ANALYTICAL FRAMEWORK FOR THE MONITORING OF BIDS, OFFERS AND MARKET HEALTH

1. Introduction

In April 2010 the MSA released a Discussion Paper entitled *Foundational Elements Shaping the Market Surveillance Administrator's Approach to Bids and Offers* (Foundational Elements).[1] In that paper the MSA provided its views on the intent of the legislation shaping the MSA's role in ensuring the *fair, efficient and openly competitive* operation of the market. The view we have provided is that effective competition should be relied upon wherever and whenever possible. In addition, two foundational elements were addressed: Firstly, a discussion of efficiency that places emphasis on the dynamic rather than the static. Secondly, detailed views around subsections 2(j) and 2(k) of the FEOC Regulation were set out.

In this paper we move forward with details of the analytical framework the MSA will use to monitor and assess whether Alberta is enjoying the level of effective competition contemplated in the legislation. It encompasses two MSA responsibilities: first, to detect and address anticompetitive behaviour by market participants, and second, to identify changes to the market framework that would enhance fair, efficient and openly competitive market operations. Both responsibilities are important, but, the second, providing input to the market design, has the added benefit of limiting the scope for anticompetitive behaviour and the need for after the fact intervention. Therefore, while this document explains the MSA's proposed enforcement strategy with respect to offers and bids in the real time market, it also introduces the broader topic of market design issues conducive to competitive market outcomes, that is, market health. As part of the package we identify some of the routine market metrics and record keeping that we see as part of our job.

The paper is organized into separate sections describing the different segments of the market impacting competition, our enforcement stance and the related monitoring activity and potential metrics. These are as follows: Section 2 discusses price responsive load, Section 3 is about supplier on supplier competition and identifies what we regard as the principal potential call on our enforcement resources, Section 4 presents our views on forward market competition and the potential to mitigate market power in the real time markets.

[1] http://www.albertamsa.ca/1125.html

2. Price Responsive Load

In most markets, interactions between supply and demand result in the formation of price. Markets with highly price responsive customers are not subject to prices being raised through the exercise of market power since attempts to raise price face diminishing demand and lower profits. While supply and demand interactions may be seen to operate in the electricity forward market it is much less the case in the Alberta spot market.[2] Alberta's spot market, typically, exhibits only weak real time demand response to changes in price (economists describe this as 'inelastic demand'). An assessment by the AESO in 2009 showed an average response of about 200 MW as prices moved from low levels to near the price cap ($999.99/MWh). For comparison there are typically over 2000 MW of generation offered at prices greater than $0 and a number of market participants that exert control over more than 200 MW of generation. For this reason the MSA believes that in the present circumstances, real-time demand responsiveness on the part of loads is not a sufficient source of pricing discipline. This implies that competition in the Alberta market is largely reliant upon supplier on supplier competition.

This does not mean the MSA will not be supportive of promoting greater means to develop demand response – short of paying load to not consume.[3] The MSA proposes to monitor the evolution of demand response. Demand response may rise (e.g. as the result of new initiatives), fall (e.g. as responsive demand leaves the Province) or be diverted (e.g. a new demand response programs may reduce response in other areas). The overall level of demand response and where it responds will be important to the MSA in assessing how much reliance must be placed on supplier on supplier competition.

At the February 2010 Roundtable it was observed that if the MSA addressed supply-side offer strategy, it should also provide guidance on the appropriateness of similar conduct by load. The MSA interprets this to mean that if it did not object to economic withholding in principle, it should be equally acceptable for loads to adopt countervailing strategies. The MSA believes the answer is yes. The Competition Bureau accepts joint purchasing agreements and buying groups as permissible in instances where the arrangement does not result in monopsony power.[4] Given the concentration

[2] See Section 4 for further discussion on the forward market.

[3] While the concept of paying load is well intended, public programs in other jurisdictions have been costly and inefficient. See Monitoring Analytics, LLC, *2009 State of the Market Report for PJM*, pages 130-32 at http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2009/2009-som-pjm-volume2-sec2.pdf and Ontario Market Surveillance Panel *Monitoring Report, July 2009*, pages 191-97 at http://www.oeb.gov.on.ca/OEB/_Documents/MSP/msp_report_200907.pdf .

