%
	Q2/10	5,782	4,682	81%	9,123	72%
	Q3/09	6,011	5,107	85%	10,241	77%
<b>Natural Gas</b>	Q3/10	4,785	3,047	64%	4,663	44%
	Q2/10	4,754	3,110	65%	5,097	49%
	Q3/09	4,431	2,841	64%	4,600	47%
<b>Hydro &amp; Other</b>	Q3/10	917	753	82%	407	20%
	Q2/10	917	712	78%	467	23%
	Q3/09	915	738	81%	490	24%
<b>Wind</b>	Q3/10	629	n/a	n/a	282	20%
	Q2/10	629	n/a	n/a	349	25%
	Q3/09	503	n/a	n/a	202	18%

Figure B.1: Available Capacity (AC) vs Maximum Capacity (MC)



## Appendix C: Operating Reserves Market Metrics

Figure C.1: On-Peak Active Settlement Prices – All Markets (NGX and OTC)

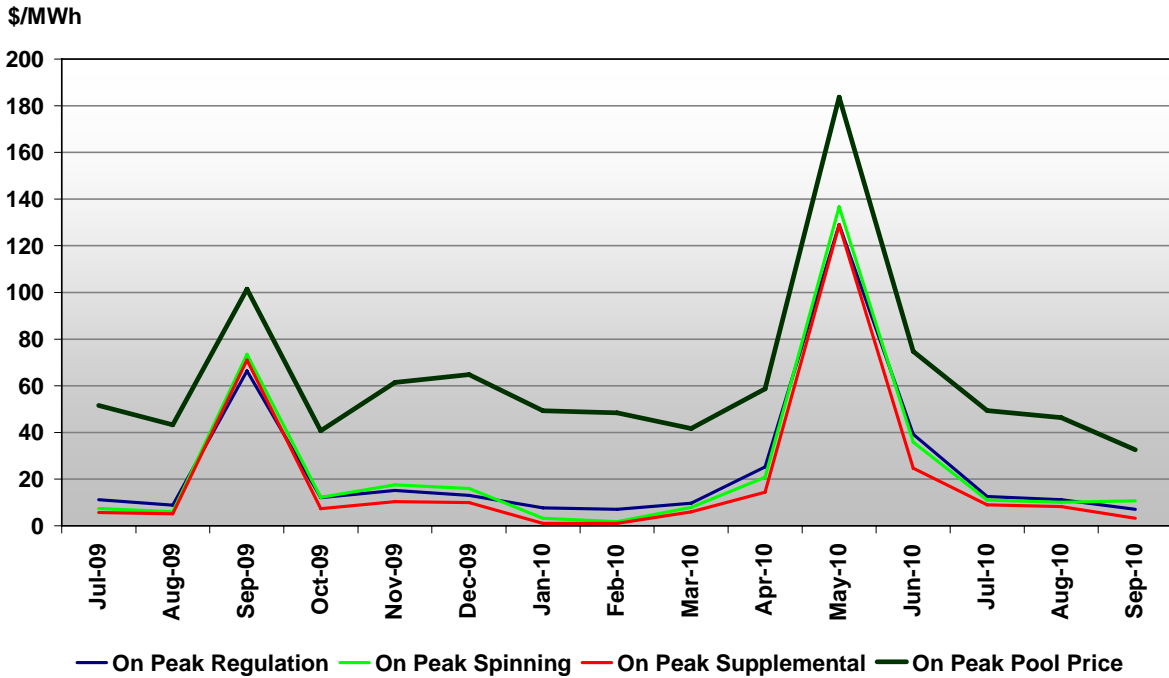


Figure C.2: Off-Peak Active Settlement Prices – All Markets (NGX and OTC)

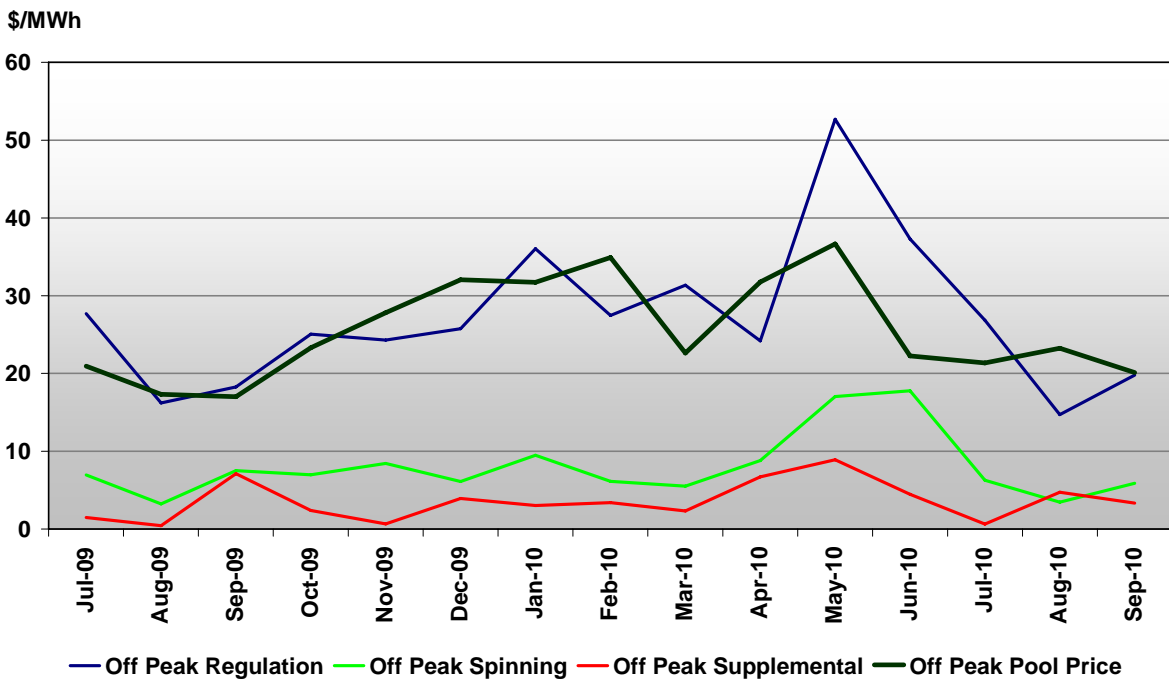
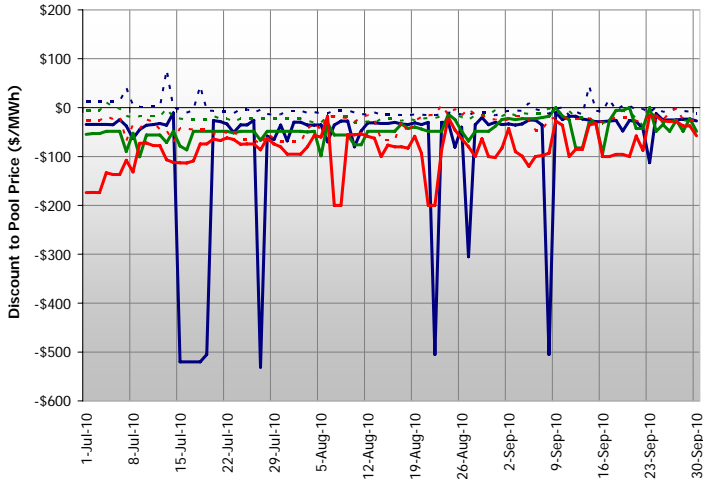
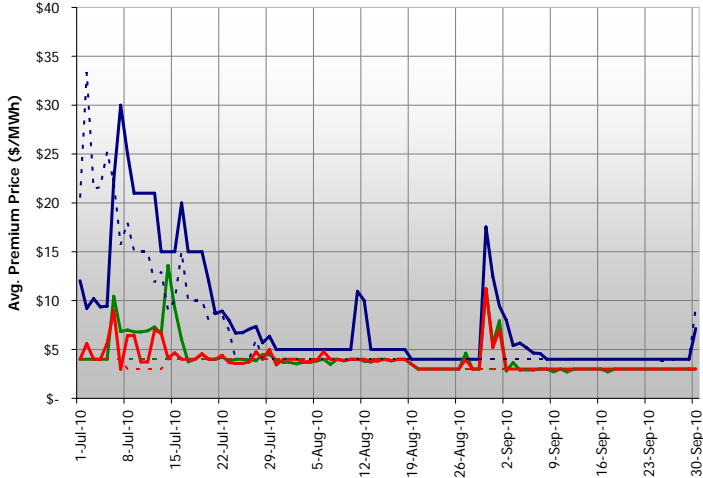


