



AESO Discussion Paper

Market Roadmap

August 30, 2007

AESO Market Roadmap – A Discussion Paper

1.0 Background:

The Alberta wholesale market policies provide for reliable and efficient operation of the electric system and open access for competition of generation assets while maintaining transmission as a regulated monopoly. For this structure to work, the policies also intend sufficient transmission infrastructure to ensure uncongested transmission. Further, the policies also cite interties as an essential part of a competitive market.

The Department of Energy (DOE) has evolved this policy construct since market opening in 1999 with extensive policy reviews and clarification through regulations. The most recent policy conclusions (as summarized in Appendix 3) direct the ISO to continue to evolve the market structure to address some market challenges, while ensuring that the framework as designed is sustainable.

The DOE market construct relies on investment decisions regarding generation development to be driven by market forces with participants making optimization choices regarding location, timing, technology and asset operations and communicating these inputs to AESO. Instead of a formal “day-ahead market”, participants conduct forward contracts of choice (i.e., physical, financial, long term, short term) and convert these inherent delivery obligations into bid strategies into the day-ahead Energy Trading System at the AESO. The AESO facilitates the market using rules and systems, and dispatches the merit order in an orderly fashion to meet instantaneous system demand. The AESO also facilitates information processes to provide the market real-time and forward-looking conditions, used for asset management and market participation.

This market plan will be successful by providing non-discriminatory access to all generators to compete in an unconstrained market. Sufficient transmission will exist for reliability and to ensure competitive results. And finally, the market structure will be sustainable in that minor adjustments can be made to meet changing needs over time.

The AESO Market Roadmap is a directional project plan that sets the context and scope for market changes envisioned by recent DOE policy work. The Roadmap outlines projects that are underway while providing some framework and timeline for those discussions. The AESO will implement the market policy outlined by the DOE through incremental market rule changes and development of systems and infrastructure to support the complexity of the market dispatch and operations.

2.0 Market Roadmap:

This section outlines how the AESO plans to meet the DOE market plan through a series of design projects and scheduled system and infrastructure changes. The Roadmap serves a number of purposes including providing direction for specific market design projects, identifying the scope of other project work that remains, grouping project work together for efficiencies, project planning for infrastructure and system work, as well as detailing a project timeline. The information provided here is not intended to supersede the need for ongoing consultation with industry on the details of any particular project, but to provide comprehensive context for those discussions by setting some recommended direction viewed to be consistent with policy.

This section summarizes considerations and development for the Roadmap. The relevant components in establishing the Roadmap include: design principles, projects, and system configuration challenges. The proposed Roadmap including timeline follows these subsections.

2.1 Design Principles:

This document represents the AESO's interpretation of the Department of Energy's stated objectives for wholesale markets. Further interpretation is required at the design phase to address market issues and challenges in ways that provide for continuity of services during the transition, but also strike a balance between complexity and stability. The following list of design principles were applied in developing the Market Roadmap and will be applied during future detailed design work and implementation.

- Incremental changes will facilitate stability of design during market evolution.
- Ongoing market change is destabilizing – market roadmap provides stability.
- Market design and operations must support a reliable system and delivery.
- Communication is key to understanding market design and pending changes. Transparency improves market efficiency.
- A balance is required between complex design and simplicity of implementation.
- Comprehensive systems are required to ensure efficient dispatch and grid operations.
- The market design changes need to be sustainable over a business cycle producing effective price signals for industry.
- The market design and operations must be consistent with “fair, efficient, and openly competitive” objectives as stated in the EUA.

2.2 Market Roadmap Projects:

The market roadmap projects are primarily gathered from the listing outlined in the Department of Energy's Market Policy framework (2005) and in subsequent industry discussions including obligations identified in the Transmission Regulation (April 2007). The summary below is intended to provide an overview of the intended market direction and is not intended to preempt industry consultation that is required during the design phase of any particular project.

The following summarizes the proposed direction for a number of market design elements associated with implementing the DOE vision. The market design elements are provided for comprehensive consultation with industry. The resulting Roadmap project plan is based on the project work stated and has been grouped for ease of discussion into the following categories: Market Obligations, Grid Operations, Interties, Monitoring and Metrics, and Other.