[4] See *Competitor Collaboration Guidelines*, Competition Bureau, December 2009, pages 37-40 at http://competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/03177.html#3.10

of ownership among supply, the MSA considers that small combinations of load are unlikely to pose competition concerns. The MSA believes it is reasonable that loads could form buying groups for the purpose of forward market purchases and even in the spot market, where they may possess more market power, there may be no concern. Having said this, the advice of legal counsel and a discussion with the MSA of the specifics of any proposal is always advisable in these matters.

3. Supplier on Supplier Competition

The relatively modest nature of demand response in Alberta means that we place more weight on the effectiveness of supplier on supplier competition. Concerns around competition fall into two categories: unilateral effects and coordinated effects. We address these in turn, followed by a discussion of a range of general indicators and benchmarks of competition.

3.1 Unilateral Effects

Unilateral effects mean the potentially adverse impact on competition of actions by a single market participant. The *Foundational Elements* discussion paper accepts that it is legitimate for market participants to have some freedom in their offer strategies without running afoul of the 'market manipulation' provision of the FEOC Regulation (Subsection 2(j)). A strategy aimed at raising the Pool price through economic withholding or lowering it by offering below cost, is not, by itself, going to be challenged. The MSA accepts that economic withholding is rational profit maximizing behaviour, for example, when a market participant has a long portfolio position (a net seller in the spot market). Similarly, below cost pricing is a rational strategy when the market participant has a short portfolio position (a net buyer in the spot market). In a workably competitive market both strategies are disciplined by the actions of competitors such that there is no expectation that a market participant can exert significant control over market outcomes.

The MSA will monitor behaviour of this kind but only begin to be concerned if there is evidence that the market participant undertook additional actions to prevent or impede competitive response, what is referred to as abusing market power. We are mindful that dynamic efficiency gains are not assured if the price signal is effectively controlled by one or more market participants – new entrants and investment will be dissuaded if they believe prices are only high because of market participant control, reasoning that post-entry the controlling incumbent may set prices at a level that would not enable the entrant to recover costs. Potential entrants may also be deterred if they observe a large amount of capacity being economically withheld. We will closely monitor episodes of this nature to determine whether the pattern of behaviour is consistent with a plausible theory of predation, that is, evidence of sufficient market power to create a barrier to entry for potential competitors.

3.2 Coordinated Effects

Alberta's tight oligopoly structure means the MSA must be vigilant to potential adverse competitive effects termed 'coordinated effects', that is, the risk of coordinated, accommodating, or interdependent behaviour among rivals. Simply put, it is easier to organize anticompetitive behaviour when there is a small number of competitors than when there is a large number. (This is not a statement about the ethical behaviour of the market participants in Alberta but simply recognition of the classic oligopoly structure of the Alberta market where a small number of entities supply most of the market.) In addition, through joint ventures and power purchase arrangements market participants are frequently in contact with one another. These arrangements are fundamental to the Alberta market and satisfy legitimate business purposes. Nonetheless, they may also create avenues for collusion or coordination.

The regulatory framework recognizes this risk, for example by setting bounds on market share offer control and the preferential sharing of non-public information (FEOC Regulation sections 5 and 3 respectively). The Alberta Utilities Commission (AUC) has characterized the rationale for this latter provision in the following terms:

> The sharing by two market participants of their non-public records has the potential to allow collusion and price-fixing by these participants, especially if the two participants have a substantial market share or market power. Such collusion can be harmful to the marketplace as a whole, especially consumers. It is, therefore, incumbent upon the Commission to carefully scrutinize record-sharing agreements in order to maintain the competitive environment that the *Electric Utilities Act* so ardently emphasizes as its goal.[5]

Coordinated behaviour among competitors can run the range from explicit collusion through tacit agreement to 'consciously parallel' behaviour. In what follows we describe how the MSA distinguishes among these types of conduct and what that means for market participants.