Figure C.3: Active Reserves Weighted Average Trade Index and Standby Reserve Prices

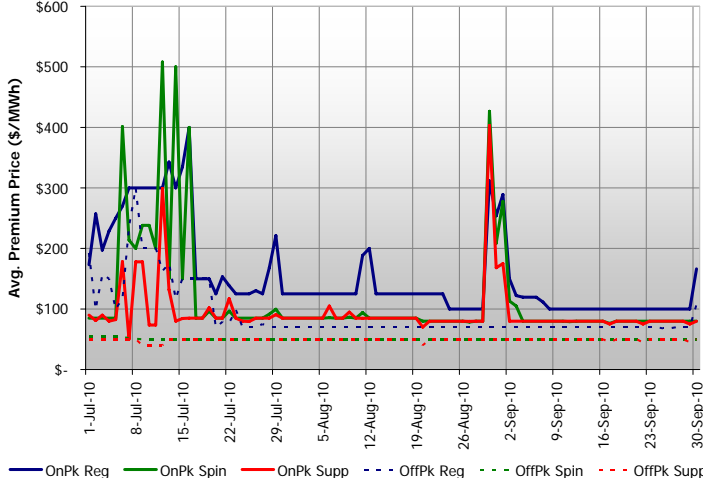
**NGX Active Reserves  
Weighted Average  
Trade Index**



**Standby Reserves  
Average Premium  
Price**



**Standby Reserves  
Average Activation  
Price**



— OnPk Reg — OnPk Spin — OnPk Supp - - - OffPk Reg - - - OffPk Spin - - - OffPk Supp