2.2.1 Market Obligations: There are a number of design changes associated with the Quick Hits package that are pending. The changes will form the basis for future design considerations and include T-2 offers, Must Offer, Must Comply rules, marginal unit compensation, and Dispatch Down Service. Some of the other outstanding design changes related to market obligations, such as Wind, FEOC and Operating Reserves, will require even more significant system upgrades to accommodate reliably.

Wind Resources:

The AESO has been in consultation with industry about the need to integrate increasing amounts of wind generation into the Alberta system. It is the AESO's expectation that wind integration will create a number of operational challenges given the intermittent and dynamic nature of the resource; however, the AESO's Market and Operational Framework (MOF) discussion paper (March 2007) outlined necessary mitigation measures and the order of use of these measures.

- The AESO is committed to replacing the current threshold with the MOF and will implement the measures described therein including wind forecasting, regulating reserves, wind following service and wind generation power management.
- The AESO will prepare transmission plans and need applications based on its assessment of a number of factors that will affect wind development in a manner similar to that used for other generation types. Current business practices will also be enhanced to establish milestones for wind projects to ensure that projects are advancing in a timely fashion to ensure efficient use of resources.

Operating Reserves:

For market efficiency and convergence, the AESO will explore with industry an operating reserve ("OR") market redesign aimed at aligning the energy and

operating reserves markets. As the energy market moves energy offers to T-2, it exposes a misalignment with operating reserves procurement continuing with the day-ahead timeline. Further, the AESO has designed “eligibility” criteria for other products that may provide guidance for how participants can continue to self optimize their energy and OR offers without incurring the complexity associated with the current design. Accordingly, the AESO will propose an OR market redesign based on the following:

- Operating reserves (reg, spin and supp) offers submitted by T-2, on the same timeline as energy offers;
- Offers indexed to pool price;
- Development of systems to monitor the eligibility of OR offers based on energy market dispatches and unit operations; and,
- Real time dispatches for active operating reserves based on the newly created OR merit orders.

In this model, the need for a standby product is eliminated. A calculated price for OR will be posted to the market.

This model would remove the complexity inherent in the current design, remove the AESO as the sole procurer of operating reserves and enable the convergence of energy and OR offers/markets and the optimization of generation assets.

2.2.2 Grid Operations: In order to ensure that market design and operations support a reliable system, ongoing changes are required to system management tools and planning. For example, the congestion management rules require sophisticated systems to manage locational congestion issues and dispatch responses. Additionally, some additional rule changes are pending that rely less on system changes including outage coordination reporting and reliability assessment (and directives as required per today’s rules).

Congestion Management:

To achieve the “congestion free” objectives outlined in the DOE policies, the AESO has developed long term transmission plans and has advanced work on various needs applications to relieve current congestion or forecasted congestion based on new generation plans¹. In the interim, the AESO will ensure that any plans to relieve real time congestion during “abnormal conditions” are consistent with DOE policy. To achieve this objective, the AESO will recommend:

- Removing the reliance on trigger participants during dispatch, instead relieving any congestion through an “effective” merit order and pro-rata re-dispatch in the congested area.
- Developing and communicating consistent congestion management protocols.
- Ensuring that resulting market price reflects market conditions by minimizing distortion due to constrained on/off resources and ensure that

¹ Even these plans accommodate wind resources only to the stipulated threshold of 900 MW at present.

associated operating policies and procedures result in reliable grid operations.

2.2.3 Interties: The transmission development plan envisions restored and expanded interties as part of a fully functioning Alberta market, providing greater connectivity with other markets, enhancing the reliability of supply in Alberta and sending market signals that allow participants to make effective generation investment decisions. New intertie proposals/options will be assessed on a case by case basis as part of future transmission developments. The market plan for interties is to introduce business practices and systems (OASIS and scheduling software) that support both regulated and merchant interties and result in effective ATC determination, allocation, scheduling, tagging and dispatch. In addition, the AESO is exploring both interim and permanent solutions that enable intra-hour dispatch of imports and exports. All of this work must be coordinated with adjacent control areas.

The AESO plan for interties includes:

- Support for new merchant interties developed to provide expanded import and export capability for Alberta.
- Evaluation of joint merchant / rate base interties, providing transmission support for Alberta while also providing intertie access.
- Development of OASIS and related systems for intertie transactions.
- Effective rules for dispatchable interties to support the Alberta market.