Subsection 2(h)(i) of the FEOC Regulation prohibits:

> restricting or preventing competition, a competitive response or market entry by another person, including
>
> (i) a market participant directly or indirectly colluding, conspiring, combining, agreeing or arranging with another market participant to restrict or prevent competition…

[5] Alberta Utilities Commission, *Decision 2010-233,* paragraph 14. See also *Decision 2010-258*, paragraphs 14-15.

In addition to this provision market participants should be aware that the recently amended criminal provision of the *Competition Act* outlaws agreements among competitors to fix prices, allocate markets or restrict output that constitute 'naked restraints' on competition (restraints that are not implemented in furtherance of legitimate collaboration). These categories of agreements are *per* se illegal and subject to significant criminal sanctions, including imprisonment.

In our view, the existence of this criminal prohibition, coupled with our mandate to closely monitor the Alberta electricity markets, should be a deterrent to any participants that might seek to lessen competition by agreement. However, if that is not the case, while each matter will be decided individually, the MSA's general intention is to refer any matters where there is evidence of explicit collusion to the Competition Bureau. Section 45 of the *Alberta Utilities Commission Act* gives the MSA authority to do so and also allow us to collaborate with a Bureau investigation. Should the Director of Public Prosecutions (Public Prosecution Service of Canada) decide to prosecute, the MSA would not seek a remedy from the AUC on the same evidence so participants do not face double jeopardy.

Note also that the MSA will work to support the Competition Bureau's Immunity Program under which businesses or individuals who are first-in may approach the Bureau and request immunity in return for cooperation.[6] If a party involved in a conspiracy to lessen competition in the Alberta electricity market approached the MSA we would facilitate its immunity application process with the Competition Bureau. If immunity is granted the MSA would discontinue its investigation into the activities of the immunity applicant.

Overt conspiracies to lessen competition are extreme forms of behaviour that one would expect would be rare; however, tacit collusion and other forms of less formalized cooperation among competitors also deny Albertans the benefits of competition in our wholesale electricity market and may be illegal. Our view is that tacit collusion is actionable under either subsection 2(h)(i) of the FEOC Regulation or the *Competition Act*. The distinguishing feature from what is known as 'conscious parallelism' is the element of the agreement among the parties involved. We adopt the explanation of the Competition Bureau put forward in its Competitor Collaboration Guidelines.[7]

Cases with evidence of tacit agreements to lessen competition require a more in-depth understanding of the unique nature of the Alberta electricity market. Therefore, our general predilection is not to refer these matters to the Competition Bureau but seek a

[6] *Immunity Program*, Competition Bureau, August, 2009 at http://competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/03155.html
[7] *Ibid*. section 2.2 at page 10.

remedy from the AUC and / or identify changes in the market framework that makes these arrangements less tenable.

Should we take a case under subsection 2(h)(i) of the FEOC Regulation to the AUC, in our view, we would be required to prove only two elements: 1) an agreement between or among market participants, and 2) that the agreement is directed at restricting or preventing competition, competitive response or market entry. To satisfy the first element we would have to show the classic 'meeting of the minds' among the parties. In the case of tacit collusion this would be discharged if the AUC is able to infer an agreement from evidence of a course of conduct, with or without direct evidence of communication among the parties. To establish the second element, we take the view that all that is necessary is to show that the evidence is consistent with the intent to restrict or prevent competition, competitive response or market entry and inconsistent with competitive behaviour.

Some of the conditions under which coordinated behaviour could be sustained appear to exist in our spot market. These include:

- The single clearing price of the spot market enables suppliers to mutually recognize the benefits of coordination;
- The relatively high degree of offer transparency close to real time allows conduct to be monitored and deviations detected;
- Market participants may be able to exert a credible deterrent mechanism by offering at very low prices or importing to suppress price;
- Lack of external factors may that threaten coordination, e.g. the small number of market participants that are actively engaged on re-pricing offers and the weak demand response.