Figure C.4: Active Regulating Reserve Market Share by Fuel Type

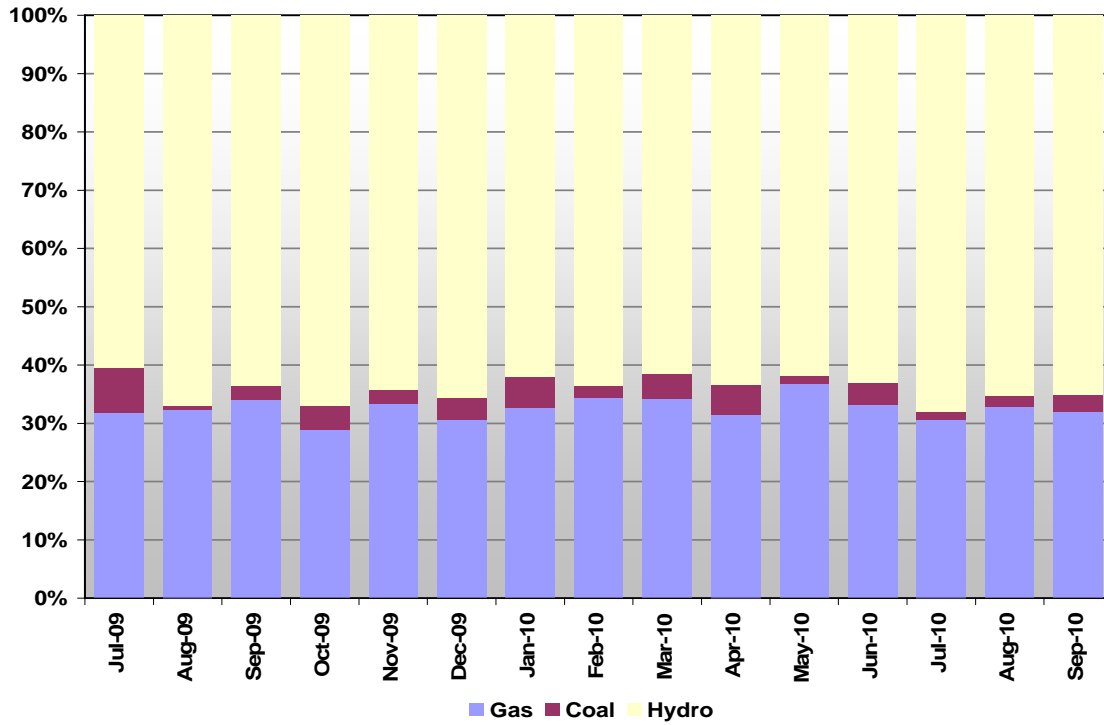


Figure C.5: Active Spinning Reserve Market Share by Fuel Type

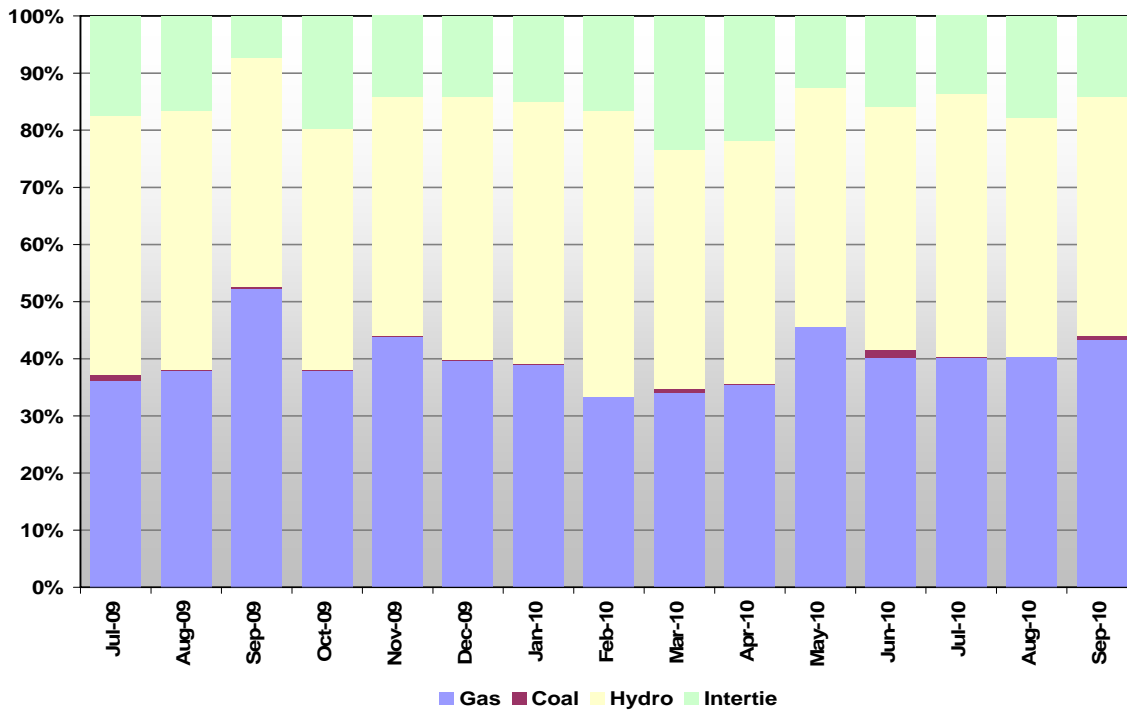
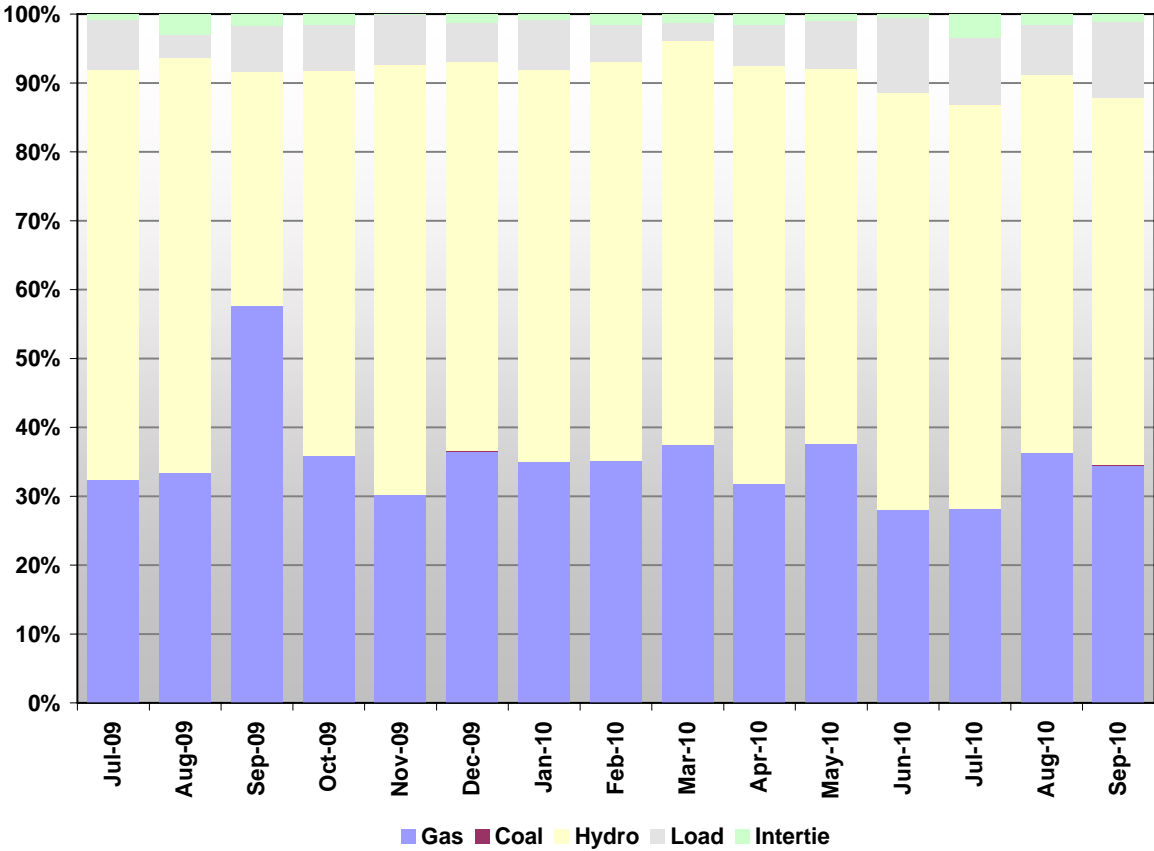


Figure C.6: Active Supplemental Reserve Market Share by Fuel Type



## Appendix D: Dispatch Down Service (DDS) Metrics

Figure D.1: Average Daily TMR, Eligible, Constrained and Dispatched DDS Volumes (MW)

