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MSA REPORT

Market Concentration Metrics

1 November, 2006

MARKET SURVEILLANCE
ADMINISTRATOR

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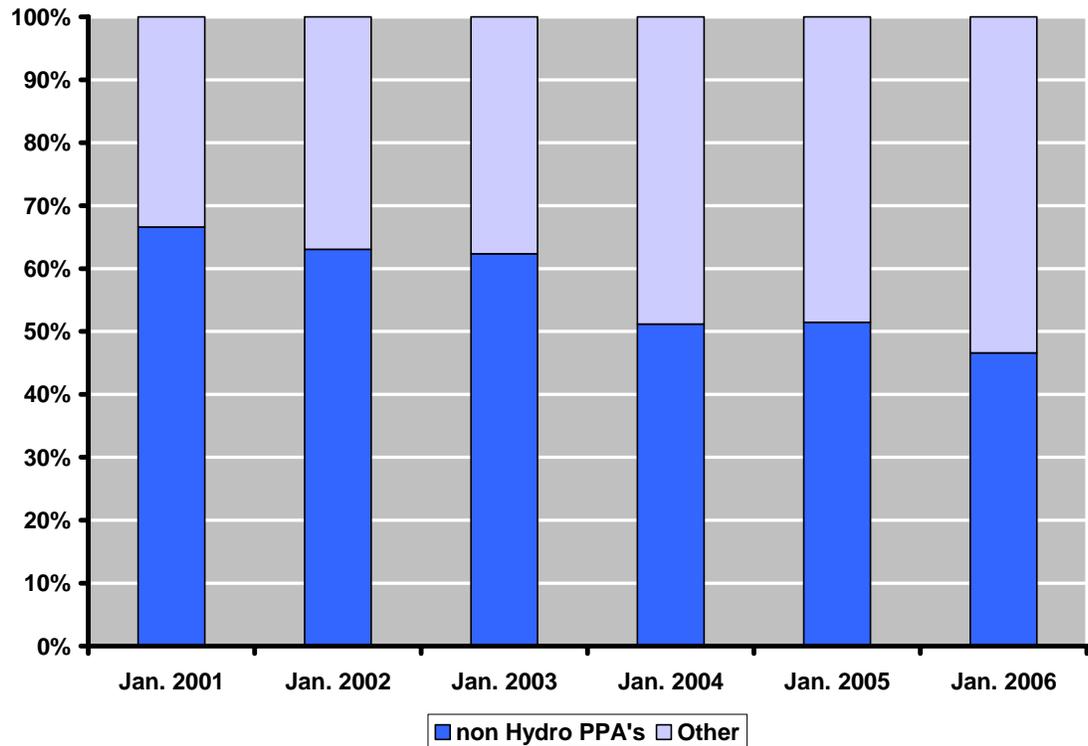
1 INTRODUCTION

The MSA has a mandate to monitor the Alberta market to ensure that it operates in a fair, efficient and openly competitive manner. In the early stages of restructuring the electricity system in Alberta, it was recognized that the size of the three major incumbents would provide a barrier to the development of a competitive market. Accordingly, it was decided to auction off the rights to the output of the previously regulated units through Power Purchase Arrangements (PPA's). As a result of the PPA auctions and subsequent additions of generation a number of new participants have entered the Alberta market. The resulting 2006 market is far less concentrated than that which existed in 2000. It is the MSA's view that this less concentrated market structure has been an important contributor to the development of a *fair, efficient and openly competitive* market.

As part of the initial PPA auctions, holding restrictions were placed on PPA capacity that in part, allowed no participant to hold more than 1390MW (20%) of PPA capacity. These restrictions were due to expire and/or be reviewed in April 2006.¹ In June 2005 the Department of Energy released a paper entitled *Alberta's Electricity Policy Framework: Competitive-Reliable-Sustainable* that acknowledged holding restrictions based on PPA capacity alone may be deficient in restricting the accumulation of control of capacity. Supporting this view, Figure 1.1 shows that the proportion of PPA capacity has declined steadily from 2001 due to asset additions and the end of some of the PPA's.

¹ The restrictions on holding PPA capacity were subsequently modified to their present form in Fall 2005.

Figure 1.1: PPA Capacity as a Proportion of total installed capacity (2001-2006)



Given this background, this report provides a survey of concentration metrics commonly used by market monitoring agencies and competition authorities around the world. Using these metrics we consider the Alberta market and the changes in capacity control and overall market concentration over the last few years. It is the MSA's view that lack of concentration can contribute in a significant way to the development and maintenance of a *fair, efficient and openly competitive* market. It is also the view of the MSA that within some bounds a concentrated market can remain competitive – however to do so, may require additional safeguards, rules and/or surveillance and enforcement tools. The MSA feels that given recent and pending changes in asset control, that this is an appropriate time to provide this information to the market. Also, the report may be useful to the discussions concerning the development of principles to clarify the intent of Section 6 of the Electric Utilities Act (EUA) - a first step in moving forward with consultation, development and implementation of an approach to mitigate potential market power abuse in the Alberta electricity market.

The report considers a number of metrics which examine different ways of assessing market concentration. The metrics in this report are viewed by the MSA as useful indicators but no one metric provides a complete picture. The metrics do suggest that in recent years concentration has increased but remains significantly below its level in 2000 (prior to the PPA auctions). Further, these

metrics do not provide insight into participant behaviour, only the potential to abuse market power.

Section 2 describes three kinds of metrics that examine the concentration of generation control. In Section 3 we present a brief summary of the MSA view that continued monitoring of these and/or other concentration metrics presents useful insights into the potential competitiveness of the Alberta electricity market.

2 GENERATION CONCENTRATION METRICS

In the Alberta market, primarily due to the existence of the PPAs and joint ownership of some generation it is important to recognize that control of offers (meaning the setting of offers into the Alberta Pool) for generating assets is distinct from actual ownership. Control over offers may provide a participant with ability to exercise market power whereas the participants overall position (determined by their economic interest in generation and load as well as financial positions from forward sales and purchases) may provide the motivation to exercise market power. Any participant may generate significant long or short *financial* positions in the market, that lead to natural motivations to prefer high or low Pool prices and these positions may change significantly over time. In the course of its general monitoring the MSA does not collect data on a participants financial position. Control over offers changes less frequently and is the focus of the metrics presented in this report. The MSA is aware of who controls the offers of most of the generating units in Alberta, but not all. In some cases, we have come to understand the relationships amongst several firms owning the asset (or rights to the asset's output) and have assigned the control of capacity accordingly.

In Appendix A we give a summary of the major generating assets currently operating along with the corresponding participant names based on publicly available data. The assignment of assets to participants used in this report differs from this listing where there are aggregation agreements or multiple participant names are under the effective control of a single participant.²

In this Appendix, we also present a table summarizing the major additions, changes in control and retirements in the Alberta market between 2000 and 2006.