Detection of tacit collusion is difficult but not impossible. Evidence of 'tacit collusion' may come from instances where a market participant repeatedly forgoes short run opportunities for individual profit maximizing (where lowering offer prices would increase dispatch and hence profits) in order to maximize collective profits. Other evidence of tacit collusion may come from instances of 'deterrence' where one supplier demonstrates to others that there is a cost associated with pursuing an individual profit maximizing strategy. Academic research has also commented on and provided direction on the detection of tacit collusion.[8]

In summary, monitoring the competitive health of the market and, in particular, whether supplier on supplier competition is vigorous or one or more market participants are able to exert significant control is the core responsibility of the MSA.

[8] Sweeting, A, *Market Power in the England and Wales Wholesale Electricity Market 1995-2000*, The Economic Journal, 117(520), April 2007.

Should we identify a concern, a range of remedies tailored to the circumstances is available to the MSA, as outlined above.

In the remainder of this section we review a variety of metrics that we intend to pursue to support our analytical framework. The primary intent is to understand the health of competition, although some metrics may also be effective in spotting abusive or manipulative actions and illegal coordinated behaviour. Our toolkit is not complete and we plan to continue to refine the measures and develop other indicators over time.

3.3 Market Concentration

3.3.1 Market Shares

Section 5 of the FEOC Regulation requires that the MSA at least annually publish market share offer control metrics. Beyond the requirements laid out in the Regulation, monitoring changes in concentration through market shares may provide other benefits. The MSA believes market share measures may not fully reflect the competitive significance of firms in the market. They may be more useful in conjunction with other evidence of competitive effects (for example, economic withholding) as a health check on competition.

Theory suggests that in an energy-only market economic withholding should, over time, be self correcting (i.e. short term static inefficiencies send signals to induce long term efficiencies).[9] Economic withholding by a large generator adversely impacts the efficiency of dispatch and hence results in a loss of productive efficiency. While this strategy is profit maximizing for the large generator it also creates an opportunity for smaller generators to achieve greater dispatch and benefit from the higher price (without incurring the opportunity cost associated with withholding). If investment by other generators does not occur in the face of persistent withholding then that may indicate that some aspect of the market structure is a cause for concern. Similarly, it would be surprising for a large generator who frequently withholds to build new capacity; however, such a generator might find it to be individually profit maximizing to purchase pre-existing capacity with the intent of increased withholding.

The MSA observed in 2006 that market concentration appeared to be increasing.[10] While the level of concentration is important, markets may be very competitive if market shares fluctuate substantially over short periods of time. Such fluctuations may be unusual in electricity markets given the nature of generation investment but the early years of deregulation did see the emergence and rapid growth of new market participants. Similar dynamics appear unlikely to be repeated in the near term.

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[9] See *Report on Competitive Bidding Behavior in Uniform-Price Markets*, Peter Cramton paragraphs 53-55, at http://www.cramton.umd.edu/papers2000-2004/cramton-bidding-behavior-in-electricity-markets.pdf.

[10] See *Market Concentration Metrics*, Market Surveillance Administrator, November 2006 at http://www.albertamsa.ca/files/Market_Concentration_Metrics.pdf

Some variants of the market share metric described in the FEOC Regulation are possible that may provide additional insight, for example:

- by fuel type
- by dispatchable capacity
- by active competitors (e.g. those who actively pursue re-pricing strategies close to real time).

Outcomes inconsistent with the predictions of theory would warrant further examination as to whether barriers exist for new generation. The MSA is also interested whether the predicted theoretical response will occur in a timely manner. Finally, we note that monitoring trends in market shares can be done relatively efficiently with little or no additional burden on market participants.

3.3.2 Pivotal Suppliers

In 2006 the MSA published a report entitled *Market Concentration Metrics*. In this report the MSA included a description of a variety of pivotal supplier metrics. A supplier is said to be 'pivotal' in a given hour if by withdrawing supply under its control there would be insufficient remaining supply to satisfy demand. The hypothesis behind this test is that a supplier who is either pivotal or close to being pivotal would be able to influence the outcomes in the market.