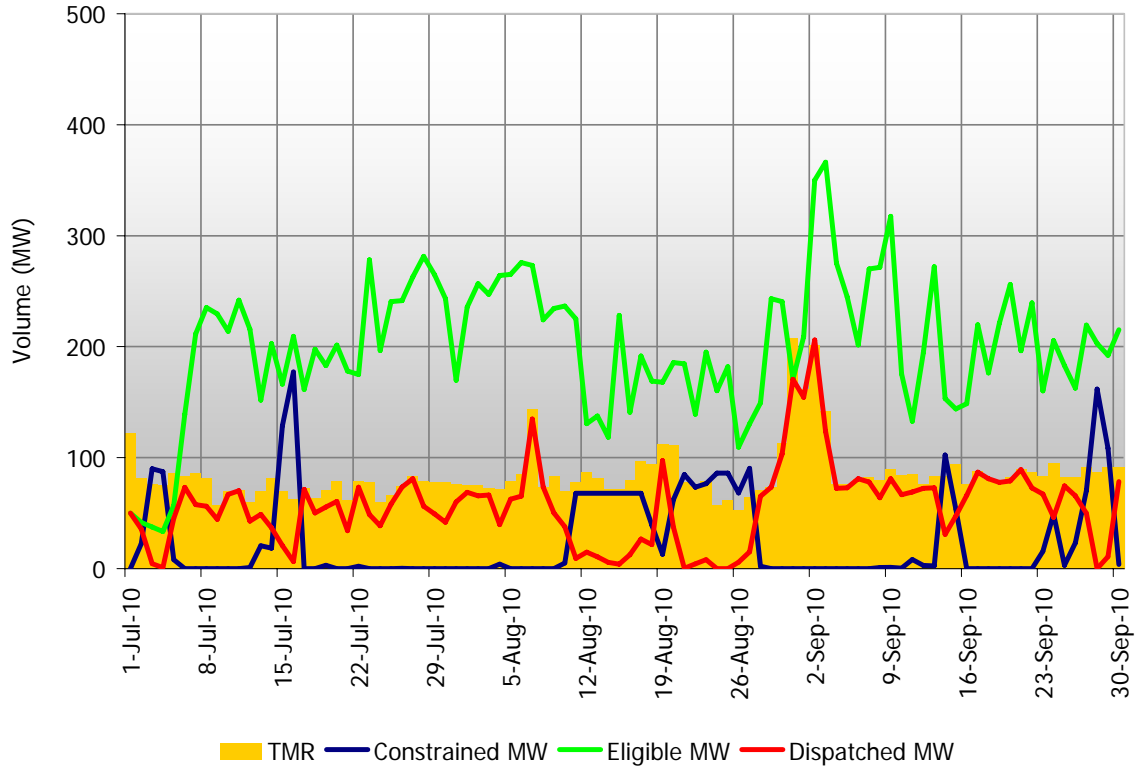
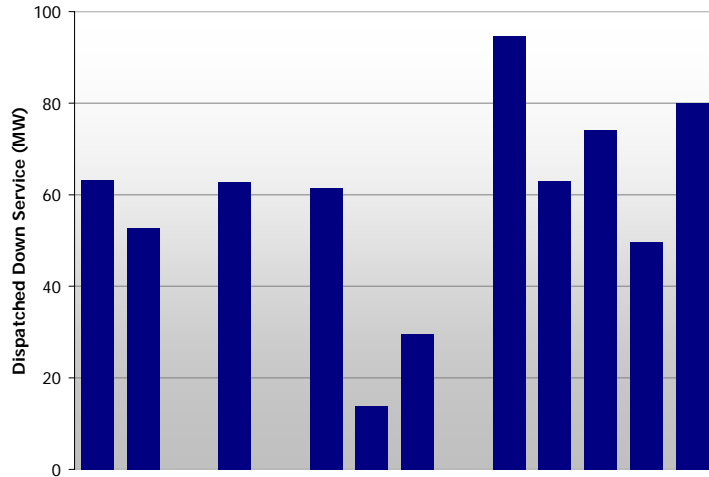
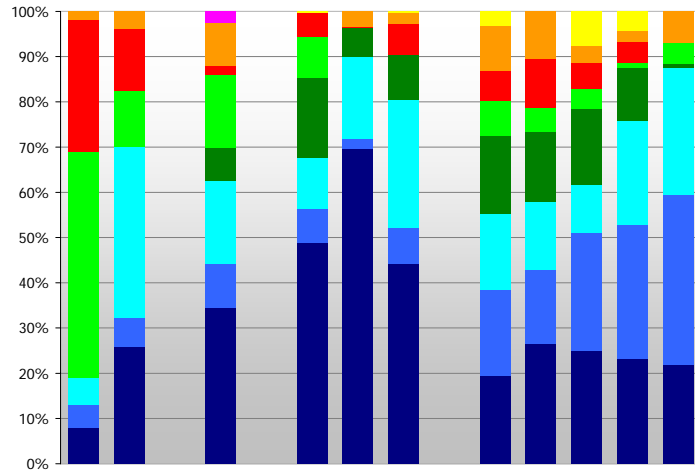


Figure D.2: Average Weekly DDS Volume, Market Share by Participant and by Fuel Type

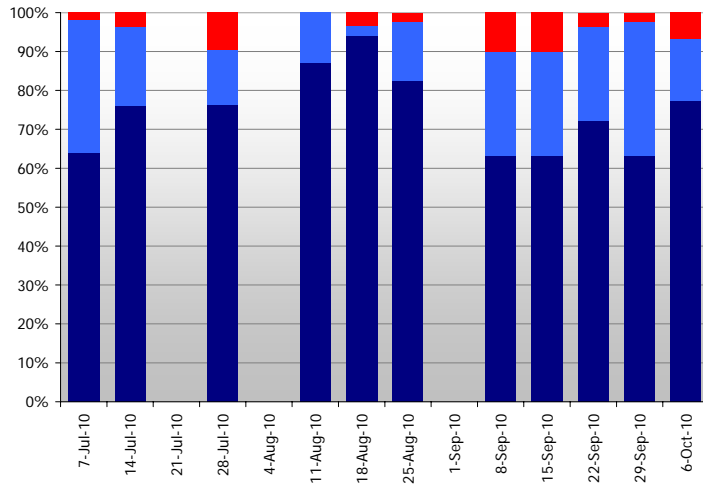
**Average Weekly DDS Volume**



**Average Weekly DDS Market Share by Participant**



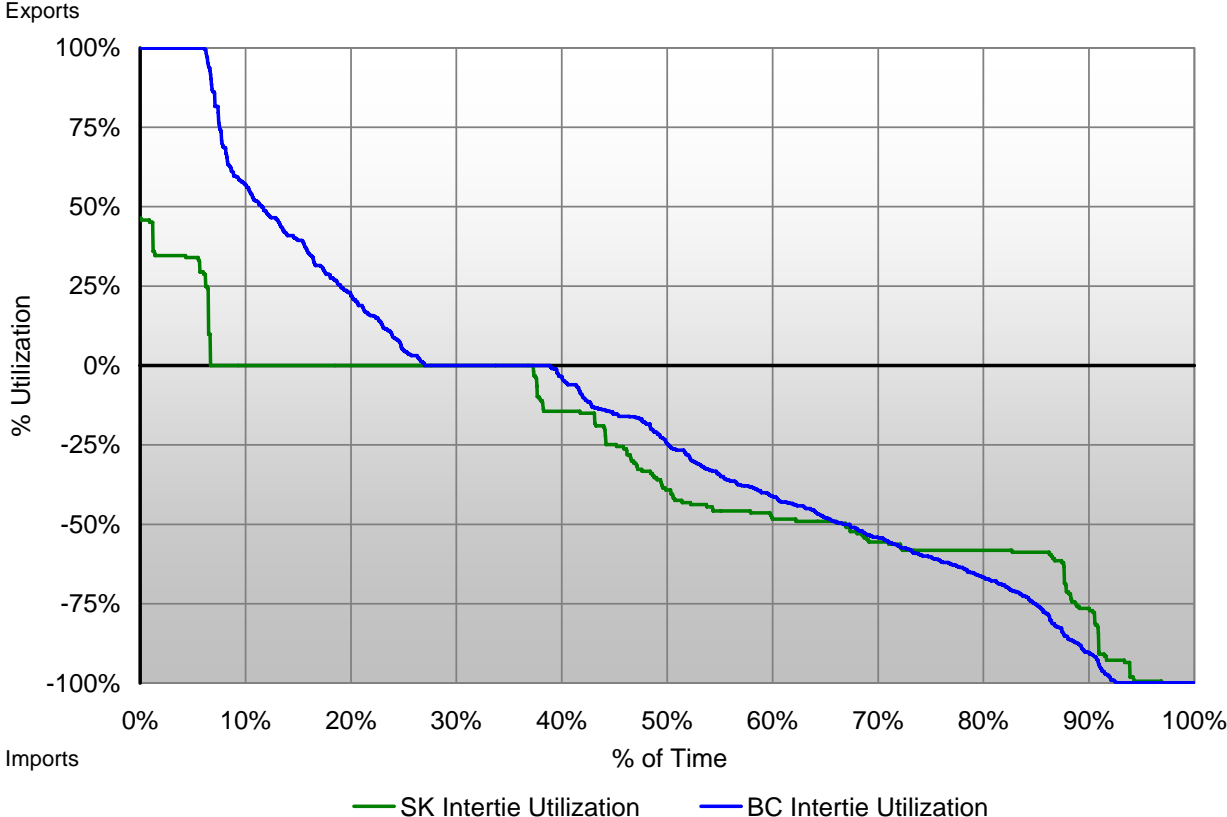
**Average Weekly DDS Market Share by Fuel Type**