In this section we estimate three kinds of metrics that examine different aspects of the concentration of generation control:

- Herfindahl-Hirschman Index (HHI)
- a variant of the Residual Supply Index (RSI)
- Price setting share

2.1 Herfindahl- Hirschman Index (HHI)

Herfindahl-Hirschman Index (HHI) is a very commonly used measure of market concentration in many industries. It is defined as the sum of squares of the percentage market share of each firm, or more formally in a market with N firms as:

$$HHI = \sum_{j=1}^N (q_j)^2$$

where : q_j = percentage market share of j th firm

² The differences are described more fully in Appendix A.

In a pure monopoly, i.e. a single firm, the HHI is 10,000. In a market with 100 equal size firms the HHI is 100. In a market with very many firms the HHI approaches zero. Since HHI is relatively easy to calculate it is often favored as an early or initial screen for assessing overall competitiveness. In considering competitiveness and merger activity, HHI is also sometimes used in conjunction with other simple concentration measures, such as market shares of merging firms and/or concentration ratios (typically CR-3 or CR-4, the total market share of the 3 or 4 largest firms).

Appendix B provides more details on the use of market shares and HHI by competition authorities in Canada and the US. In summary, the US Department of Justice considers HHI values below 1000 to indicate a lack of concentration and unlikely to have adverse competitive effects, values between 1000 to 1800 to indicate moderate concentration and values above 1800 to indicate markets with high concentration. HHI increases of more than 100 points in moderately concentrated markets or more than 50 points in highly concentrated markets are seen to raise ‘significant competitive concerns’.

In estimating HHI we can consider different ways of measuring market share (e.g. actual generation or installed capacity) and different market definitions (e.g. considering generation by geographical area and/or by fuel type).

Figure 2.1 shows an estimate of HHI based on yearly **generation data** from January 2000 to the end of May 2006. The generation of units has been allocated to participants based on an assessment of offer control.³ Assets under the control of the Balancing Pool or under the control of strip holders have been assumed to represent diverse ownership (i.e. add no points to HHI).⁴

Figure 2.2a shows estimates of HHI based on the **maximum continuous rating (MCR)** of units in January of each year, from 2000 - 2007. The capacity of units has been allocated to participants based on an assessment of offer control. For 2007 we have estimated a range of HHI values based on changes in asset control that have occurred between January 2006 and October 2006 (including the announced long term tolling arrangement for the Calgary Energy Centre), as well as one possible change in asset control that may occur during 2007 (the sale of the Geneses 1 & 2 PPA). Assets under the control of the Balancing Pool or under the control of strip holders have been assumed to represent diverse ownership (i.e. add no points to HHI). Figure 2.2b-d show the HHI calculated considering generation by different fuel types: coal fired generators (Figure 2.2b); gas-fired generators (Figure 2.2c); and both coal and gas fired generators but excluding hydro generators (Figure 2.2d).

³ For obvious reasons no control has been assumed for wind generation. For units that are offered through aggregators we have estimated the number of MWh assumed to have been controlled by each participant. While we view ‘offer control’ as a useful measure it does have some limitations in that it does not easily distinguish other constraints on the operation of generation (e.g. requirements imposed by a steam host on a cogeneration unit).

⁴ Making an alternative assumption that assets under Balancing Pool control and PPA strips are treated as a single participant the values for HHI between Jan 2001 and Jan. 2006 are higher but follow a similar trend.

The different approaches to assessing HHI as all have some merit. An HHI assessment based on MWh of actual generation (Figure 2.1) is preferable in that it applies lower weight to less efficient generation that may be available or economic only infrequently and also lower weight to energy constrained units (such as hydro). An HHI assessment based on control of capacity (Figures 2.2a-2.2d) may be preferable in assessing future competitiveness, since it is less dependent than actual generation on the historic supply/demand balance. In selecting the appropriate measurement of market share the Competition Bureau prefers measures that are likely to be a good indicator of future competitive significance.⁵ A measure based on control of capacity may also provide a better indicator of potential market power during critical times when supply is tight and all or almost all capacity is required.

Assessments based on fuel type further provide insight into the potential for competition in various parts of the merit order. For example, during hours when prices are below an implied market heat rate of about 6, dispatchable capacity at gas-fired generators is unlikely to run. At these times, prices are likely to be set by competition amongst coal generators and the HHI displayed in Figure 2.2b may provide the most insight into competitiveness.

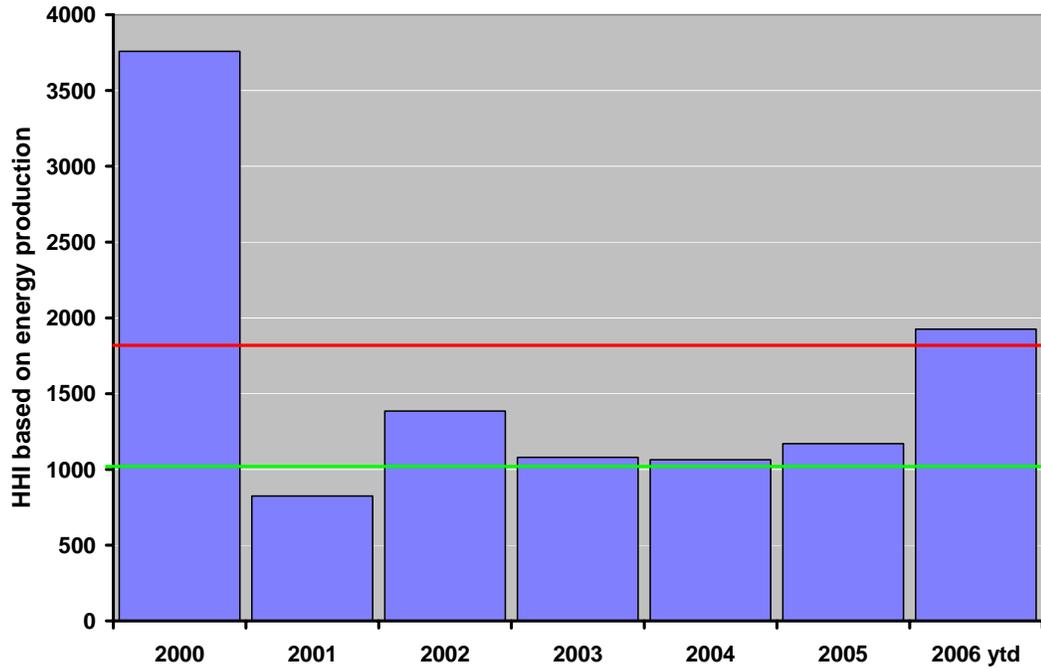
In reviewing the estimates of HHI we note that the PPA auctions resulted in a dramatic reduction in concentration with most of the resultant estimates of HHI falling to below 1000.⁶ The observed increase in overall and coal HHI in 2002 is largely as a result of transfer of ownership of the Sundance 3 & 4 PPA. New gas generation, including cogeneration, contributed to downward pressure on HHI in 2002 and 2003 (most evident in Figure 2.2c). The re-concentration of gas in Jan 2006 shown in Figure 2.2c is largely due to the decommissioning of units at Clover Bar.⁷ The HHI in later years increases due to the end of Wabumun PPA (2003), commissioning of Genesee 3 (March 2005) and sale of the Sheerness PPA (January 2006). The various estimates of HHI in 2006 are all higher than in any year since 2000 and based on the ranges adopted by the US Department of Justice all indicate either 'moderate' (between the 'red' and 'green' lines) or 'high' concentration (above the 'red' line).