2.2.4 Monitoring & Metrics: Market Services will conduct ongoing review and development of market performance metrics for in-house assessment of market performance; assessment of the impact of design changes and identification of structural issues that impact overall market stability and sustainability. Additionally, new metrics are also being developed for communication with industry. For example, the AESO intends to commence posting information reports regarding wind variability and system performance. Also, new metrics have recently been posted regarding Long Term Adequacy.

Metrics will be shared with other agencies and participants when and if appropriate to improve the fair, efficient and openly competitive operation of the market. Depending on the outcome of the Section 6 consultations, and any subsequent regulations, additional market power metrics may be developed, published and monitored for use by both agencies and participants.

2.2.5 Other: A comprehensive review of the authoritative documents including the ISO rules is in progress and will be completed following pending legislative and regulatory developments. Additionally, the AESO will develop, and file for approval, an ISO rule making process as required in the draft AUC Act.

Within the timeline of the market roadmap, there may be changes in environmental law that will have an impact on generation assets and their attendant obligations. The AESO does not expect that these environmental

policy changes would have a significant impact on the market design for energy or operating reserves, however, the AESO will respond to any unforeseen market need.

3.0 Market Infrastructure and Grid Operations Systems:

AESO hardware and software applications used to facilitate grid and market operations have evolved over time to meet the changing market structure and increasingly complex grid management requirements. Due to the specialized nature of grid and market operations generally, and the market design in Alberta specifically, standardized, off-the-shelf software that meets our requirements is not available. As a result, the AESO has historically chosen to develop custom software rather than modify standard off-the-shelf offerings, if available, in order to meet our specific needs.

The summary table in Appendix 2 outlines the significant system tools and market interfaces that AESO has relied on over the years along with a brief summary of their design purpose. Each system provides a specialized function for grid operations, market operations, industry interface or data management that must be accommodated in market design considerations.

As the market complexity has increased, the pressure on the current systems has increased, requiring changes and adaptations to already aging infrastructure. Future changes as outlined by the market roadmap need to be planned in concert with system changes to ensure that the market can properly function to required standards. It is expected that future updates to this Market Roadmap will include the necessary hardware and software system changes and timelines required to accommodate the proposed design changes.

4.0 Project Plan & Timeline:

Given the status of the infrastructure and the market design projects that remain outstanding to meet the market plan, the following project groupings and timelines have been proposed to allow for effective discussions and sufficient system configuration to support changes. Further, the final DOE construct cannot be met until the transmission backlog is addressed and the interties can be restored and even expanded. These dates are also reflected in the Market Roadmap timeline.

Given the dynamic nature to project planning requiring system changes and infrastructure development, the timelines presented herein are illustrative for sequencing purposes. Further work will be conducted following consultation and internal systems assessment to finalize implementation dates for the Roadmap.

5.0 Conclusion:

The AESO Market Roadmap provides context for the market design consultations and changes that are needed to meet the intent of DOE policy. In order for the Roadmap to be effective, the AESO will take steps to update this document on a semi-annual basis including providing information about system changes that will be required to meet the design specification that will evolve through discussions with industry.

It should be noted that the Market Roadmap is not intended to be a comprehensive AESO project planning document nor to replace separate communication on related but separate issues.

The AESO welcomes feedback on this document including input on project groupings, scope, and direction. It should be noted that this document is not intended to replace specific and ongoing market design consultation on these individual market design elements.