Pivotal supply only measures the ability to raise prices in the spot market.[11] A market participant's incentive to raise price will depend upon the level of fixed price forward sales (i.e. portfolio position). A market participant without a long portfolio position has little incentive to use its pivotal status. Combining fixed price forward sales/purchases with a measure of pivotal supply (sometimes described as 'net pivotal') can thus measure the incentive and the ability to raise prices, i.e. a market participant without a long portfolio position has little incentive to use its pivotal status. 'Net pivotal' metrics are limited by the fact that no participant knows with certainty the exact level of its pivotal position (it may depend on dispatch and changing load obligations). Nevertheless this is relevant information that the MSA may request from time to time from market participants on an ex-post basis when it has identified a concern.

Tests for a 'pivotal supplier' are typically conducted using historic supply and demand data, taking into account unit outages and other supply constraints (such as reduced capability for imports). A variety of 'pivotal supplier' metrics used in other markets are

[11] The MSA is not aware of an equivalent pivotal metric that has been considered for the ability and incentive to suppress prices. In theory, construction of such a metric is possible but it may have limited value in understanding competition. The reason for this is may be that while market participants may have an incentive to suppress prices (i.e. a short portfolio position) their ability to do so and the potential gains may be much more limited.

summarized in Appendix A. In 2006 the MSA used variants of the Residual Supply Index (RSI) based on energy offers and total declared energy. Given ISO rule changes since that time the MSA would likely base future measures on 'available capability' in the merit order.

We believe that pivotal supplier information is interesting and relevant for assessing the state of competition in the market. It is not determinative by itself and the MSA would not intervene solely on the basis of this metric.

3.4. Intertie on Generator Competition

'Intertie on Generator' competition is a just a special case of supplier on supplier competition. In the MSA's view it is very important in shaping competition, since the set of importers / exporters on the interties are often different from those with generation assets in Alberta. In 2005 the MSA introduced guidance around intertie conduct where unusually high export loss factors were thought to impede competitive response. That guideline was reviewed in 2008 following changes in market rules and set to be less restrictive.[12]

One speaker at the MSA's February 2010 roundtable raised the view that that intertie conduct and the existing guideline should be re-considered in light of the current consultation. The MSA is inclined to agree and proposes to rescind the guideline. Conduct on the intertie will be judged on the same basis as conduct by in-province generators and not be subject to additional requirements. If the MSA were to maintain its current intertie conduct guideline it would be natural to consider whether similar restrictions should be placed on in-province generation. On balance the MSA believes this would be counter-productive and impede competition.

The MSA is aware that some market participants view out of province market participants related to Crown corporations as competing on an uneven playing field. We note that Section 3 of the Power Purchase Arrangements Regulation prevents provincial governments or related persons from holding interests in power purchase arrangements, but we are not aware of other restrictions on their participation within the Alberta market. The MSA believes out of province participants are important contributors to efficiency and should be judged on the same standard as in-province generators.

We propose to continue to monitor the efficiency of intertie flow and market participant conduct on the intertie. Should we find market outcomes deteriorate as a result of removing the guidance we will share that observation. In preference to restoring the guideline we will examine whether changes to market rules could resolve the problem and if so advocate for those changes.

[12] *Intertie Conduct,* Market Surveillance Administrator, July 2008 at http://www.albertamsa.ca/files/Intertie_Conduct_Guideline_071408(3).pdf

3.5 Competitive Benchmark Analysis

3.5.1 Assessment of Long Term Build Signal

In the *Foundational Elements* paper the MSA presented some simple estimates of the net revenue accruing to hypothetical generators. The MSA has in the past also provided similar analysis and commentary in its *Quarterly* and *Year in Review* reports. The MSA continues to believe that these assessments provide a useful health check on the market. The MSA is considering some variants of this approach:

Actual vs. Hypothetical Revenue - Monitoring Analytics, LLC, the independent market monitor for PJM conducts a net revenue assessment for generators across all markets (energy, capacity and ancillary services).[13] In the context of the Alberta market the MSA could examine revenue adequacy from energy, ancillary services, dispatch down service and payments to suppliers on the margin for specific generators on the system. If the MSA pursued this approach, publishing of results would be sensitive to concerns that individual market participant's revenue streams might be identifiable.