⁵ See Appendix B for further details on the Competition Bureau's approach to using HHI.

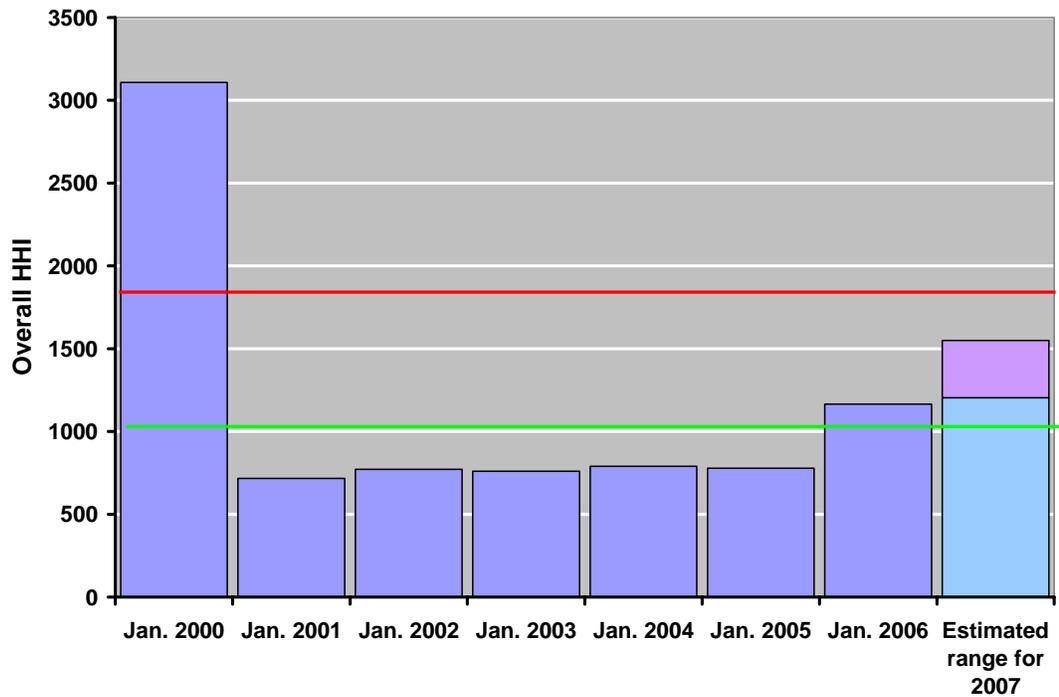
⁶ The exception being the estimate of coal HHI in Figure 2.2 which fell below 1500.

⁷ This has less impact on the HHI based on energy production (Figure 2.2a) given that in prior to decommissioning Clover Bar units were generating infrequently.

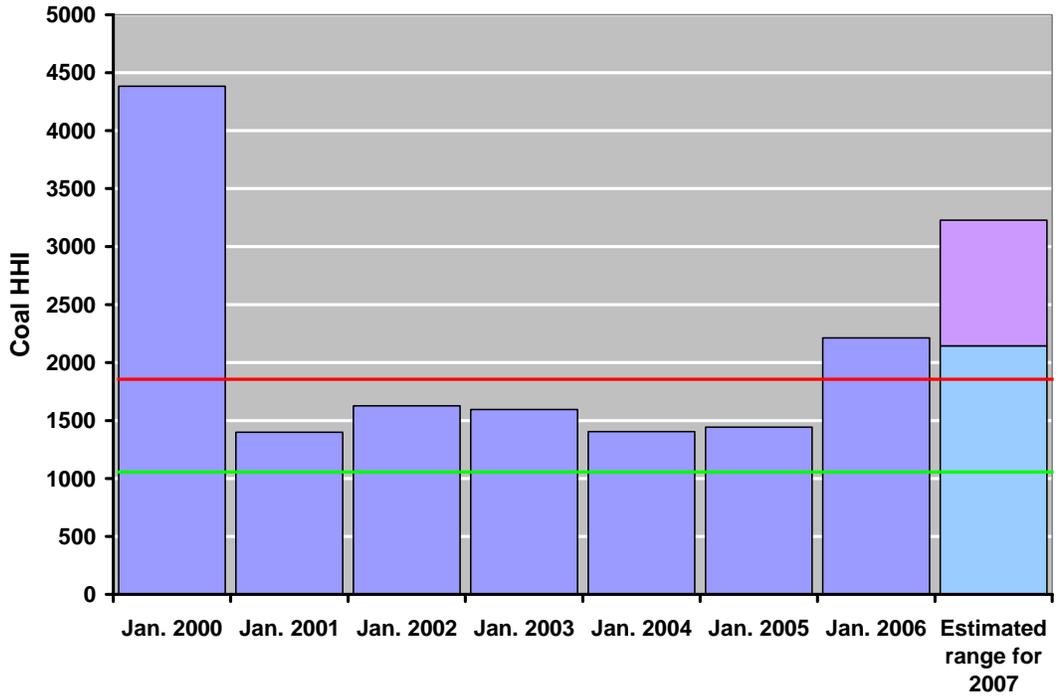
**Figure 2.1: HHI based on annual generation (MWh) 2000-2006 year to date
All assets assigned on the basis of offer control**



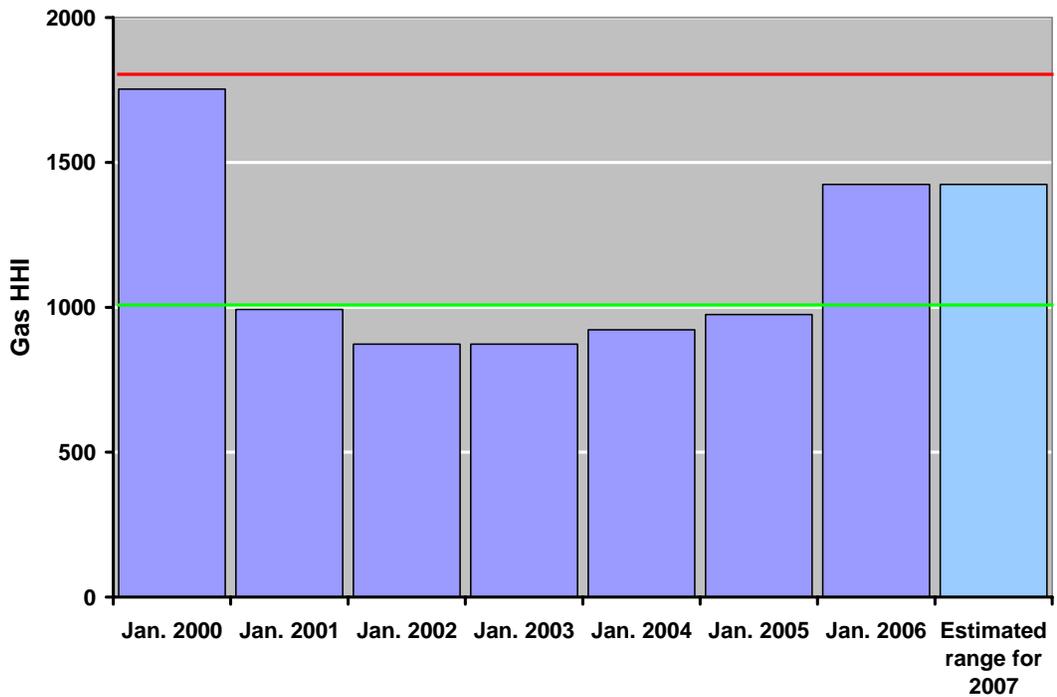
**Figure 2.2a: HHI based on capacity control for 2000-2007 (estimated)
All assets assigned on the basis of offer control**