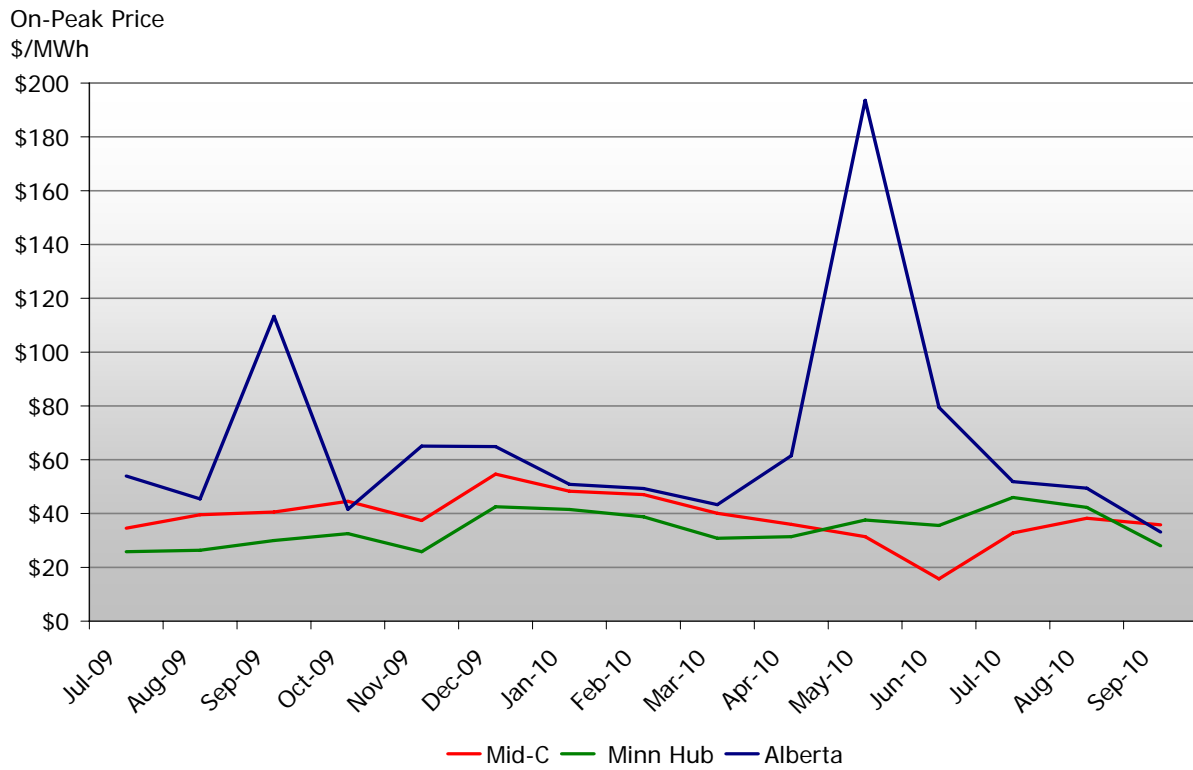


# Appendix E: Intertie Metrics

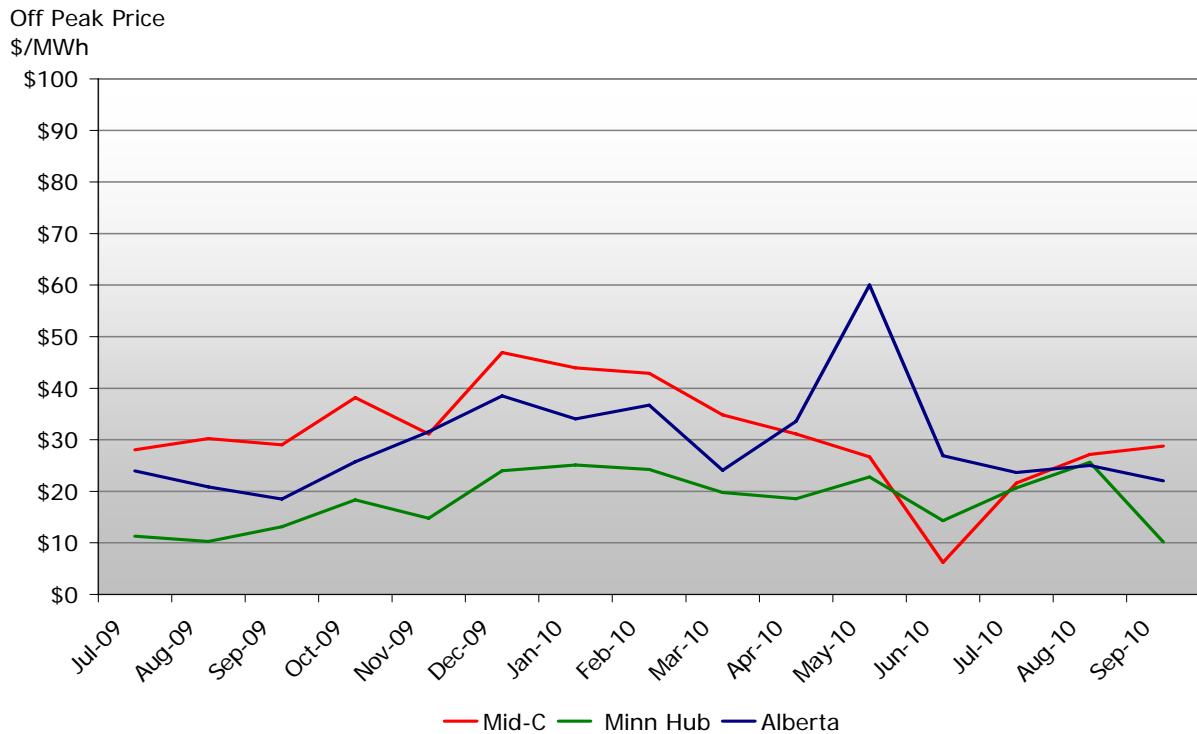
Figure E.1: Intertie Utilization



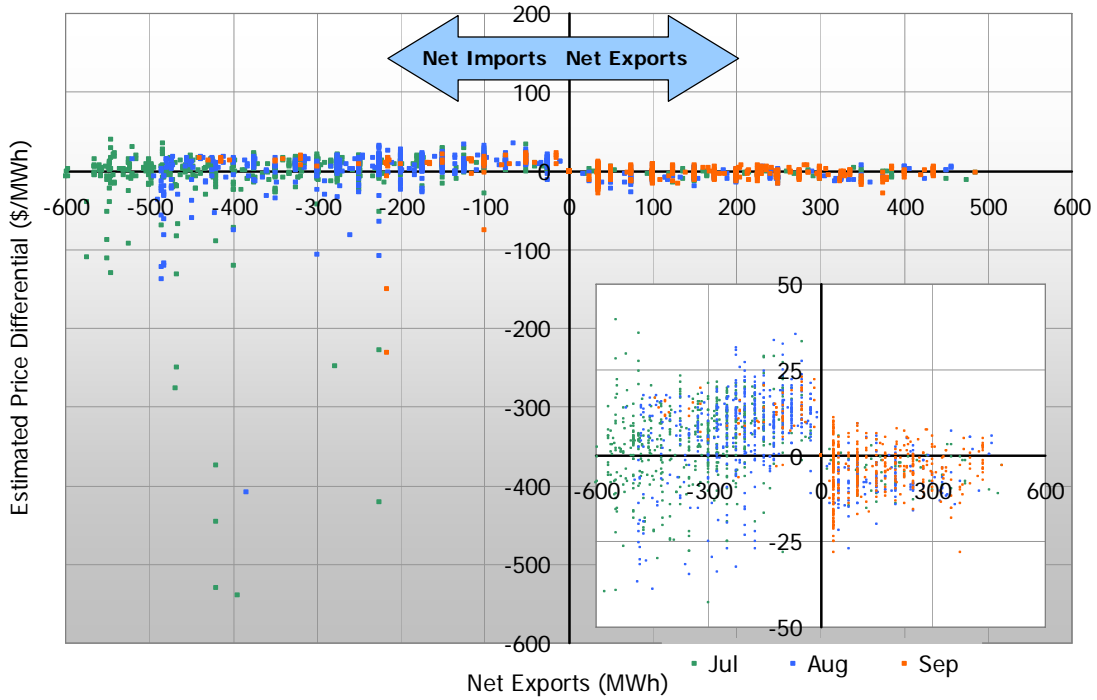