Focus on Long Run Marginal Cost – It has been suggested that market monitors might focus less on isolated price spikes and more on how prices over longer time periods are related to long run marginal costs.[14] Spot prices systematically higher than long run marginal cost would suggest that competitive forces are not effectively disciplining the spot market. The MSA sees merit in this approach and in extending it to examine the relationship between forward prices and long run marginal cost. Estimating the appropriate benchmark for long run marginal cost would require similar information to the 'net revenue' calculations described above.

Cumulative Contribution to Fixed Costs - A similar / equivalent idea to the above is to adapt a cumulative price threshold test to be a ongoing reporting of 'net revenue' for a peaking generator unit, i.e. show rolling returns vs. benchmark.

3.5.2 Assessment of Short-term Efficiency Losses and Impact of Offer Behaviour

Despite the MSA's focus on the importance of dynamic rather than static efficiency the MSA still plans to estimate and report static efficiency losses. We note that the assessment of market power abuse involving the Public Utilities Commission of Texas and TXU used a combination of information around the pivotal nature of TXU and a

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[13] Monitoring Analytics, LLC, *State of the Market Report for PJM, Q1, 2010,* page 49 at http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2010/2010q1-som-pjm.pdf

[14] See the notes of Stakeholder comments at the February 2010 MSA Roundtable meeting http://www.albertamsa.ca/files/Round_Table_Notes_-_100218DRAFT.pdf and also the Trebilcock/Yatchew submission to Ontario's Market Surveillance Panel at http://www.oeb.gov.on.ca/documents/msp/market_power_framework/submissions/market_power_framework_comments_opgtrebilcock_20070509.pdf, p.19-20.

simulation substituting TXU's offers for ones based on short run marginal cost. Some further details of the TXU case are provided in Appendix B.

It is the MSA's view that 'cost-based' simulations have limited relevance to the Alberta market. Simulation and impact tests may have other uses, for example, examining whether differences between a market participant's strategy between times at which they are pivotal and times at which they are not is important in determining outcomes. As part of the Market Abuse Licence Condition introduced in the U.K., the regulator, Ofgem, considered one kind of 'abuse' to be when a participant:

> (c) pursues discriminatory pricing policies by determining wholesale prices for electricity that differ unduly between times when market demand and cost conditions are otherwise similar."

This is not dissimilar to some of the discussions at the Section 6 committee that sought to view consistent offers more favourably than inconsistent ones.[15] Ofgem had limited experience in applying the Market Abuse Licence Condition since it was removed for all generators following a decision of the U.K. Competition Commission (for further details see Appendix C).

The MSA thinks tests for offer consistency or offers that differ 'unduly' may be useful only in very limited circumstances. An approach to enforcement or monitoring that promotes consistent or static strategies from hour to hour is unlikely to be consistent with the promotion of vigorous competition. Over a longer time horizon such an approach may be useful in determining the extent to which factors other than fundamentals influence outcomes.

In summary, the MSA intends to employ a variety of market metrics. No one is determinative but together they will be helpful in monitoring the state of competition in the Alberta markets.

4. Forward Market Competition

Overall the MSA is less concerned with conduct in the forward market than in the spot market. Structurally the market has a number of features that promote competition:

- The number of active buyers and sellers is relatively large in comparison to the spot market;
- Costs of entry and exit for new participants may also be lower than in spot market;

[15] Alberta Electric Utilities Act (EUA) Section 6 Committee Phase II Report at http://alberta.raabassociates.org/Phase%20II%20Final%20Report.pdf

- Forward market prices beyond the near term may be insulated from the exercise of market power by the possibility of new build.[16]

At the February 2010 roundtable, one speaker expressed the view that overall efficiency of the market would be increased if market participants managed their risk within the market rather than self insuring by building their own capacity. To the extent that managing risk within the market comes at lower cost than building capacity the MSA would expect profit maximizing market participants to seek out those opportunities. Since there is a clear incentive to seek lower cost outcomes the MSA sees no need to interfere with market forces.

More broadly, the MSA will continue to monitor liquidity and consider whether enhancements could be made. The MSA believes gaining a greater understanding of the product offerings in the contract market and the nature of impediments to trade can shed light on the nature of competition and relieve the spot market from excessive scrutiny.

