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MSA Report

Operating Reserves Procurement – Understanding Market Outcomes

16 September, 2009

Market Surveillance Administrator

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1 INTRODUCTION

The procurement of operating reserves in the Alberta market is quite complex. The operating reserves market is relatively small compared to the energy market, seeing only annual trades of $269m[1] which is less than 5% of the size of the energy market[2]. Despite its small size, the MSA applies considerable resources to monitoring the operating reserves market – a function both of the market's complexity and that operating reserves are frequently the subject of stakeholder concerns around competitiveness. Concerns identified by stakeholders and the MSA's monitoring have in the past been addressed in the MSA's quarterly reports, special reports and in some instances through MSA investigations.

The MSA's quarterly and special reports have largely focused on specific events. The purpose of this paper is broader and primarily aimed at explaining some of the dynamics of the operating reserve market and why on occasion interesting outcomes appear to be odd. The MSA believes that some persistent stakeholder concerns can be addressed by providing a better understanding of how small changes in market fundamentals can have a large impact on operating reserve prices. Compared to the energy market there is a relative absence of information about participant offers and market dynamics. While this may not restrict competition between sophisticated market participants it is the view of the MSA that this does not provide other stakeholders with sufficient confidence that the market is competitive. A better understanding of these factors may also assist market participants in understanding the AESO's proposed re-design of the operating reserves market. Given the prospect of a re-designed market the MSA is not considering increased regular reporting at this time but believes this special report will be beneficial to stakeholders.

Section 2 of this paper provides a brief introduction to operating reserve products and procurement. Section 3 considers how market dynamics impact market outcomes in operating reserve markets. Section 4 considers a variety of examples of how relatively small changes can cause large changes in prices in the active operating reserve market. Section 5 concludes the report.

2 OPERATING RESERVES

The complexity of the operating reserves market is a function of the number of services procured and the method of procurement. In Table 1 we provide a summary of the key differences between different kinds of operating reserves and consider each of these differences in more detail in the next few sections.

[1] http://www.aeso.ca/downloads/Q4_2008_Stakeholder_Financial_Report.pdf
[2] http://www.aeso.ca/downloads/OR_Market_Paper.pdf

Table 1: Key Differences between Different Types of Operating Reserves

Product Type	Technical Requirements	Simultaneous Participation in the Energy Market	Procurement Platforms	Number of Eligible Participants	Number of Eligible Assets	Typical On-peak Volumes (MW)*	Typical Off-peak Volumes (MW)*
ACTIVE RESERVES							
Regulating	-Synchronized to the grid -AGC equipped -Cannot be supplied by load or intertie	No	Watt-ex D-1 - 9am to 9:40am D-2 through D-5 – 2pm to 2:30pm OTC – after Watt-ex close	8	18	160 - 165	110 - 125
Spinning	-Synchronized to the grid -Deliver volume within 10 minutes -Can be supplied by interties but not by load	No	Watt-ex D-1 - 9am to 9:50am D-2 through D-5 – 2pm to 2:40pm OTC – after Watt-ex close	14	42	235 - 260	170-185
Supplemental	-Deliver volume within 10 minutes -Can be supplied by interties and load	No	Watt-ex D-1 - 9am to 10:00am D-2 through D-5 – 2pm to 2:50pm OTC– after Watt-ex close	17	54	235 - 260	170-185
STANDBY RESERVES							
Regulating	-Synchronized to the grid -AGC equipped -Cannot be supplied by load or intertie	Yes – until activated	Watt-ex D-1 - 9am to 10:10am D-2 through D-5 – 2pm to 3:00pm OTC – after Watt-ex close	8	18	110-140	110-140
Spinning	-Synchronized to the grid -Deliver volume within 10 minutes -Can be supplied by interties but not by load	Yes – until activated	Watt-ex D-1 - 9am to 10:20am D-2 through D-5 – 2pm to 3:00pm OTC– after Watt-ex close	14	42	105	105
Supplemental	-Deliver volume within 10 minutes -Can be supplied by interties and load	Yes – until activated	Watt-ex D-1 - 9am to 10:30am D-2 through D-5 – 2pm to 3:00pm OTC– after Watt-ex close	17	54	35-45	35-45

*** Volumes vary. See OPP 401 and 402 for more detail concerning AESO Operating Reserve procurement practices.**

2.1 Operating Reserves – Regulating, Spinning, and Supplemental

There are three kinds of operating reserves: regulating reserves, spinning reserves and supplemental reserves. For each of these, the AESO procures 'active' reserves and 'standby' reserves, where 'standby' reserves are only activated when active reserves are unable to supply the services procured (e.g. the asset is on an unplanned outage) or there has been a forecast error in the demand for operating reserves and insufficient active reserves have been procured. Until called upon, assets supplying 'standby' reserves are still able to participate in the energy market.[3]

The three kinds of operating reserves have different characteristics:

- **Regulating Reserves -** Regulating reserves are a front line tool that aids the system controller to maintain system stability. Regulating reserves respond to small, moment to moment, variations in supply and demand. Assets that are providing regulating reserves must be synchronized to the grid and must be equipped with automatic generation control (AGC). AGC allows the asset to automatically balance the energy without any involvement from the asset operator. Compared to the supplemental and spinning reserve products, there are not many assets within the Alberta market that meet the technical requirements needed to be a provider of regulating reserves. Thus, the regulating reserve market has only eight market participants who own a total of 18 assets (1,710 MW) that are eligible to provide these reserves. These market participants compete for approximately 160 MW of on-peak and 120 MW of off-peak active reserves along with a similar or smaller amount of standby regulating reserves.

- **Spinning Reserves -** Spinning reserves are intended to protect the system against contingency events, such as the sudden loss of major generation assets. Spinning reserves are required to deliver the entire volume offered within ten minutes of a directive from the AESO and are dispatched by the system controller. Like regulating reserves, spinning reserves must also be synchronized to the grid; however assets providing these reserves do not need to be equipped with AGC. In the spinning reserve market there are 14 qualified market participants which have a total of 42 assets (including the BC intertie) consisting of a total of 3,066 MW. These market participants compete for approximately 250 MW of on-peak and 180 MW of off-peak active reserves along with a considerably smaller amount of standby spinning reserves. ISO Operating Policies and Procedures 402, states at least 50% of contingency reserves must be spinning reserves.

- **Supplemental Reserves –** Supplemental reserves, like spinning reserves, are also intended to protect the system against contingency events. For this reason supplemental and spinning reserves are collectively also

[3] Standby suppliers have fifteen minutes to get into position when called upon by the system controller

known as 'contingency reserves'. Supplemental reserves must also deliver the entire volume offered within ten minutes of a directive from the AESO and are dispatched by the system controller. However, supplemental reserves, unlike regulating and spinning reserves, do not have to be synchronized to the grid. Supplemental reserves can be provided by generation or load that is capable of delivering the directed volume within ten minutes of receipt of the directive. Load supplying supplemental reserves must reduce consumption within 10 minutes of a directive. As a result of having the fewest technical requirements, the supplemental reserves market has the largest number of qualified market participants. Seventeen participants with a total of 54 assets which include the BC intertie (3,263 MW) are qualified to supply supplemental reserves. These market participants compete for approximately 250 MW of on-peak and 180 MW of off-peak active reserves along with a considerably smaller amount of standby supplemental reserves.