**Figure E.2: On-Peak Prices in Neighbouring Markets**



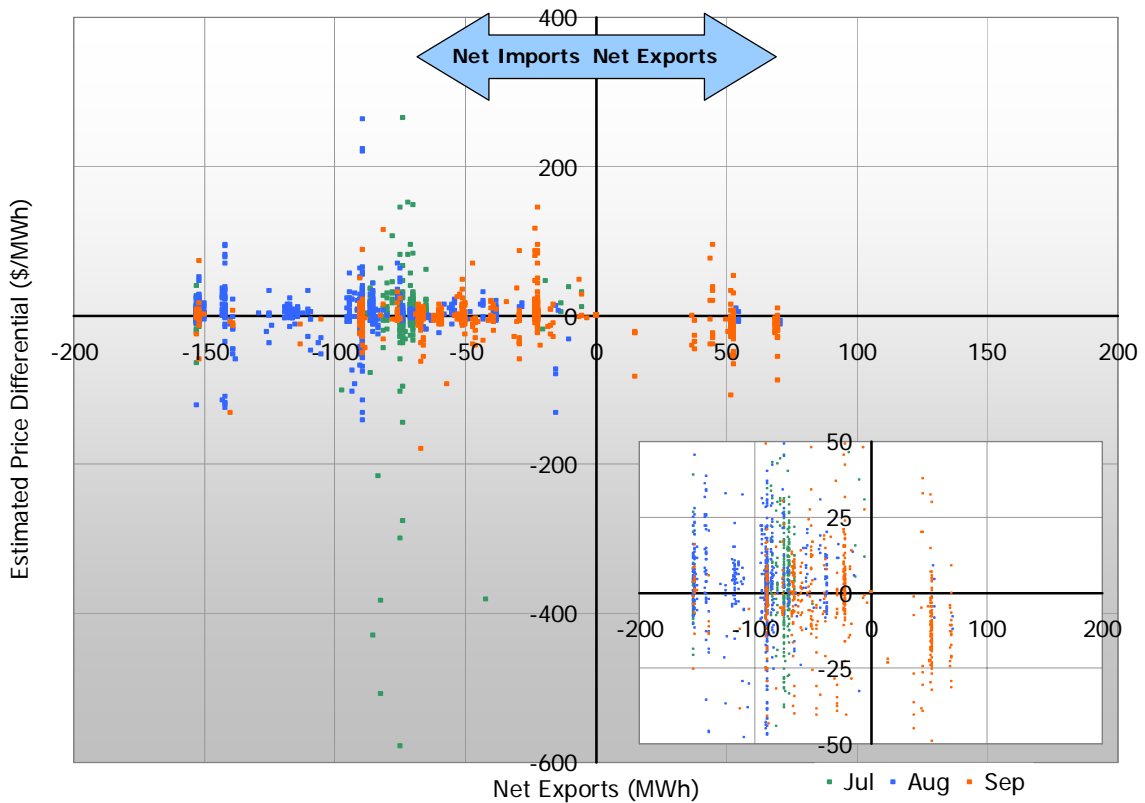
**Figure E.3: Off-Peak Prices in Neighbouring Markets**