5. Summary and Next Steps

This document and the first discussion paper, *Foundational Elements*, should be read as one. Together they communicate the MSA's focus on promoting competitive solutions in Alberta energy markets. Market participant offer behaviour will be viewed through the lens of its contribution to dynamic efficiency. The MSA will be a staunch defender of *fair, efficient, and openly competitive markets* and it will take action if it believes market participants are abusing their market power or acting in consort to undermine competition. It will also, on a routine basis, identify and recommend changes to policy makers designed to enhance competition.

After absorbing the comments of stakeholders on the MSA discussion papers, both written and those delivered in meeting(s), we intend to release a draft document for comment that we will formalize as a guideline under subsection 39(4) of the *Alberta Utilities Commission Act*.

[16] In the near term, market participants that believe they will be able to exercise market power in the real time market may be disinclined to sell at prices that do not reflect the possible future exercise of market power.

Appendix A: Pivotal Supplier Indices

Index	Definition	Critical value indicating pivotal supplier
Residual Supply Index (RSI) – California	$RSI_j = \frac{(CAP_{tot} - CAP_j)}{LOAD}$ where: CAP_{tot}= total capacity (including imports) CAP_j=capacity of supplier j LOAD = total load (including exports)	RSI<1
"Must-Run-Ratio' (MRR) – New England	$MRR_j = \frac{LOAD - (CAP_{tot} - CAP_j)}{CAP_j}$	MRR>0, >0.2 suggested as the basis for mitigation
Supply Margin Assessment (SMA) - FERC	$SMA_j = CAP_{tot} - LOAD - CAP_j$	SMA<0
Capacity Surplus Index (CSI) – FERC	$CSI_{j,t} = (CAP_{tot,t} - CAP_{j,t}) - (PO_{tot,t} - PO_{j,t}) + \min(UCAP_t, TTC_t) - LOAD_t$ where: $CAP_{tot,t}$ = total capacity (including imports) at time t $CAP_{j,t}$ =capacity of supplier j at time t $PO_{tot,t}$ = planned outages of all suppliers at time t $PO_{j,t}$ = planned outages of supplier j at time t $UCAP_t$ = uncommitted capacity available for import $TTC_{j,t}$ = total transmission constraints at time t $LOAD_t$ = total load (including exports) at time t	<=0
Dominant capacity reserve ratio*	$\frac{CAP_j}{(\text{reserve} + \text{import capacity})}$	Values <1 indicate withdrawal of dominant firms capacity
Minimum Number of Pivotal Suppliers (NPS) **	$\min_{NPS} CAP_{tot} - \sum_{j=1}^{NPS} CAP_j$	Numeric
HHI measure of number of pivotal suppliers (HHI_{PS}) **	$HHI_{PS} = 10000 * \sum_{j=1}^{NPS} \left(\frac{CAP_j}{CAP_{PS}} \right)^2$ where: CAP_{PS} = total capacity of the minimum number of pivotal suppliers	Suggested ranges similar to conventional HHI

Source: Eakin, K., Morey, M, (2004), *Preliminary Blueprint for Addressing Market Power Issues*, Laurits R. Christensen Associates, Inc.

* Source Newberry (2002)

** These metrics were proposed by Laurence D. Kirsch in a submission to the U.S. Federal Energy Regulatory Commission. For further details see *Comments of American Public Power Association and Transmission Access Policy Study Group on Market Power, Market Monitoring, and Market Mitigation Issues in Supply Margin Assessment and Standard Market Design, October 23, 2002*. Accessed at http://www.tapsgroup.org/sitebuildercontent/sitebuilderfiles/appatapssmasmdcomments.pdf

Appendix B: Case Study - Public Utilities Commission of Texas and TXU

In Texas possession of market power is not, in and of itself a violation of the *Public Utility Regulatory Act*. Rather, the Act prohibits actions by a person with market power that tend to unreasonably restrict, impair, or reduce competition, and should the Commission determine that such abuse has occurred, then mitigation of the market power is required.