2.2 Operating Reserves - Procurement

2.2.1 Exchange and OTC markets

The AESO acts in the market as the sole procurer of operating reserves based on forecast requirements of each kind of reserve product. The criteria for determining minimum operating reserves, contingency reserves plus regulating reserves are established by the Western Electricity Coordinating Council (WECC).[4] The majority of the operating reserves are procured via Alberta Watt Exchange Limited (Watt-ex). These consist of either commitments to make available reserves for the on-peak (Hour Ending 8 through 23 for Monday through Sunday) or off-peak (Hour Ending 1 through 7 and HE 24 for Monday through Sunday) periods. This differs from the energy market where all of Sunday is considered off-peak. The AESO may also use bilateral or 'over-the-counter' (OTC) trades to procure operating reserves. OTC procurement is mostly used for 'shaping' i.e. filling in the gaps between hourly operating reserve requirements and on-peak and off peak strips that have procured on the exchange. OTC is used for shaping as only on-peak and off-peak products are traded on the Watt-ex administered markets.

The procurement of each kind of operating reserve is done over the five days prior to the day on which the reserves are required to be available. These days are often referred to as D-1 through D-5, where D-1 is one day prior to the day on which the reserves are required. Operating reserve products do not trade on weekends, public holidays or AESO holidays. Consequently, D-1 procurement may occur for several delivery days on the same trading day (e.g. D-1 procurement for the delivery days Saturday, Sunday and Monday usually occurs on a Friday).

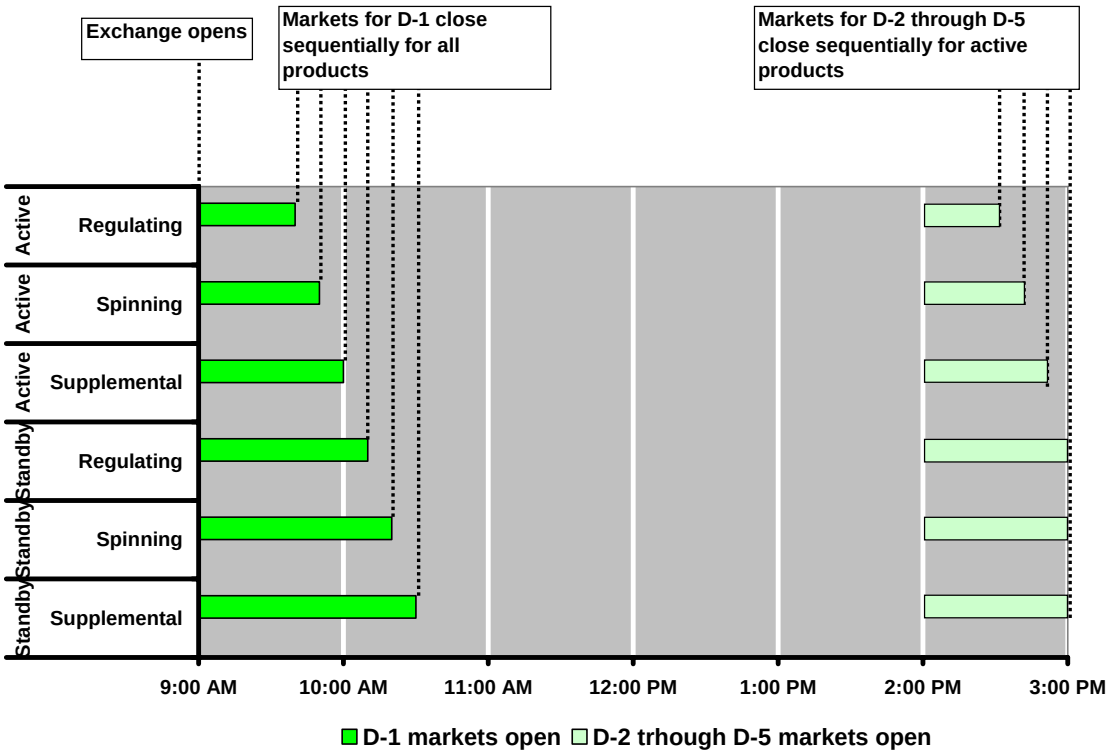
Figure 1, shows the different opening and closing times of each market. On each trading day the exchange opens at 9.00AM. In the morning, D-1 products are traded while D-2 through D-5 are traded in the afternoon. Some product markets

[4] AESO OPP 401 and 402: http://www.aeso.ca/downloads/OPP_Contents.pdf

close sequentially - regulating then spinning and finally supplemental – to give participants who did not trade in one market opportunity to compete in another. [5] All markets are closed by 3:00PM.

OTC trades can occur at any time but it is the AESO's current practice not to trade OTC products while the market for that product is open on the exchange.

Figure 1: Exchange Opening and Closing Times for Different Operating Reserve Products



Price determination in active operating reserves markets

Each day of procurement (D-1 through D-5) the AESO determines how much of its forecasted need it will attempt to procure. Procurement on the exchange is done for on-peak or off-peak strips (i.e. a commitment covering all on-peak or off-peak hours of the delivery day). The AESO posts a bid volume and associated price and participants post offer volume and prices. Bid and offer prices for active reserves are indexed to Pool price with a negative (positive) trade price indicating a discount (or premium) to Pool price. No trades occur on the exchange until the market closes. All offers (starting with the lowest priced offer) are accepted up until the point that either the AESO has procured the desired amount that day or no offers remain at or below the AESO's bid price.[6] The most expensive offer that has all or a portion of its volume accepted is the offer that

[5] Note that unlike the energy market, a market participant is not required to offer operating reserve products (i.e. there is no 'must offer' requirement).
[6] The AESO's bid effectively acts as a price cap.

clears the market (C in Figure 4). The trade price (market clearing price) is not the offer price that cleared the market but the mid point between this offer price and the AESO's bid price. Thus, if the AESO's bid price is $40 and the offer that cleared the market was $-60, the trade price, is $-10 [= ($40+-$60)/2], (see Figure 2).

Figure 2: Trade Price

Trading continues in the same manner during each of the five days of procurement (D-1 through D-5). The volume weighted average trade price of all five days is used to determine the index price as displayed in the members section of the Watt-ex web-site[7]. The MSA uses this index in its Weekly Market Monitor to calculate the daily weighted average of the prices paid by the AESO for active reserves.

For purposes of settlement, the trade price is applied as a discount or a premium to Pool price in the hour that the market participant provides the product. Consequently, a market participant supplying reserves each hour may receive a different price during each hour as Pool price changes. Should the discount to Pool price result in a negative price, the payment per MWh is set to zero (i.e. market participants providing reserves cannot receive less than $0/MWh). Table 1 presents an example of how the trade price of -$57 for an on-peak product is applied to Pool price to yield the revenue stream to the provider. In addition to the price received for making the operating reserves available the market participant also receives payment (at Pool price) for any energy produced. This occurs all the time when providing regulating reserves with the amount of payment depending on how much of the regulating reserve the AESO draws upon. On balance the AESO tries to remain at the middle of its regulating reserve range such that it is equally capable of responding to up and down movements. Consequently, sellers expect on average to generate 0.5 MWh per MW of regulating range service they have sold to AESO. For contingency reserves, the frequency of being directed to make energy is much lower.

[7] http://www.watt-ex.com/

Table 2: On-Peak Pricing at a -$57 Trade Price per MWh

HE	Pool Price [A]	Trade Price [B]	Difference [A]+[B]=[C]	Payment per MWh =if [C] =< 0, 0,[C]
8	$74.83	-$57	$17.83	$17.83
9	$54.31	-$57	-$2.69	$0.00
10	$48.03	-$57	-$8.97	$0.00
11	$27.78	-$57	-$29.22	$0.00
12	$35.69	-$57	-$21.31	$0.00
13	$52.01	-$57	-$4.99	$0.00
14	$74.41	-$57	$17.41	$17.41
15	$84.31	-$57	$27.31	$27.31
16	$138.92	-$57	$81.92	$81.92
17	$75.11	-$57	$18.11	$18.11
18	$407.01	-$57	$350.01	$350.01
19	$675.20	-$57	$618.20	$618.20
20	$48.61	-$57	-$8.39	$0.00
21	$32.90	-$57	-$24.10	$0.00
22	$31.26	-$57	-$25.74	$0.00
23	$45.22	-$57	-$11.78	$0.00

The operating reserve market design allows for considerable flexibility in AESO bid and market participants offer behaviour. In practice, bids and offers in the active markets exhibit some typical characteristics, such that:

- The AESO is currently procuring the majority of its reserves on D-1 (one day ahead) with smaller volumes procured on D-2 through D-5.
- The AESO posts bids shortly after market opening. Bids for a given product are usually fairly similar from day to day and the bid price for D-1 is often the same during a given week.
- Market participants' offers usually only appear shortly before market closing.