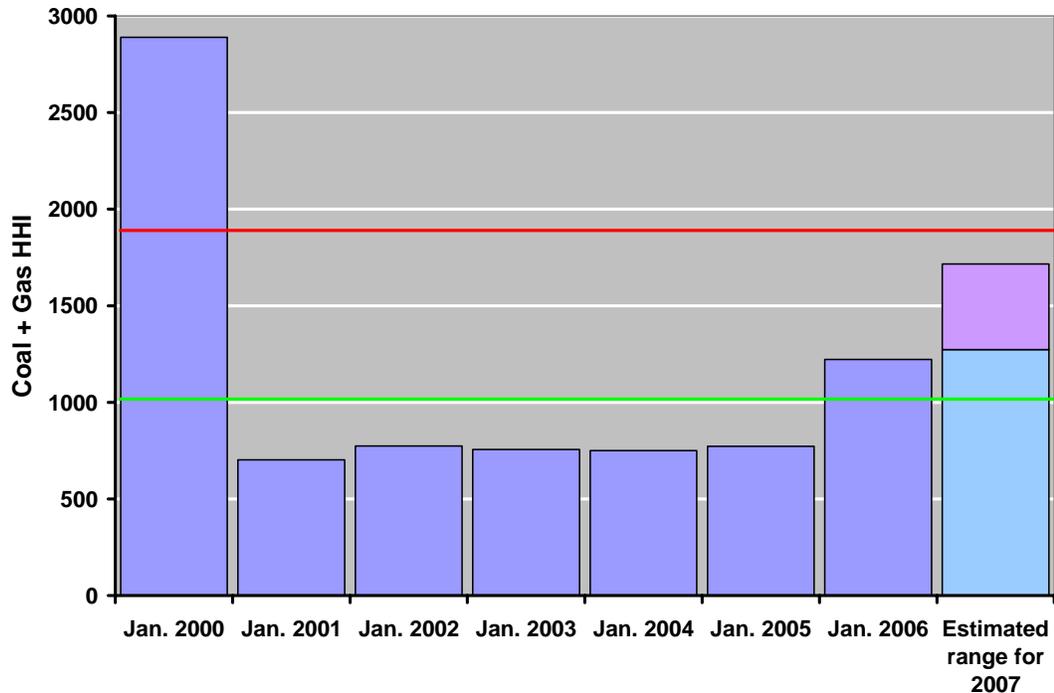
**Figure 2.2b: HHI based on capacity control for 2000-2007 (estimated)
Coal generation assigned on the basis of offer control**



**Figure 2.2c: HHI based on capacity control for 2000-2007 (estimated)
All Gas generation assigned on the basis of offer control**



**Figure 2.2d: HHI based on capacity control for 2000-2007 (estimated)
Coal and gas generation assigned on the basis of offer control**



2.2 Pivotal Supplier Tests

Critics of HHI have indicated a number of problems with the application of HHI in electricity markets in that it may not be a good measure of concentration in the presence of congestion or when there are other short-term supply constraints. Also, HHI makes no reference to the level of demand for the market product. Alternate measures have been proposed that examine whether there exists a ‘pivotal supplier’ (or group of pivotal suppliers). 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. Tests to see whether a ‘pivotal supplier’ exists are typically conducted using historic supply and demand data, taking into account unit outages and other supply constraints (such as reduced capability for imports). Appendix C presents a summary of different pivotal supplier tests that have been proposed.

For illustrative purposes we have estimated a variant of the Residual Supplier Index (RSI) defined as:

$$\text{Residual Supply Index for participant } x = \frac{\text{Total Supply} - \text{Supply controlled by participant } x}{\text{Demand}}$$

An RSI of less than 1 indicates that the participant's supply is needed to meet demand (i.e. the participant is 'pivotal'). Values close to one indicate that the participant is close to pivotal.

Estimating 'supply' in the Alberta market presents some difficulties given the choice afforded to participants in a given hour as to whether to offer in the energy market.⁸ Consequently, we estimate supply in two ways, firstly based on 'total declared energy'(TDE)⁹ and secondly based on volumes offered in the merit order. In both cases we make adjustments for 'behind-the-fence' generation at industrial sites, potential supply from imports and non-offered supply (such as actual wind generation). In some cases, tests for 'Pivotal Suppliers' are adjusted to reflect only uncommitted capacity (e.g. to account for volumes not committed to long term sales). As an example, FERC's indicative market power screens are based upon an assessment of uncommitted capacity (see Appendix D for further details on FERC's indicative screens). Data on long term sales agreements in Alberta is not readily available and consequently we have estimated RSI without distinguishing between committed and uncommitted capacity.

Values for the RSI for 5 participants are presented in the Figure 2.3 and 2.4 for the period January 2005 to May 2006. For each participant we have estimated control of assets as of June 2006. Consequently the metric is indicative of whether based on this control a participant would have been 'pivotal' given the prevailing supply and demand in each hour. Figure 2.3 is based on total declared energy (TDE) and Figure 2.4 is based on offered volumes. In both cases, the 'total' line corresponds to 'Total Supply / Demand' i.e. a measure of the supply demand balance.

In interpreting the results from Figure 2.3 we can see the most pivotal participant, participant A, is pivotal (has an RSI of less than 1) approximately 25% of the time and is nearly pivotal (has an RSI of less than 1.1) approximately 67% of the time. Similarly, the fifth most pivotal participant, participant D, is pivotal in no hours and nearly pivotal in only a few hours. Overall we can see from the 'total' line the supply margin (based on TDE) has been above 1.3 (a 30% surplus) approximately 75% of the time.