In 2007 Potomac Economics, acting as the Independent Market Monitor, investigated the impact of TXU's offers on balancing market energy prices in 2005. The report stated that:

> When TXU offers its capacity at well above short run marginal costs, TXU expects that its offer strategy will raise the MCPE enough to compensate it for any foregone sales Given the frequency with which TXU is pivotal, and the historical information available to TXU on offer patterns and deployments in the balancing energy market, this is a reasonable expectation because TXU could foresee that economically withholding significant quantities would be likely to result in higher balancing market price.[17]

The impact of TXU's offers were estimated by "balancing energy market simulations substituting the non-competitive offers with offers at prices that reflect our estimates of the short-run marginal costs of TXU's online generating units."[18] Based on this simulation the impact on price from TXU's offers was estimated to be 11.4%.[19] TXU was found to be 'pivotal in 84.3 percent of the 657 price spike intervals during the Study Period'. These two results led to a conclusion that TXU had an ability to significantly affect prices. The assessment also examined the TXU's incentives, finding it was a substantial net seller during the period. The matter was ultimately settled through an Administrative Penalty of US$15 million.[20]

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[17] Revised Investigation of the Wholesale Market Activities of TXU from June 1 to September 30, 2005, Potomac Economics, p 23; September 2007.
[18] Reference
[19] The initial estimate of a 15.5% was revised in September 2007 (http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/34061_105_562337.PDF)
[20] http://interchange.puc.state.tx.us/WebApp/Interchange/Documents/34061_233_604613.PDF

Appendix C: Case Study - United Kingdom: Ofgem and the Market Abuse Licence Condition

In 1999-2000 Ofgem (and its predecessor Offer) instituted a 'Market Abuse Licence Condition'. This proposed licence changes for initially seven generators such that:

> The Licensee shall not engage in conduct, whether alone or with one or more other undertakings, which amounts to an abuse of a position of substantial market power in the determination of wholesale prices for electricity under the relevant trading arrangements.[21]

Abuse was said to fall within three areas:

> (a) acts in such a way as materially to prejudice the efficient and economical balancing of the transmission system;
> (b) without good cause limits generation or capacity availability in such ways as materially to increase wholesale prices for electricity; or
> (c) pursues discriminatory pricing policies by determining wholesale prices for electricity that differ unduly between times when market demand and cost conditions are otherwise similar.

Clause (c) above is the perhaps the most interesting since it proposed that a breach of the licence condition would occur "if a company substantially varied the mark-up of bid prices on costs as between periods when market conditions were otherwise similar. Whether or not such conduct would amount to a breach of the MALC would depend, among other things, on the extent of the effects of such conduct on Pool prices."[22]

Note that the licence condition amendment was accepted by some generators and challenged by others in front of the U.K. Competition Commission (CC). The CC ultimately rejected and Ofgem subsequently removed the condition for all generators. The CC has noted:

> In part, the CC's reasons for rejecting the application related to the specific circumstances of the two referred generators. Other reasons were more generic. The CC noted that decreasing

[21] *The Market Abuse Licence Condition for Generators: A Decision Document,* U.K. Office for Gas and Electricity Markets, April 2000 at http://www.ofgem.gov.uk/About%20us/Archive/The%20market%20abuse%20licence%20condition%20for%20generators%20A%20decision%20document%201404.pdf

[22] http://www.competition-commission.org.uk/rep_pub/reports/2001/fulltext/453c4.pdf, p.90

> concentration in the sector made market power less likely, even at peak times, and that the NETA [New Electricity Trading Arrangements] made manipulation of specific rules less likely to succeed. The CC also had concerns about the effect of such a power, stating that the MALC 'would cause uncertainty, because of the difficulty of distinguishing between abusive and acceptable conduct, and would risk deterring normal competitive behaviour.[23]

The CC also noted in its 2008 review that since the rejection of the Market Abuse Licence Condition, market concentration has fallen and the market has experienced overcapacity. In the CC's view these developments have not fully tested the need for MALC and that experiences elsewhere would support Ofgem's view that powers might be necessary in some circumstances.

[23] *Evaluation of the Competition Commission's Past Cases*: *Final Report*, January 2008, pages 7-8, at http://www.competition-commission.org.uk/our_role/analysis/evaluation_report.pdf,