2.2.2 Price determination in standby operating reserves markets

Standby markets differ from active markets in that they do not feature a single trade price but rather a two part price: a premium for promising to supply reserves that is received whether or not they are activated and an activation price that is received if the reserves are dispatched to active service. The two part price means that the market clearing operates differently. The AESO is able to lift offers made by market participants and similarly, market participants may lift bids made by the AESO.

2.3 Operating reserves market redesign

The AESO has proposed a redesign of the operating reserves market.[8] One of the key objectives for the redesign is the elimination of the AESO as a 'strategic' buyer. The redesign includes a number changes that reduce the complexity of the procurement process:

- Procurement of reserves only on D-1 (rather than D-1 through D-5)
- Removal of the need for the AESO to post a bid price (with market clearing at the last offer price accepted rather than the mid point between this and the AESO's bid).
- Watt-ex [Natural Gas Exchange (NGX)] as the only trading platform, eliminating OTC.
- Procurement of shaping products on the exchange
- Operating reserve market price cap equal to energy market price cap
- Operating reserves continue to be indexed to Pool price.

3 UNDERSTANDING MARKET DYNAMICS IN THE ACTIVE OPERATING RESERVE MARKETS

The previous section has provided a basic review of how the procurement process works in the active and standby markets. Standby regulating market volumes are similar to volumes of active regulating volumes; however the volumes for the standby spinning and supplemental are considerably less than for the active market. Consequently, the remainder of the report focuses on active reserve markets.

Figure 3 illustrates an example of the Watt-ex daily weighted average trade index over 28 days through a period where the energy Pool price has been soft (on the low side). Often there are long periods when the trade indices appear to be more or less flat. For example, from day 1 through 11, trade indices are relatively flat. Generally off-peak trade prices are higher (smaller discount or higher premium) than on-peak trade prices mostly due to the fact that the trade price is applied to Pool price and off-peak Pool prices typically are softer than on-peak Pool prices (i.e. a market participant can tolerate a lower operating reserve price during on-peak hours and still make a return).

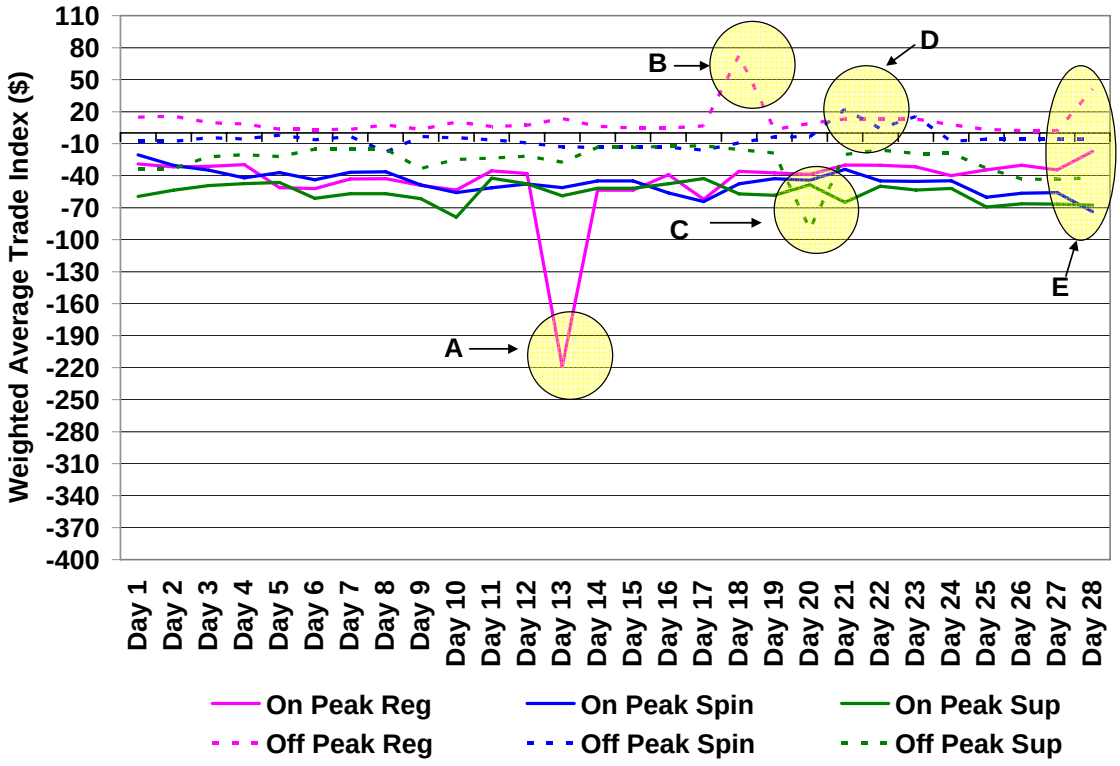
Of the two kinds of contingency reserves, spinning reserves usually trade at a small premium to supplemental reserves. The reason is that, while the two products provide the same essential service, spinning reserves must immediately be responsive to frequency events whereas supplemental reserves are not.

The relationship among the prices of regulating, spinning and supplemental reserves is more complex. As noted in section 2.2.2 regulating reserves often receive payments both for the provision of the service and the energy produced. For this reason, if a regulating reserves provider expects to incur a loss supplying

[8] http://www.aeso.ca/downloads/AESO_Recommendation_Paper_OR_Market_Redesign_January_2009.pdf

energy he will 'demand' a higher premium than if he expects a gain. Typically, off-peak regulating reserves are priced higher than spinning and supplemental reserves (since energy prices are usually lower during the off-peak), whereas the reverse maybe true in the case of on-peak regulating reserves (when energy prices are likely to be higher).

Figure 3: Watt-Ex Volume Weighted Average Trade Index ($)



Despite the typical patterns described above, at times what appears to be 'odd' behaviour occurs within the operating reserve market. Letters A through E, in Figure 3, represent a sample of spikes and dips within the market that seem to be outside typical pricing. Section 4 of the report describes some of the causes of this 'odd' pricing in more detail. Before doing so it is helpful to see the shape of a typical operating reserve supply curve. While information on market participant offers in the energy market is readily available on the AESO's website (see for example the Historical Trading Report[9]) this is not the case in operating reserve markets. This difference may partly explain why market dynamics and outcomes in operating reserves markets are frequently misinterpreted. The next section describes a typical supply curve which is then used in section four as a basis to examine how, in theory, different events impact the determination of the market clearing price.