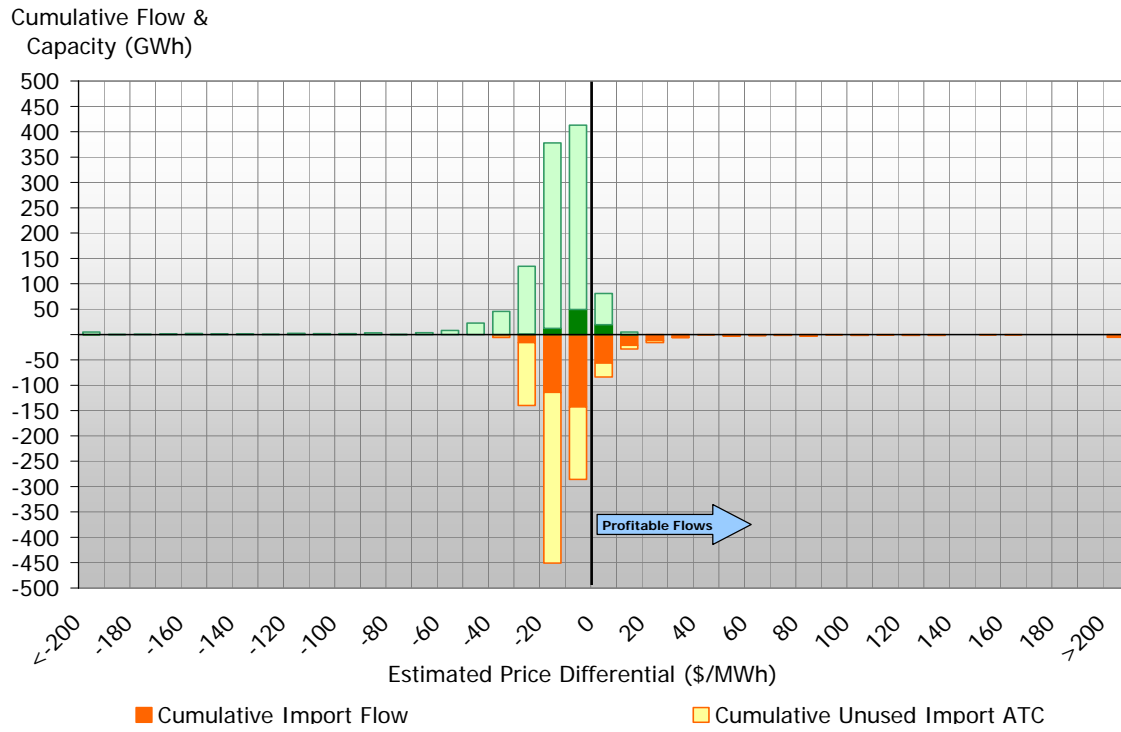
**Figure E.4: Intertie Price Differentials and Net Flow – British Columbia**



**Figure E.5: Intertie Price Differentials and Net Flow - Saskatchewan**



**Figure E.6: Imputed Profitability and Unused Capacity – British Columbia**



**Figure E.7: Imputed Profitability and Unused Capacity - Saskatchewan**

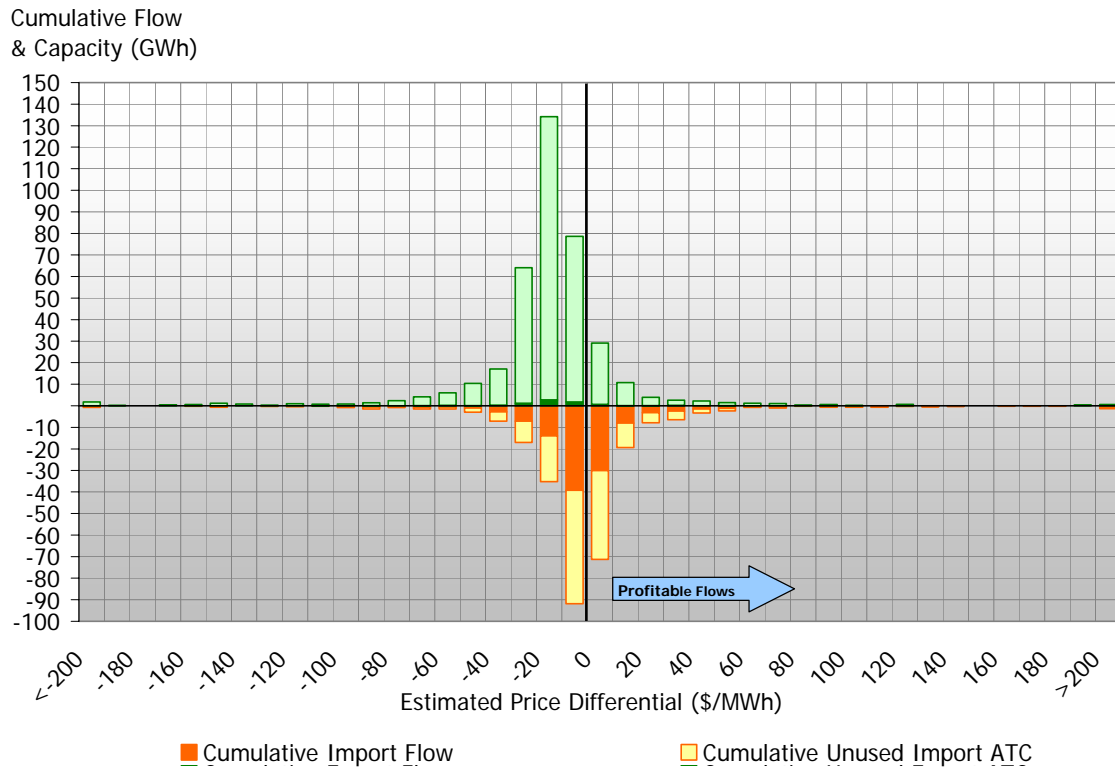
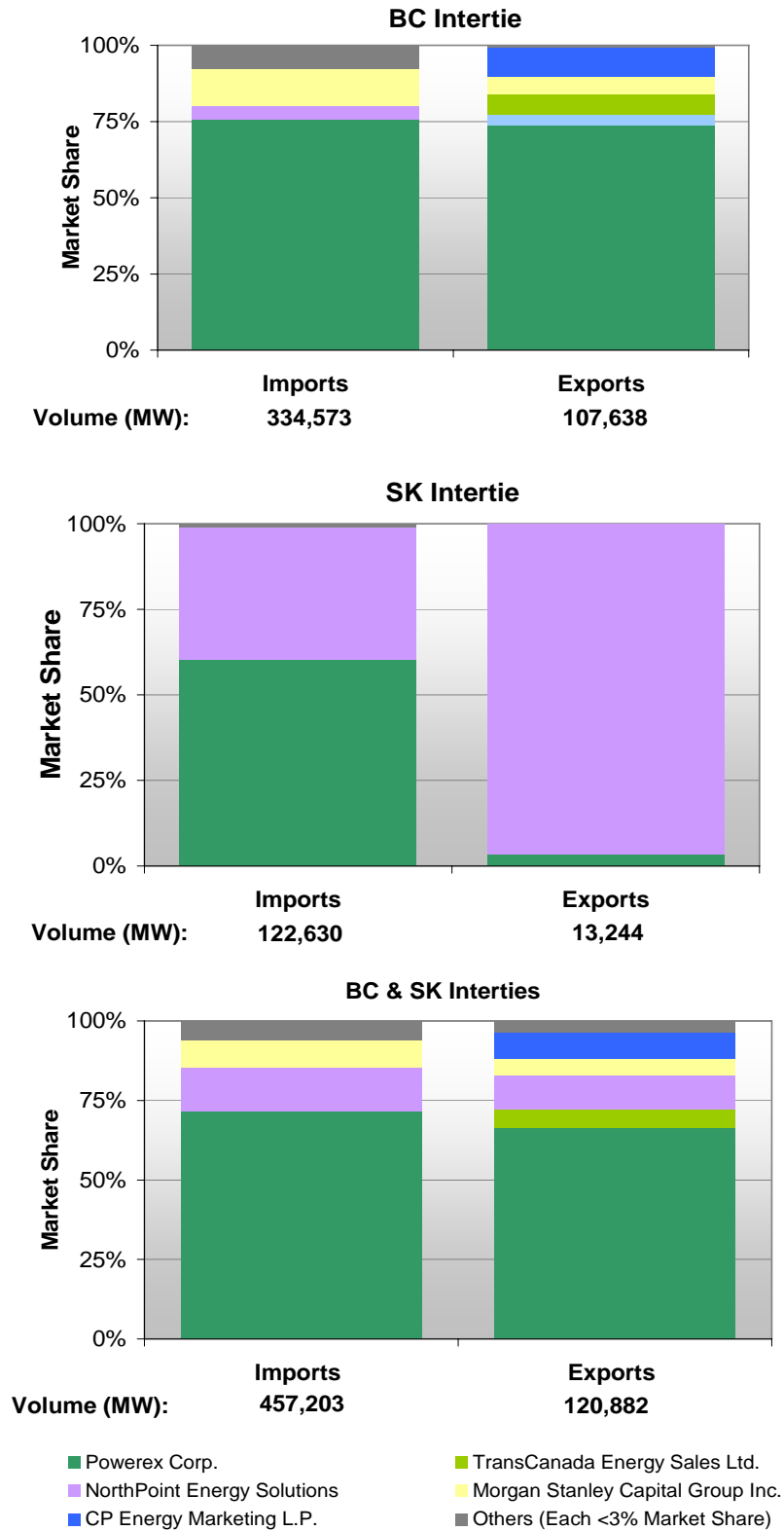