The results of Figure 2.4 based on energy offers show that the most pivotal participant is pivotal in approximately 98% of hours and nearly pivotal in all hours. Similarly, the fifth most pivotal participant is pivotal in only a few hours and nearly pivotal 70% of the time. From the 'total' line the supply margin

⁸ With the 'Must Offer' requirement contemplated in AESO rule changes assessment of 'supply' should become more straightforward.

⁹ Total Declared Energy values have been submitted to the AESO since December 2004, with modification in March 2005 such that TDE values no longer had to reflect ancillary services provided. An AESO review after the first few months concluded a small number of participants had been failing to update their TDE submissions. Inaccurate TDE submissions are a possible source of bias in our estimate of RSI. For further information on TDE submissions during the first few months, see http://www.albertamsa.ca/files/TDE_Submissions_and_TPG_04290511.pdf.

(based on offered energy) has been above 1.15 (a 15% surplus) approximately 60% of the time.

In comparing Figure 2.3 and 2.4, note that the duration curves are considerably shallower in Figure 2.4. This is indicative of scarce conditions (and presumably higher prices) attracting more megawatts of energy to be offered.

Due to the reactive nature of energy offers, the assessment based on TDE (Figure 2.3) probably presents a more realistic assessment of whether a supplier is pivotal. However, the analysis based on offered energy may be more indicative of when suppliers find themselves pivotal for only short periods (i.e. during the time it takes for more energy to be offered in the merit order, dispatched and begin generating).

Figure 2.3: Duration curve showing Residual Supply Index for Five Participants (based on Total Declared Energy, Jan. 2005 – May 2006)

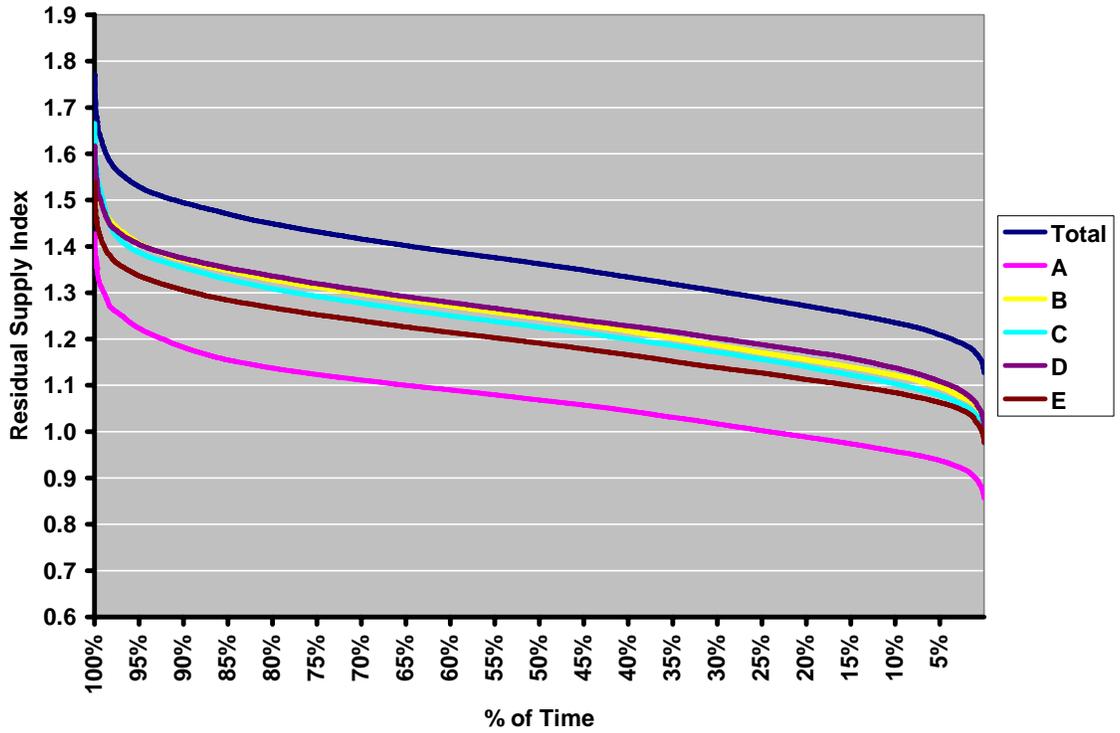
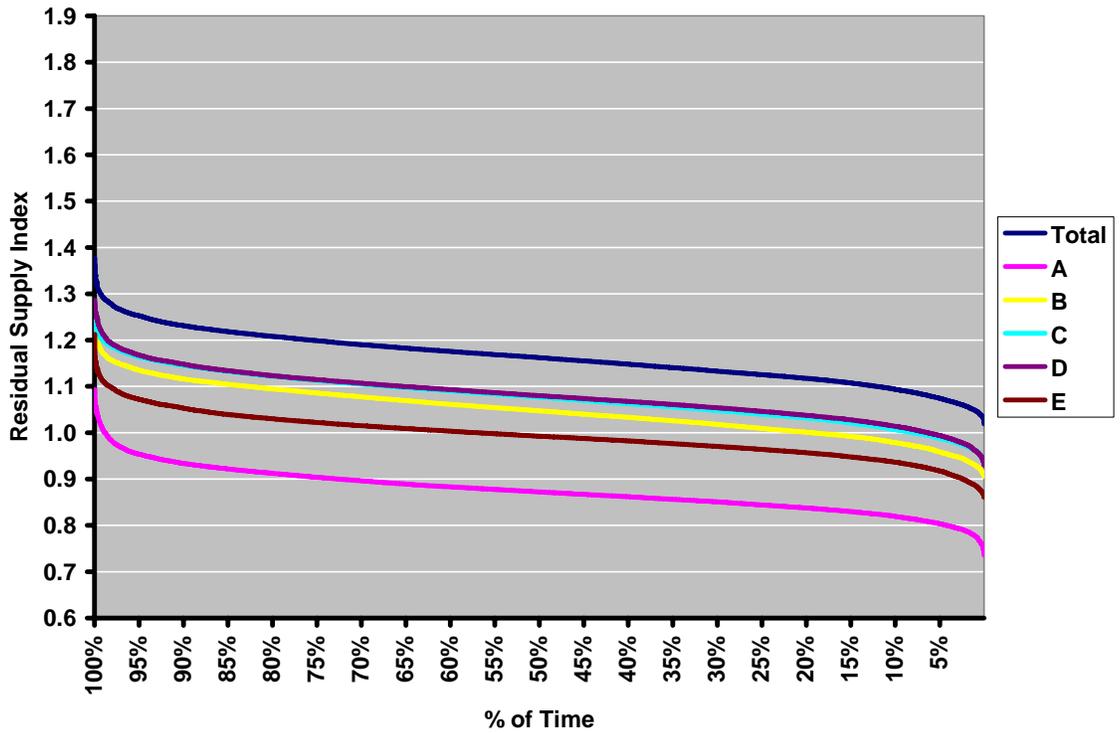


Figure 2.4: Duration Curve showing Residual Supply Index for Five Participants (based on offered energy, Jan. 2005 – May 2006)



3 FURTHER WORK ON CONCENTRATION

This report has focused on metrics examining the concentration of control in generation. The MSA intends to continue reporting these or similar metrics on an ongoing basis and is considering developing concentration metrics in other areas where they may shed light on potential competitiveness.¹⁰ In providing these updates the MSA is intending to provide market participants with an overview of changing trends in control. It is the MSA's view that maintaining a reasonably diverse control over assets is one way to assist in achieving a *fair, efficient and openly competitive* market.