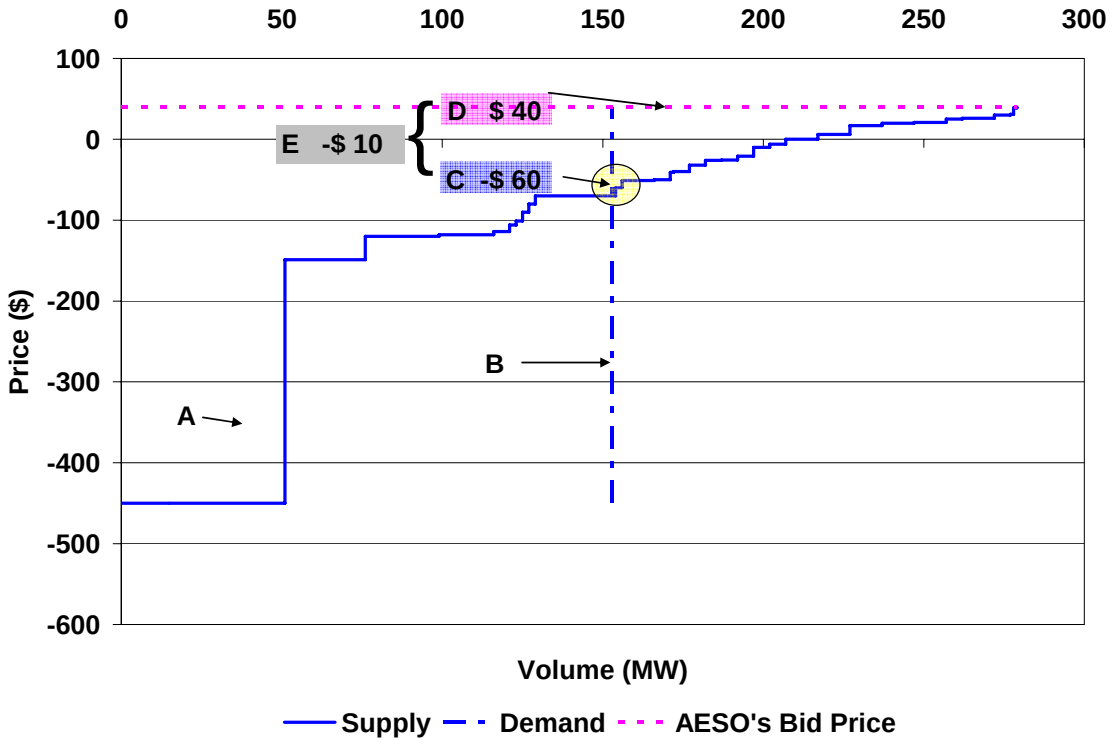
[9] http://ets.aeso.ca/

3.1 Operating Reserve Supply Curve

3.1.1 Supply Curve: Basics

Figure 4 illustrates a typical supply curve within the operating reserve market. The supply curve (A) is made up of aggregated individual offers submitted by market participants, like the energy market merit order. Each offer could be a different volume and/or price and a market participant may submit multiple offers each with a different volume and/or price for one or more assets.[10] The demand line (B) is the amount the AESO needs to purchase from that market for that day. The market clears at the point the supply and demand curves intersect. The trade price for that day is $-10 (E in the figure below), determined by the mid point between the price of the last offer required to meet demand, -$60 (C), and the AESO's bid price $40 (D).

Figure 4: A Typical Operating Reserve Supply Curve



3.2 Supply Curve: Offer Behaviour

The operating reserve supply curve, shown in Figure 5, can be subdivided into three types of offers:

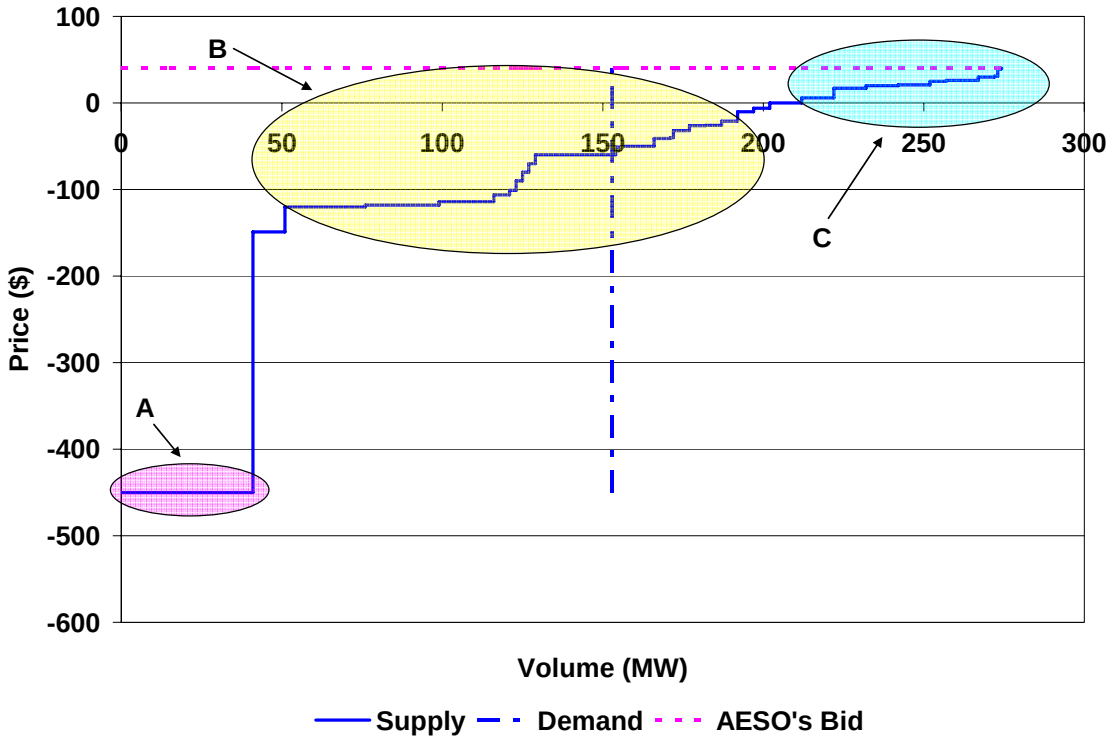
[10] The market also allows participants to supply using a 'virtual' asset and decide at a later date which asset or assets are capable of best meeting the aggregate level of sales.

A) **Price takers**- Price takers within the operating reserve market are like zero dollar offers within the energy market. These participants are primarily concerned about selling volume (MW) and are typically priced well below expected normal market clearing prices. There are a number of reasons why participants might offer in this zone (just as there are for price takers in the energy market). One important driver for price taking behaviour is the Hydro PPA which features obligations based around a 'notional quantity' of reserves supplied from the major Hydro assets

B) Typical price setters – offers in this zone clear the market and set the trade price most often. Participants in this zone may include those who also had 'price taking' volumes. On a typical trading day successful sellers' offers may be relatively similar in price, with certain participants' assets allowing them to be marginally more competitive than group C

C) **Uncleared offers** – offers in this zone represent those above the area in which price is typically set. Some operating reserve providers may place offers only within a higher priced range which simply reflects their higher cost of supplying reserves. This group does not frequently set price but may do so if one of participants in group A (price takers) or B (price setters) does not show up in the market. The uncleared offers play an important role in ensuring the market is competitive – while these assets may rarely be called upon, this will happen on occasion and substantiates their continued participation in the market.