Figure E.8: Intertie Market Share



## Appendix F: Forward Market Metrics

Figure F.1: Volume by Trading Month<sup>8</sup>

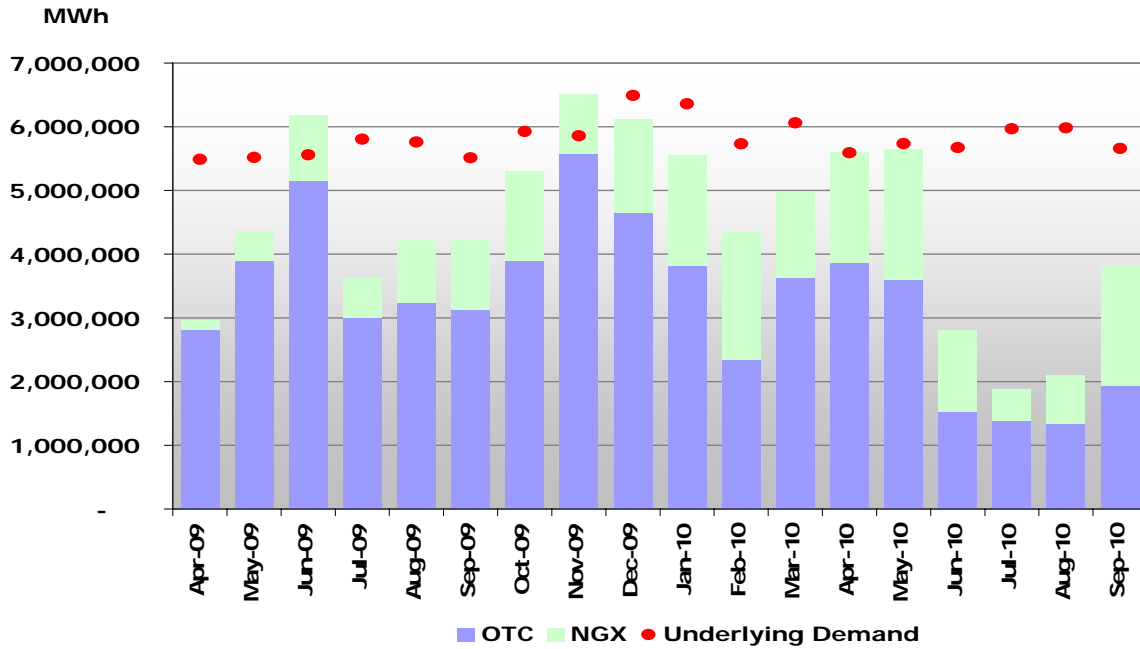
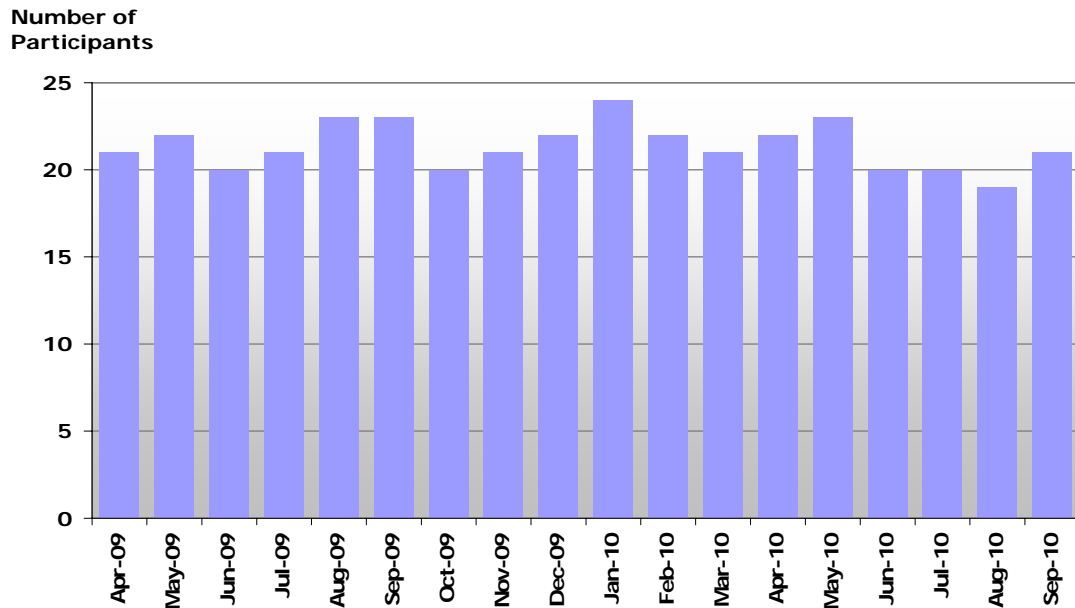


Figure F.2: Number of Active Market Participants by Trading Month



<sup>8</sup> The volumes include only one side of the transaction. NGX volumes do not include transactions facilitated elsewhere but settled through NGX.

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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.