The MSA is interested in feedback from participants on:

- other suggested metrics;
- whether existing metrics can be enhanced (e.g. would metrics be enhanced if generators provided information on long term capacity commitments);
- whether the accuracy of metrics would be significantly enhanced if the MSA requested data on control directly from participants; and,
- whether transparency would be well served if the MSA presented the details of its calculations and/or disclose the actual market shares of each participant. Doing so could entail the naming of particular participants and potentially release non-public information concerning the control of assets. The MSA recognizes the natural conflict that exists between the rights of the owners of proprietary information and the market at large. We are interested in feedback from participants as to whether the release of this information would benefit or harm fair, efficient and open competition.

¹⁰ For example, in developing the Trading Practices Guideline the MSA reported on the forward market information share (knowledge about forthcoming asset outages).

APPENDIX A: GENERATION ASSETS

In Table A.1 we give a summary of the major generating assets currently operating along with the corresponding participant names.¹¹ In assessing HHI and RSI in this report we have based our assignment of assets to participants on this list with modifications to account for cases where this listing does not accurately reflect actual offer control. We have made modifications where:

- a number of different participant names are effectively under common control we have assigned these to a single participant;
- one participant has assigned offer control to a second participant (through agency or other agreements) the asset has been assigned to the second participant. This is typically the case in joint ventures or partnerships where effective control over dispatch is assigned to a single member of the partnership or joint venture;
- a single asset is controlled by more than one participant and offered into the market by an aggregator. Where this is the case we have assigned a proportionate share to each controlling participant; and
- no control has been assumed for wind generation assets.

The net effect of these adjustments is that offer control of assets is more concentrated than appears for the list given below.

We also present, in Table A.2, a summary of the major additions, changes in control and retirements in the Alberta market between 2000 and 2006.

¹¹ This list only includes assets with a capacity rating above 5MW.

Table A.1: Major generating assets with corresponding participant name

Participant Name*	Asset ID*	Asset Name*	Fuel Type**	MCR (MW)**	Total MCR
Air Liquide Canada Inc.	ALS1	ALS1 Air Liquide Scotford #1	Gas	80	80
Alberta Pacific Forest Ind Inc	AFG1	AFG1 APF Athabasca	Wind and Other	99	99
Albian Sands Energy Inc.	MKR1	MKR1 Muskeg River	Gas	200	200
AltaGas Limited Partnership	ME02	ME02 Maxim Energy #2	Gas	8	21
	ME03	ME03 Maxim Energy #3	Gas	7	
	ME04	ME04 Maxim Energy #4	Gas	6	
ASTC Power Partnership (AltaGas and TransCanada Energy)	SD3	SD3 Sundance #3	Coal	353	706
	SD4	SD4 Sundance #4	Coal	353	
ATCO Power (J.V. with CNRL)	PR1	PR1 Primrose #1	Gas	85	85
ATCO Power (J.V. with Nova)	JOF1	JOF1 Joffre #1	Gas	474	474
ATCO Power (Poplar/Rainbow)	OMRH	OMRH CUPC Oldman River	Hydro	32	323
	PH1	PH1 Poplar Hill #1	Gas	47	
	RB1	RB1 Rainbow #1	Gas	26	
	RB2	RB2 Rainbow #2	Gas	40	
	RB3	RB3 Rainbow #3	Gas	21	
	RB5	RB5 Rainbow #5	Gas	47	
	RL1	RL1 Rainbow Lake #1	Gas	47	
	ST1	ST1 Sturgeon #1	Gas	10	
	ST2	ST2 Sturgeon #2	Gas	8	
	VVW1	VVW1 Valley View 1	Gas	45	
ATCO Power Scotford Upgrader	APS1	APS1 Scotford Cogen	Gas	184	184
Balancing Pool	GN1	GN1 Genesee #1	Coal	384	768
	GN2	GN2 Genesee #2	Coal	384	
Calpine Power L.P.	CAL1	CAL1 CALP Gen #1	Gas	250	250
Canadian Gas & Electric Inc.	GPEC	GPEC Grande Prairie	Wind and Other	25	25
Canadian Hydro Developers	TAY1	TAY1 Taylor Hydro 1	Hydro	12	12
City of Medicine Hat	CMH1	CMH1 Medicine Hat #1	Gas	205	205
Dow Chemical Canada Inc.	DOW (DOW1 &DOWG)	DOW1 & Total Gen. & SR	Gas	310	310
EnCana Corporation	EC01	EC01 EnCana #1	Gas	120	120
	EC04	EC04 EnCana Foster Creek	Gas	80	
ENMAX Energy Corporation	AKE1	AKE1 McBride Lake Windfarm	Wind and Other	75	837
	KH1	KH1 Keephills #1	Coal	381	
	KH2	KH2 Keephills #2	Coal	381	
ENMAX PPA Management Inc.	BR3	BR3 Battle River #3	Coal	148	664
	BR4	BR4 Battle River #4	Coal	148	
	BR5	BR5 Battle River #5	Coal	368	
EPCOR Power Development Corp	GN3	GN3 Genesee #3	Coal	450	450
EPCOR PPA Management Inc	SD5	SD5 Sundance #5	Coal	353	752
	SD6	SD6 Sundance #6	Coal	399	
Glacier Ammonia Ltd.	DRW1	DRW1 Drywood	Gas	6	6
Imperial Oil Limited	IOR1	IOR1 Mahkeses Central Plant	Gas	180	180
Irrigation Canal Power Cooperative Ltd.	ICP1	ICP1 Drops 4, 5, 6	Hydro	7	7
Maxim Power Corp.	GOC1	GOC1 Gold Creek Facility	Gas	7	7
Milner Power Inc.	HRM	HRM H.R. Milner	Coal	143	143
Nexen Inc. / Encana Corporation	NX01	NX01 Nexen Inc #1	Gas	120	120
Northstone Power Corp	NPC1	NPC1 Northstone Elmworth	Gas	9	9
Penn West Petroleum Ltd	PW01	PW01 Minnehik-Buck Lake	Gas	6	6
Powerex Corp.	FNG1	FNG1 Fort Nelson	Gas	47	47
Suncor Energy Inc.	SCR1	SCR1 Poplar Creek	Gas	445	445
Suncor Energy Products Inc.	SCR2	SCR2 McGrath	Wind and Other	30	30
Syncrude Canada Ltd.	SCL1	SCL1 Syncrude #1	Gas	345	345