Figure 5: A Typical Operating Reserve Supply Curve - Offer Behaviour

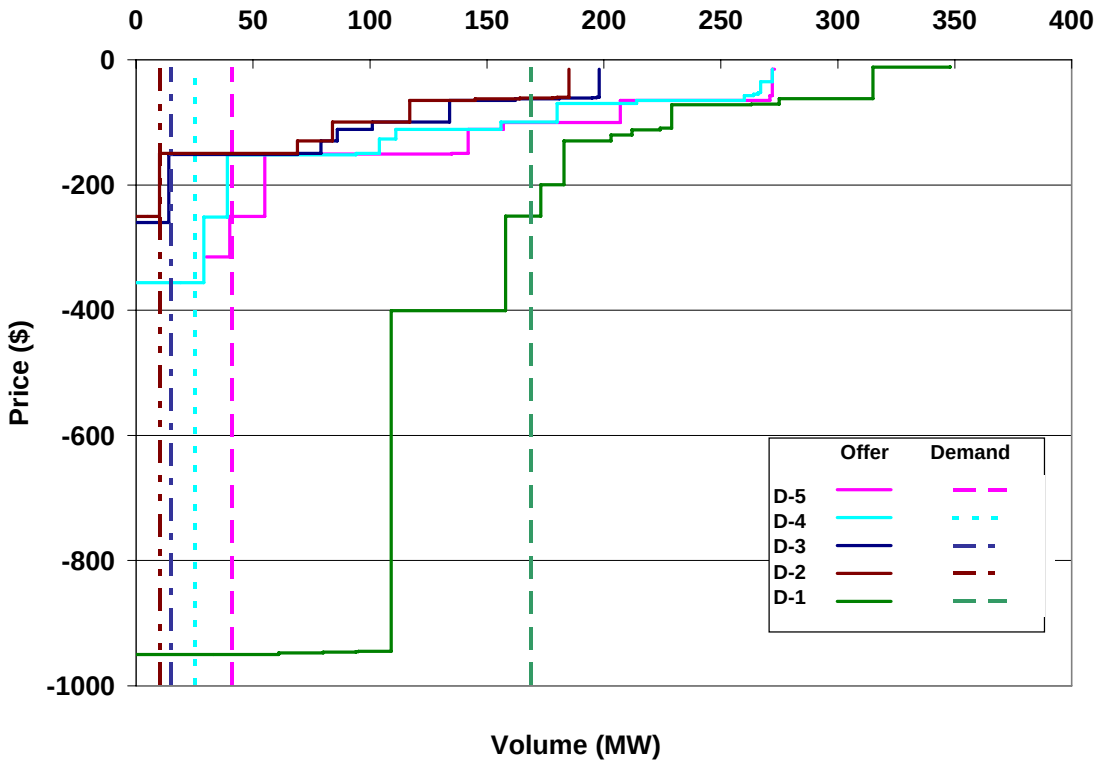


3.2.1 Supply Curve: D-1 through D-5 Trading

The Watt-ex trade index for a given day is composed of the volume weighted average trade price of all five trading days (D-1 through D-5). Each trading day can have a different volume the AESO wishes to procure (labeled below as 'demand') and will often clear at a different price. Sometimes as little as 5MW is procured in D-2 through D-5, and consequently fewer market participants show up for trading and do so with smaller volumes. Figure 6 shows typical offer curves and procurement volumes for each trading day, D-1 through D-5.

Figure 6 also shows that the AESO procures most volume on D-1 (i.e. the 'demand' line is further to the right on this day). Currently, approximately 80% of the AESO's procurement occurs on D-1 with the remaining 20% spread throughout D-2 through D-5. Due to this, the remainder of the report focuses on supply curves typical of D-1.

Figure 6: D-1 through D-5 Typical Trading

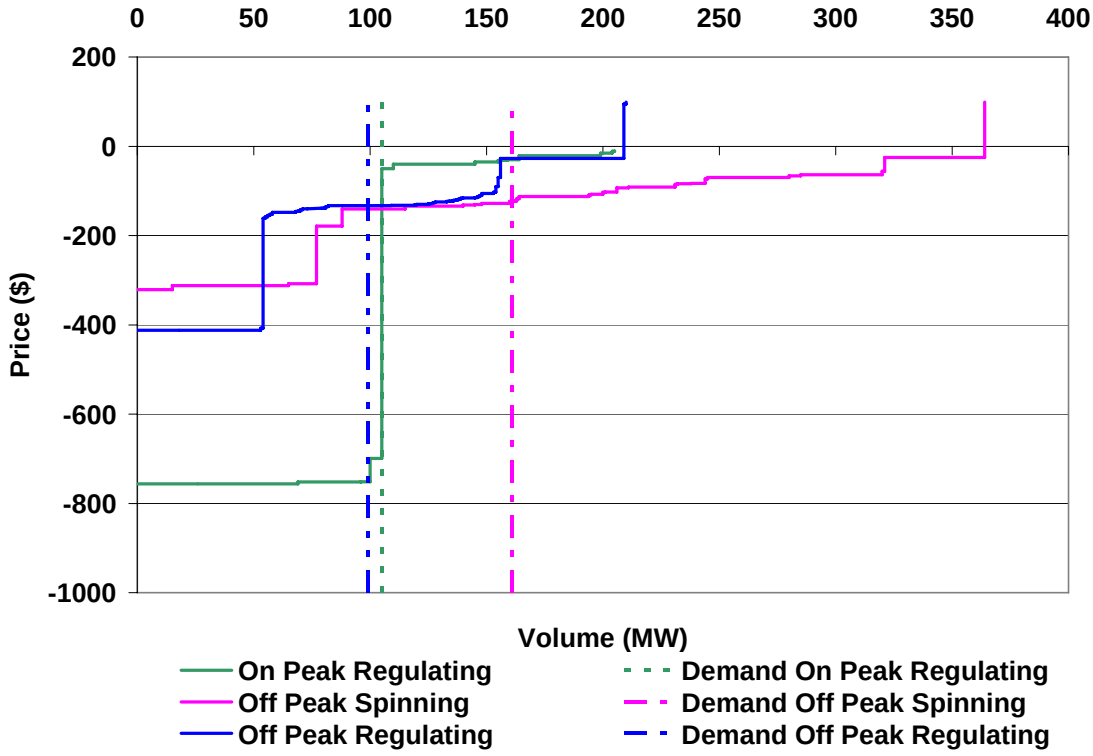


3.2.2 Supply Curve: Product Differences

During 2008, 16 participants successfully sold at least one type of operating reserve products which is an increase over previous years. However, there is considerable difference in the participation rates in the markets for some products and a corresponding difference in the shape of each product's supply curve. Each type of reserve has to be supplied by assets that meet the technical requirements set out by the AESO. The technical requirements for regulating reserves are the most stringent. Further some assets can only meet the technical requirements to supply reserves over a narrow range of their output – consequently when these assets supply reserves a relatively large portion of MW's become 'must-run' and are typically offered at $0 in the energy market. As an example, on-peak regulating reserves are usually characterized by a relatively 'thin' supply curve which is due to the technical requirements for this product along with a large amount of volume typically sold by price takers. In contrast, off-peak regulating and off-peak spinning supply curves are relatively deep. For these products price takers do not typically sell the majority of the volume. In addition for off-peak spinning reserves, more volume is procured and more market participants are qualified sellers. Other reserve products are usually

between these extremes and all products exhibit considerable variation on occasion (see Figure 7).

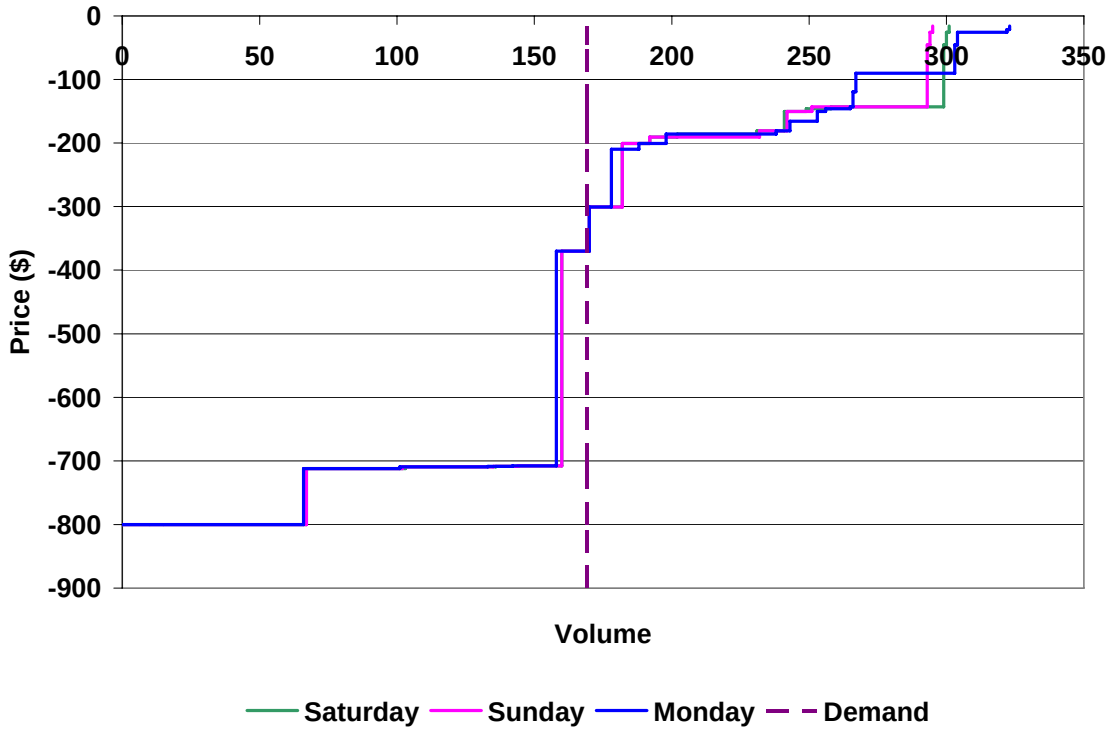
Figure 7: Supply Curve – Example of Product Differences



3.2.3 Supply Curve: D-1 Trades for Weekend Delivery

Friday is usually the busiest trading day within the operating reserve markets as three delivery dates are traded in D-1. An interesting observation of this trading day is that all three supply curves (Saturday, Sunday and Monday) for a common operating reserve product tend to be very similar, if not identical (Figure 8). This trading behaviour is not surprising given that all three days will be traded simultaneously for each of the products. Across a regular weekend, if a company is selling volume for all of the operating reserve active products, the trader needs to put in offers for 18 separate items. Offers made on Friday for Saturday, Sunday and Monday are often similar even though a Monday usually has a different load shape and Pool prices from the weekend days.

Figure 8: Weekend Trades



4 UNDERSTANDING INTERESTING BEHAVIOUR IN THE ACTIVE OPERATING RESERVE MARKETS

While active products vary to some extent, most feature similar dynamics. This section examines four examples:

- When a large participant is absent from the market
- Price takers clear volume and clear the market
- Small incremental offers and cancelled trades
- Impact of high Pool prices on operating reserve trading

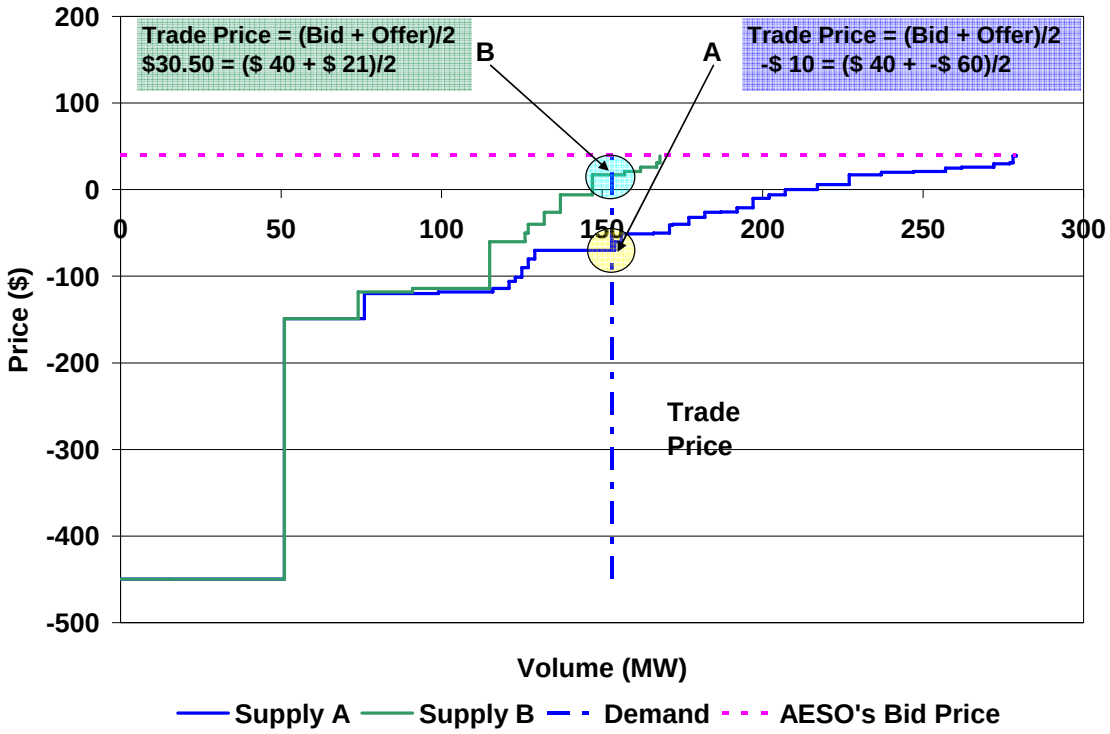
In each example, relatively small changes can have a large impact on the trade prices within the active operating reserves markets.

4.1 When a Large Participant is Absent from the Market

When a large participant is absent from the market the supply curve shifts to the left resulting in normally uncleared offers trading and a higher clearing price. Figure 9 illustrate the dynamics of the operating reserve market when a major participant is absent on a particular day.

Supply curve A in Figure 9 is the supply curve with all of the typical market participants still in place. Whereas, supply curve B illustrates the change of the supply curve when a large market participant is absent from the market, for example due to an upcoming outage. In this illustration the absent participant makes a variety of offers at different volumes and prices in the typical price setting zone (note the supply curve in the price taking zone is unchanged in this example)[11]. The trade price with supply curve A is $-10, (a discount to the Pool price). However, with the absence of the large participant in supply curve B, the trade price is $30.50 (a premium to the Pool price).

Figure 9: Change in Supply Curve with a Large Participant Absent From the Market



The size of the impact depends on a number of factors. If the absence of the large participant is not observable by the rest of the market and the participant typically only supplies one reserve product this may appear as a 'spike' in price for that product. This may look like point B in Figure 3. If the absence is known to the rest of the market there may be a more dynamic response (additional participants offering) or participants might shift from one market to another that may result in a more muted impact or an increase in the trade price across a number of products as opposed to a single product 'spike'.

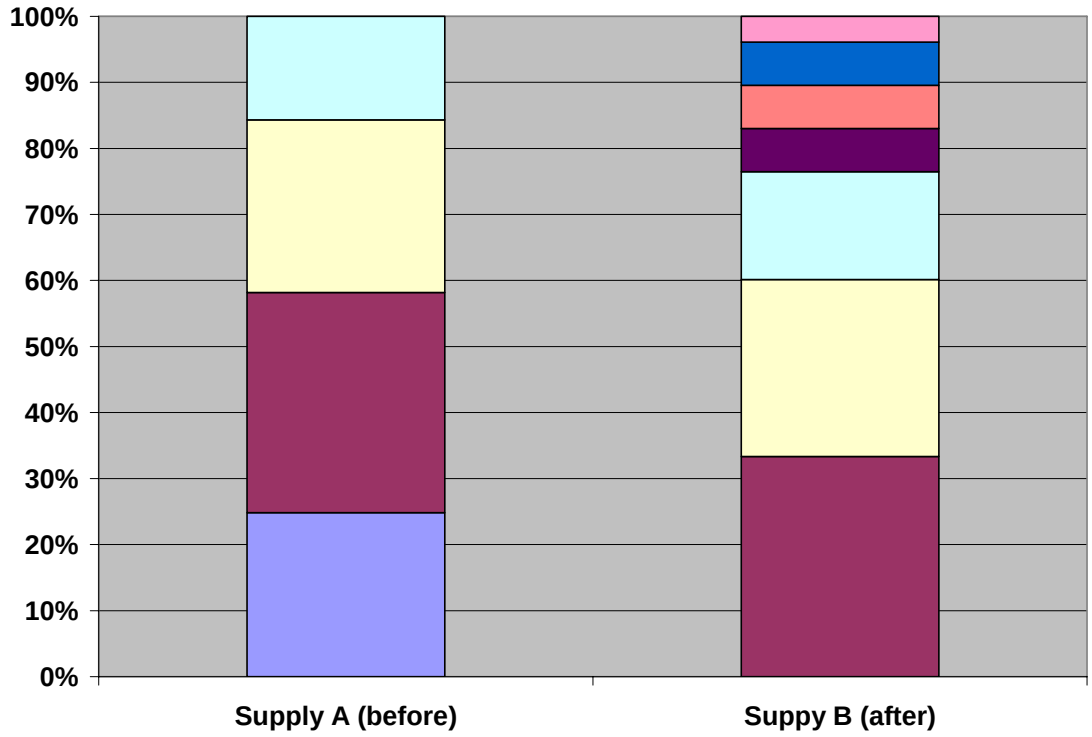
The size of the impact may also depend on the absent participant's 'normal' position in the supply curve. For example, the absence of a 'price taker' may