**Table A.1: Major generating assets with corresponding participant name
(continued)**

TransAlta Utilities Corp.	BIG	BIG Bighorn Hydro	Hydro	120	1188.5
	BOW1	BOW1 Bow River Hydro	Hydro	319	
	BRA	BRA Brazeau Hydro	Hydro	350	
	CHIN	CHIN Chin Chute	Hydro	11	
	CRWD	CRWD Cowley Ridge Phase 1	Wind and Other	38	
	DV1	DV1 Drayton Valley	Wind and Other	11	
	EAGL	EAGL Whitecourt Power	Wind and Other	25	
	RYMD	RYMD Raymond Reservoir	Hydro	18	
	WB4	WB4 Wabamun #4	Coal	279	
	WST1	WST1 Westlock	Wind and Other	17.5	
TransCanada Energy Ltd.	BCRK	BCRK Bear Creek Cogen	Gas	80	1681
	MKRC	MKRC MacKay River Cogeneration Plant	Gas	165	
	SD1	SD1 Sundance #1	Coal	280	
	SD2	SD2 Sundance #2	Coal	280	
	SH1	SH1 Sheerness #1	Coal	378	
	SH2	SH2 Sheerness #2	Coal	378	
	TC01	TC01 Carseland Cogen	Gas	80	
TC02	TC02 Redwater Cogen	Gas	40		
University of Alberta	UOA1	UOA1 UofA Generator	Gas	39	39
Vision Quest Windelectric Inc.	CR1	CR1 ARM2262	Wind and Other	40	40
Vision Quest Windelectric, a division of TransAlta Energy Corporation	IEW1	IEW1 Summerview Phase 1	Wind and Other	68.4	68.4
Weldwood of Canada Limited	WWDC (WWD1 & WWD2)	WWD1 Weldwood 20MW Steam Turb. & WWD2 Weldwood 30MW Steam Turb.	Gas	50	50

* Selected active source assets and participant names taken from <http://ets.aeso.ca/Market/Reports/AssetListReportServlet?contentType=html>

** Maximum continuous rating (MCR) and Fuel type based on data from <http://ets.aeso.ca/Market/Reports/CSDReportServlet>

Note: The table does not include the Rossdale units (RG8,9,10). Currently these units are dispatched by the AESO in accordance with OPP 518. The table also does not include a number of wind generators that have come online during 2006.

Table A.2: Generation additions, changes in control and retirements 2000-2006

	2000 -Jan 2001	2001 - Jan 2002	2002 -Jan 2003	2003- Jan 2004	2004 -Jan 2005	2005 - Jan 2006
New	<p>Gas: JOF1: ATCO SCR1 (Poplar Creek): TransAlta ALS1: Air Liquide</p> <p>Hydro: TAY1: Canadian Hydro</p>	<p>Coal: SD6 upgrade: TransAlta</p> <p>Gas: TC01: TransCanada TC02: TransCanada RB5: ATCO VWV1: ATCO NX01: Nexen CMH1 (CanCarb) EC01: Encana ME01-04: Maxim</p>		<p>Gas: IOR1: Imperial Oil CAL1: Calpine BRCK: TransCanada MKR1: ATCO APS1: ATCO EC04: Encana</p> <p>Hydro: OMRD: ATCO</p> <p>Wind: AKE1 (McBride Lake)</p>	<p>Gas: MKRC: TransCanada</p> <p>Wind: SCR2 Suncor Magrath IEW1: Summerview</p>	<p>Coal: GN3: EPCOR / TransAlta</p>
Changes in control	<p>Coal: SD1 & 2: TransAlta to TransCanada SD3 & 4: TransAlta to ENRON SD5 & 6: TransAlta to EPCOR KH1 & 2: TransAlta to ENMAX SH1 & 2: ATCO to Balancing Pool HRM1: ATCO to Balancing Pool WB1-4: TransAlta to Enmax BR3-5: ATCO to EPCOR</p> <p>Gas: CG1-4: EPCOR to Balancing Pool RG8-10: EPCOR to Engage RB1-3: ATCO to Engage</p>	<p>Coal: SD3 & 4: ENRON to ASTC Power Partnership</p> <p>Gas: FNG1: TransAlta to BC Hydro (Powerex)</p>	<p>Coal: SH1 & 2: Balancing Pool to strips (MAPII)</p> <p>Gas: CG1: Balancing Pool to Constellation CG2: Balancing Pool to El Paso CG4: Balancing Pool to Duke</p> <p>Wind: TransAlta purchase VisionQuest</p>	<p>Coal: WB4 to TransAlta (end of PPA) GN1&2: Balancing Pool to strips (MAPII)</p> <p>Gas: RG8-10: to EPCOR (end of PPA) CG4: Duke to UBS</p>	<p>Coal: HRM1: Balancing Pool to Maxim</p> <p>Gas: ME01-4: Maxim to Altagas CG3: to Enmax Rossdale agreement between AESO and EPCOR</p>	<p>Coal: SH1-2: Balancing Pool to TransCanada</p> <p>Gas: CG3: to Sempra for 6 months RB1-3: to ATCO (end of PPA)</p>
Decommissioned			<p>Coal: WB3 decommissioned</p>		<p>Coal: WB1-2 decommissioned</p>	<p>Gas: CG1-4 decommissioned</p>

APPENDIX B: USE OF MARKET SHARE ANALYSIS AND HHI IN CONSIDERATION OF MERGER ACTIVITY

The Competition Bureau's Guidelines on Merger Enforcement¹² note that it considers market shares, four firm concentration ratios (CR-4) and also examines changes in HHI. The Bureau does not use HHI levels as 'safe harbour threshold' i.e. there is a lower bound for HHI below which competitive concerns do not exist. In defining market shares the Bureau notes that dollar sales, unit sales, capacity or, in resource based industries, reserves may be used, preferring that which provides the best indicator of a firm's 'future competitive significance'. Where different data sources are likely to yield similar results the basis for measurement is seen to depend largely of data availability.

The Competition Bureau notes that in reference to assessment of mergers:

Information that demonstrates that market share or concentration is likely to be high does not, in and of itself, provide a sufficient basis to justify a conclusion that a merger is likely to prevent or lessen competition substantially. However, market shares and concentration can inform the analysis of competitive effects when they reflect the market position of the merged entity relative to its rivals. In the absence of high post-merger concentration and market share, effective competition in the relevant market is generally likely to constrain the creation, maintenance, or enhancement of market power by reason of the merger.¹³

The MSA supports this conclusion and notes that the metrics presented in this paper should be viewed as indicative.