[11] For discussion on the typical 'price setting' and 'price taking' zones see Section 3.2, including Figure 5.

have very limited impact on the trade price if there are usually a large number of uncleared offers in the 'price setting' zone.

The occasional absence of large participants drives participation in the market by more marginal players. Figure 10 displays the market share for the two supply curves considered above. Under the typical supply curve A only four participants have market share. With the absence of one of these (supply curve B) four additional participants supply reserves. This example illustrates how important all of the suppliers are to the operating reserve market. Those on the tail end of the supply curve may not receive the volume every day. However when they do it can be quite profitable. Without them the AESO would not have been able to fill its required volume from the Watt-ex platform (resulting in them either seeking volumes on the OTC market or, ultimately, through conscription). With no 'must offer' and small demand, the absence of a big provider often causes price to increase. This absence is not often visible to the market at the time that the market is trading.

Figure 10: Market Share With and Without a Large Market Participant

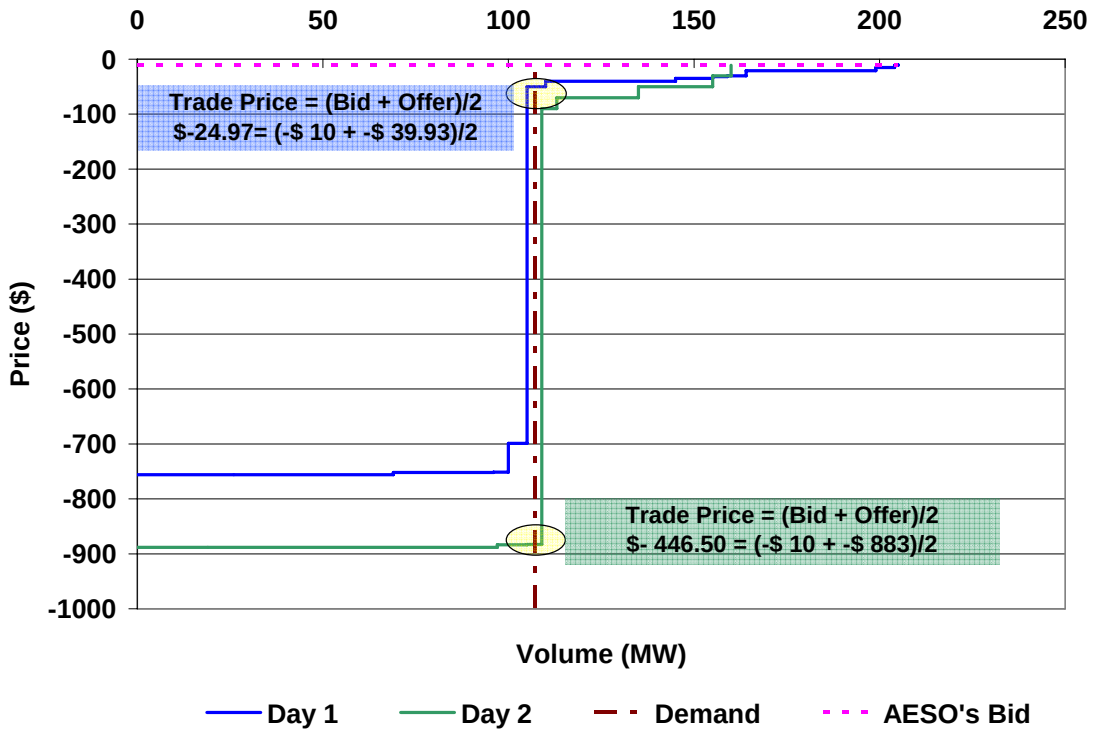


4.2 Price Takers Clear Volume

Dips in trade prices are unusual but generally occur when price takers inadvertently clear the market. These incidents can be explained by unexpected decreases in demand or unexpected increases in volumes from other price takers. They may result from human error. Price dips, while unusual, are more frequent in markets where the supply curve is relatively thin – for example in Figure 3, point A shows a dip in the price for on-peak regulating reserves. Figure 11 shows

two supply curves for regulating reserves on two separate days. While the supply curves are very similar and demand is the same the trade price is considerably different ($-24.97 compared to -$446.50). Unusually low reserve prices that persist for some time would likely be the subject of further MSA scrutiny.[12]

Figure 11: Price Takers Clear Volume

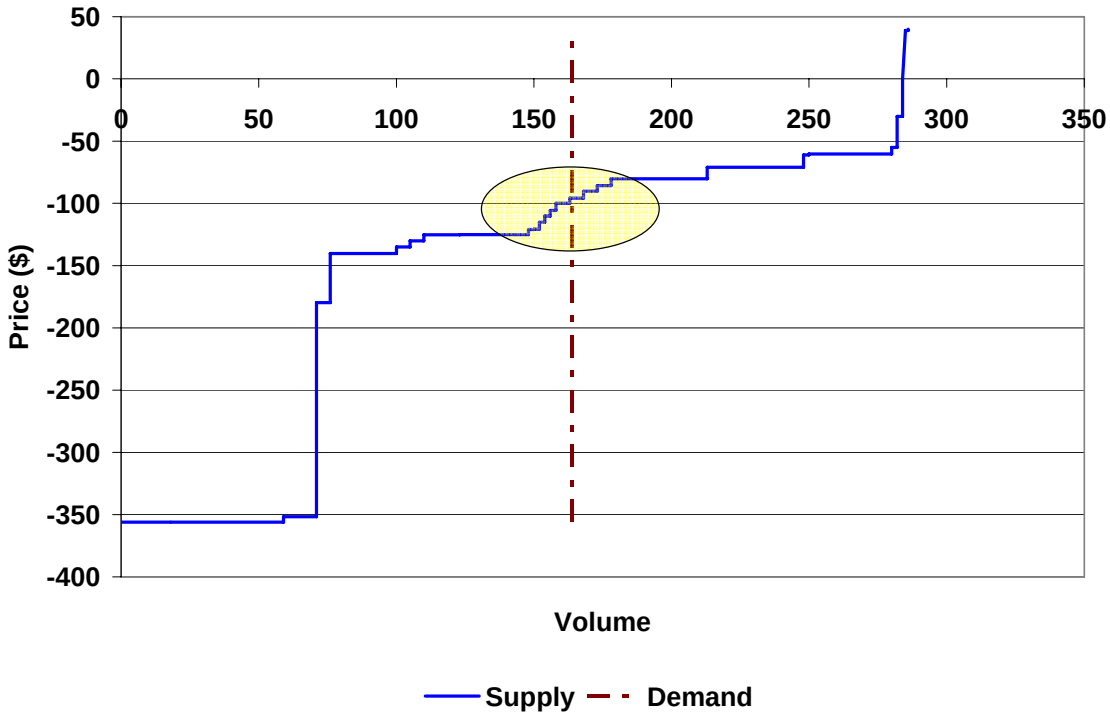


4.3 Small Incremental Offers and Cancelled Trades

Small incremental offers are observed on a regular basis in the price setting zone. One or more participants will submit multiple offers in increments of 1 to 5 MW, from either the same asset or from a combination of assets. Competition can be quite intense in this zone and, absent unusual circumstances, price often settles among these incremental offers. Figure 12 illustrates a supply curve with a number of small incremental offers clustered around the demand line.

[12] See, for example, http://www.albertamsa.ca/files/SpinningReserveMarketEventReport012304.pdf

Figure 12: Small Incremental Offers in the Supply Curve



Small incremental offers can sometimes result in odd outcomes since they may result in an increased likelihood of cancelled trades. In its April 20th, 2006 Customer Contract Notice, Watt-Ex added a new section to its customer contract which addresses trade cancellations. Item 3: Trade Cancellations states:

1. New Section 204

This section has been added to acknowledge the various instances whereby Watt-Ex can cancel Trades. This new section reads:

"The Customer agrees that Watt-Ex shall have sole discretion and authority to cancel trades in the following instances:

(a)Trades in Error pursuant to the provisions of Section 203;

(b)Where a trade or trades doe not meet AESO standards for inclusion in their "Merit Order". At the time of publication of this contract, that includes:

i. Where at the close of the Day Ahead Market, the volume of any Active Ancillary Services Contract that is then to be performed is less than 5 MW, all Trades that together comprise such Active Ancillary Services Contract;

ii. Where at the close of the Day Ahead Market, the volume of any Standby Ancillary Services Trade that is then to be performed is less than 5 MW…

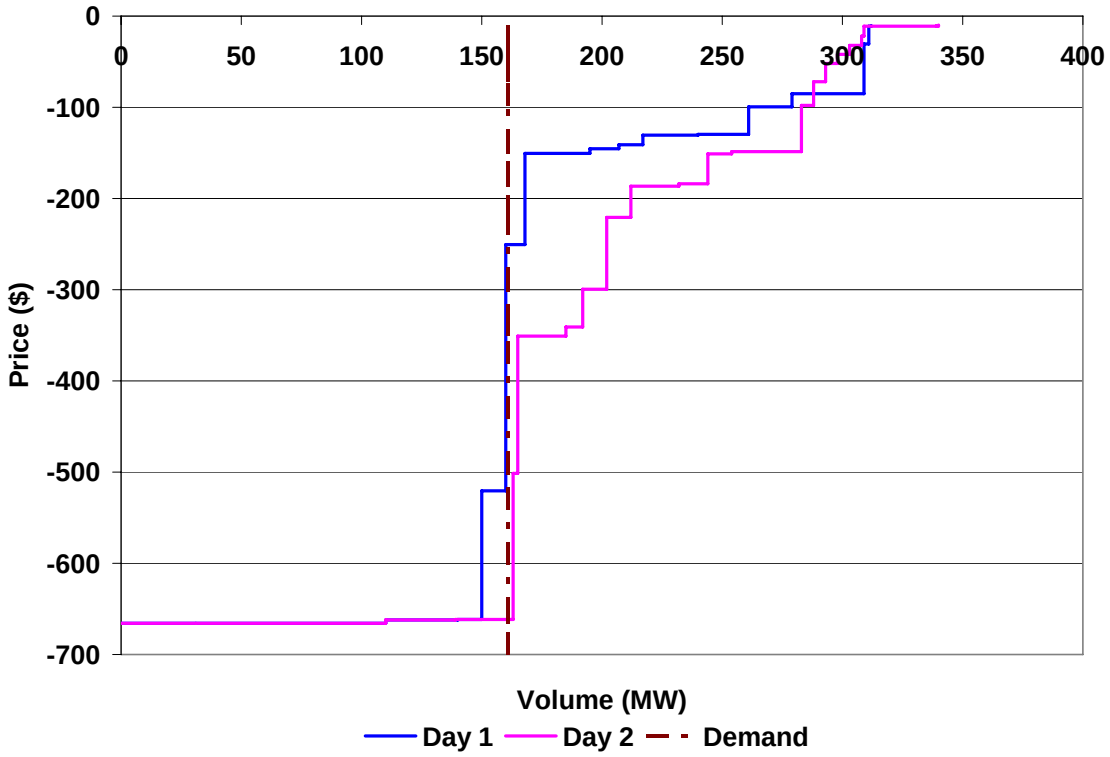
Trades may be canceled in the day-ahead market (D-1) if in aggregate 5MW has not been procured from a particular asset between D-1 through D-5. Some of these cancelled trades may have cleared the market on prior trading days and consequently set price. The MSA does not view cancelled trades setting the trade price to be a good feature of the market. In many cases the impact on price from the cancelled trade is small (e.g. there is another incremental offer priced a little below the cancelled trade).

4.4 Impact of High Pool Prices on Operating Reserve Trading

Market fundamentals within the energy market can impact trading behaviour in the operating reserve market because operating reserves are indexed to Pool price. For example, high price events within the energy market can make operating reserve participants more aggressive (offering at larger discounts). In terms of the Watt-ex trade index this may appear as a 'dip' in one or more of the indices, for example letter C in Figure 3; it may also reverse the normal ordering between regulating and contingency reserves as the opportunity cost of load following changes.

Figure 13 show the supply curve for one particular operating reserve product on two days. Day 1 shows a supply curve on a typical trading day. Day 2 shows a supply curve during a trading day in which high Pool prices were observed. During trading for the Day 2 supply curve, Pool price rose to almost $500 due to a number of outages and derates; whereas Pool price during trading for the Day one supply curve did not exceed $50. On this day some of the typical 'price setters' have offered much larger discounts, presumably on the expectation that the high prices observed during the trading day will continue until the delivery day.

Figure 13: Impact of High Pool Price during the Trading Day



5 CONCLUSION

This report has examined the procurement of operating reserves in the Alberta market and attempts to explain some of the dynamics of the operating reserve market and why, on occasion, there are outcomes that may appear to be 'odd'. The MSA believes that some persistent stakeholder concerns can be addressed by providing a better understanding of how small changes in market fundamentals can have a seemingly large impact on operating reserve prices.

Given the prospect of a re-designed market the MSA is not considering increased regular reporting at this time but does believe that one test of any new design is how it responds in unusual circumstances. Until the new design is implemented, the MSA will continue to monitor and report on special events that occur in the operating reserve market.

Stakeholders wishing to understand more about the operating reserves market are recommended to consult the MSA's previous Year in Review, Quarterly and special reports on this subject, which include:

- 2008 Year in Review – Section 4. Featured Operating Reserves (OR) Market Developments
- 2007 Year in Review – Section 3. Featured Ancillary Services Market Developments During 2007
- 2007 Second Quarter Report (July) – Section 1.3 Ancillary Services Market Review

- 2006 Year in Review (March) – Section 3. Featured Ancillary Services Market Developments During 2006
- Regulating Reserve Performance (October 2004)
- Powerex Active Spinning Reserve Review (August 2004)
- Spinning Reserve Market Event Report (January 2004)

The MSA is interested in the views of market participants on whether this analysis is useful in better understanding the market at work. If you have any comments on this paper or our market monitoring reports in general please contact Mike Nozdryn-Plotnicki, Manager, Market Monitoring (email: mike.nozdryn-plotnicki@albertamsa.ca, phone: 403-705-8503).