In the assessment of horizontal mergers the US Department of Justice (DOJ) uses the Herfindahl-Hirschman Index ("HHI") to assess the likely competitive potential effect of a merger. The US DOJ considers both the post-merger market concentration and the resulting increase in concentration:¹⁴

- a) Post-Merger HHI Below 1000. The Agency regards markets in this region to be unconcentrated. Mergers resulting in unconcentrated markets are unlikely to have adverse competitive effects and ordinarily require no further analysis.
- b) Post-Merger HHI Between 1000 and 1800. The Agency regards markets in this region to be moderately concentrated. Mergers producing an increase in the HHI of less than 100 points in moderately concentrated markets post-merger are unlikely to have adverse competitive consequences and ordinarily require no further analysis. Mergers producing an increase in the HHI of more than 100 points in moderately concentrated markets post-merger potentially raise significant competitive concerns depending on the factors set forth in Sections 2-5 of the Guidelines.
- c) Post-Merger HHI Above 1800. The Agency regards markets in this region to be highly concentrated. Mergers producing an increase in the HHI of less than 50 points, even in highly concentrated markets post-merger, are unlikely to have adverse competitive consequences and ordinarily require no further analysis. Mergers producing an increase in the HHI of more than 50 points in highly concentrated markets post-merger potentially raise significant competitive

¹² <http://www.competitionbureau.gc.ca/internet/index.cfm?itemID=1717&lg=e>

¹³ <http://www.competitionbureau.gc.ca/internet/index.cfm?itemID=1717&lg=e>

¹⁴ Horizontal Merger Guidelines, US Department of Justice and the Federal Trade Commission http://www.usdoj.gov/atr/public/guidelines/horiz_book/4.html.

concerns, depending on the factors set forth in Sections 2-5 of the Guidelines. Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise. The presumption may be overcome by a showing that factors set forth in Sections 2-5 of the Guidelines make it unlikely that the merger will create or enhance market power or facilitate its exercise, in light of market concentration and market shares.

The US DOJ also notes that other factors may mean that the HHI measure understates or overstates the impact upon competition. Two examples where concentration may be incorrectly stated are where there are ongoing changes in market conditions (e.g. due to new technology) or whether there is a wide gap between demand substitutes in the product and geographic markets. A merger that increases efficiency may also be treated differently.

APPENDIX C: PIVOTAL SUPPLIER INDICES

A number of pivotal supplier indices are in use (see Table C.1). The RSI, MRR and SMA are essentially the same measure expressed with different limits. The capacity surplus index (CSI) introduces a time dimension to the assessment of pivotal supply and the number of pivotal suppliers (and the HHI variant thereof) recognizes problems of potential collusion.

Table C.1: Pivotal Supplier Indices

Index	Definition	Critical value indicating pivotal supplier
Residual Supply Index (RSI) – California	$RSI_j = \frac{(CAP_{tot} - CAP_j)}{LOAD}$ <p>where: CAP_{tot}= total capacity (including imports) CAP_j=capacity of supplier j LOAD = total load (including exports)</p>	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	$CSI_{j,t} = (CAP_{tot,t} - CAP_{j,t}) - (PO_{tot,t} - PO_{j,t}) + \min(UCAP_t, TTC_t) - LOAD_t$ <p>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}= planed 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</p>	<=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}) **	$HHI_{PS} = 10000 * \sum_{j=1}^{NPS} \left(\frac{CAP_j}{CAP_{PS}} \right)^2$ <p>where: CAP_{PS} = total capacity of the minimum number of pivotal suppliers</p>	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 Kirsch. 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/appatapsmasmdcomments.pdf> on March 20, 2005.

APPENDIX D: FERC GENERATION MARKET POWER TESTS

In this appendix we present a summary of FERC market power tests and provide some background as to their evolution of the years. In the overall assessment of whether a seller would be allowed to sell power at market based rates FERC has typically employed a four-prong test. Sellers passed the four-prong test if they were able to show they did not have:

1. Generation market power
2. Transmission market power
3. The ability to erect barriers to entry
4. The ability to engage in ‘affiliate abuse’ or reciprocal dealing

We focus our attention on the evolution of the ‘first prong’: generation market power. FERC’s approach in much of the 1990’s was a ‘hub and spoke’ test, where analysis would focus on the share of installed and uncommitted capacity in the sellers control area (the ‘hub’) and in each directly connected area (the ‘spokes’). No clear bright line test was established but generally sellers with an excess of 20% market share would have to provide further evidence to support claims they lacked generator market power. Over time the ‘hub and spoke’ approach was criticized for failing to capture some important elements of market power, such as even small players could potentially be pivotal in tight markets.

In November 2001, FERC proposed an interim measure based around a Supply Margin Assessment (SMA), a variant of the pivotal supplier test. Sellers would fail the SMA if, together with affiliates, they controlled generation in excess of the supply margin (the difference between installed capacity and load).¹⁵ A seller was required to pass the SMA in control area’s where their generation was located as well as in neighboring areas. Sales that occurred in markets with approved market power mitigation measures were exempt from the Supply Margin Assessment.

Implementation of the SMA was deferred following criticism that the approach was both overly simplistic and included capacity that was committed to serve native load.

In 2004 FERC announced a new approach based on two indicative screens. Failing either screen would result in a presumption of market power. The screens consist of an uncommitted pivotal supplier analysis and an uncommitted market share analysis. A seller fails the pivotal supplier screen if their uncommitted capacity is larger than the difference between wholesale load and total uncommitted supply in a geographic area. The pivotal supplier screen is intended to measure the sellers’ ability to exercise market power at the time of the annual peak. A seller fails the market share screen, if in any season a participant has greater than 20% market share in a geographic market. The market power screen is intended to measure the potential for market power in all four seasons.

¹⁵ Included in the ‘supply’ was installed capacity as well as uncommitted capacity in neighboring jurisdictions

Following the presumption of market power a seller has three choices:

1. sell at cost-based (rather than market-based) rates
2. propose mitigation tailored to specific circumstances to eliminate the ability to exercise market power¹⁶
3. submit a rebuttal in the form of a Delivered Price Test (DPT), consisting of a more detailed pivotal supplier test, market share test and a market concentration test (based on HHI's).¹⁷ Failing the delivered price test would require the seller to choose between offering mitigation or selling at cost-based rates.¹⁸

In Figure D.1 we show a graphical representation of the FERC market power framework.

¹⁶ In the case of SMA, sellers in some ISO's/RTO's with approved market power mitigation were exempt from consideration. In the new framework, no exemption exists and sellers even in areas with approved market power mitigation are subject to the indicative screens. However, in making a case that they do not possess market power applicants may point to mitigation rules present in the relevant market that demonstrates adequate mitigation.

¹⁷ FERC has traditionally used a 'delivered price test' in the analysis of the competitive effects of mergers and other transfers. The DPT contemplates considering metrics in conjunction with one another. For example, absent compelling evidence from interveners an HHI of less than 2500 for all season/load conditions would be viewed as acceptable if the applicant was not pivotal or possessed more than 20% market share, whereas an applicant with greater than market share may argue it was unlikely to have market power in a unconcentrated market (HHI less than 1000).

¹⁸ Since the more detailed analysis contained in the delivered price test may take some time the FERC model also includes that should the test be failed cost based rates will be applied retroactively to the time when market power was presumed.

Figure D.1: Representation of FERC Generation Market Power Analysis