AESO Market Roadmap Summary – Draft For Discussion Only				
Market Design Element				
Market Obligations	Direction	Design Considerations	System Changes	Timeline / Status
- Quick Hits (DDS, T-2, MOMC, Marg. Unit comp)	Electricity Policy Framework 05 (Market Policy)	<ul style="list-style-type: none"> Quick Hits / Workarounds to address short term adequacy and pool price fidelity 	Major IT work required. Dispatch Tool and ETS	Implement 2007
- FEOC / Market Power	Section 6 Committee, report submitted, pending Ministerial direction	<ul style="list-style-type: none"> Measurement and monitoring system prototyped based on preliminary proposals (Option A). Further action as required. 	New measurement and monitoring system must be developed	FEOC report to Minister, expect response Sep 07. Design and Implement 2008
- Operating Reserves Market	Market Policy Electric Utilities Act 03 (EUA) re role of AESO	<ul style="list-style-type: none"> Operating Reserves market re-design in steps – procure as much volume as is reasonably possible through forward exchange (NGX), consultation on convergence of operating reserve and energy markets (T-2). 	Major IT work required for complete OR redesign. ETS changes and complete overhaul or replacement of ASP	Paper pending Q4 Consultation 2008 Design and system changes 2009/10 Implement 2010/11
- Wind / Intermittent Resources	Market Policy EUA re non-discriminatory access	<ul style="list-style-type: none"> Rules for forecasting, additional regulating reserves, wind following, and power management developed for intermittent resources. 	Major IT work required. One year wind forecasting pilot EMS, ETS, MARGO and new SC decision support tools	Forecasting pilot to 2008 Rule changes pending Transmission upgrades pending Implement 07 through 2012.
Grid Operations	Direction	Design Considerations	System Changes	Timeline / Status
- Congestion Management Rules	T-Reg 03 / 07 Transmission Development Policy 03 (TDP)	<ul style="list-style-type: none"> Economic dispatch and prorata to address real-time congestion management. Plan for TMR and RAS until the tx system is congestion free. Commercial terms for compensation of TMR dispatches, Article 11 as backstop. 	DT , MARGO changes Results in “effective” merit orders System changes required for price reconciliation	Paper pending Q3 Interim implementation thru OPPs in 2007. System changes for full implementation in 2008/2009.
- Reliability Assessment (RUC) - Outage Coordination - Load Curtailment Plan	Transmission Regulation 07 (T-Reg)	<ul style="list-style-type: none"> Outage reporting required on 24 month rolling basis. Directives and compensation for changes to schedule. Development of rules for day ahead reliability assessment and unit commitment directives if required for reliability and associated compensation. 	Minor, STA report could be amended. Amendment to current RUC rules.	Preliminary consultation. Paper pending Q4 Rules due April 11, 2008 per T-Reg Implement 2008

- Mandatory Reliability Standards	NERC Standards and DOE Policy	<ul style="list-style-type: none"> Rationalization of OPPs with standards as appropriate with energy market. 		Link to ROAD project
Interties	Direction	Design Considerations	System Changes	Timeline / Status
- Dispatchability / Setting Price	Market Policy TDP	<ul style="list-style-type: none"> Dispatchable, priced imports and exports facilitated in market. Increased automation and functionality where possible/practical (Dynamic Scheduling) 	EMS, MARGO New OASIS required	Discussion paper Q4 Design and implement Dispatchable 2008 Dynamic 2009
- Available Transmission Capacity (ATC)	TDP	<ul style="list-style-type: none"> Work with industry regarding additional interties to meet system and market needs. 	OASIS and scheduling software	OASIS and scheduling software required for additional interties In 2008/2009
- Intertie Business Practices	Market Policy TDP	<ul style="list-style-type: none"> Develop and Implement new business practices for all interties. 		
Monitoring & Metrics	Direction	Design Considerations	System Changes	Timeline / Status
- LTA	Market Policy	<ul style="list-style-type: none"> Reporting of metrics commences in 2007. Rules for threshold and threshold actions determined and public. 	ETS	Metrics Q3 07 Rules 2007/2008 Implement 2008
- Market Performance Metrics	Market Policy	<ul style="list-style-type: none"> Ongoing review and development of market performance metrics and assessment of design changes and structural issues 	None	Ongoing
- Compliance Tools	EUA Section 6 AUC	<ul style="list-style-type: none"> Clarity in agencies roles and mandates Support for development of associated systems. 	TBD	Link to FEOC work above.
Other				
- Review of Authoritative Documents (ROAD)	EUA Obligations	<ul style="list-style-type: none"> Rewrite and consolidate ISO market rules, OPPs, standards, business practices to provide industry clarity and remove barriers to entry. 	None	
- AUC Rule Process Filing	AUC Act	<ul style="list-style-type: none"> File proposed AESO rules process with AUC for review and approval 	None	2008
- Demand Response	Market Policy	<ul style="list-style-type: none"> Work with industry participants to implement demand response initiatives 		
- Environmental		<ul style="list-style-type: none"> Assess and monitor environmental impacts of electricity generation in Alberta 		

Appendix 2 – Systems Description

System \ Function	Market Operations
ETS (Energy Trading System)	Accepts Energy Bids & Offers, Accepts Energy restatements, Total declared energy, Unit constraints, Creates energy merit order
ASP	Accepts AS offers, Does AS Settlement, Creates AS merit order
OASIS	E-tag interface, transmission capacity management, transmission priority allocation, Settlement data output.
ADaMS	Respond AESO dispatches, View dispatch history, View AESO messages
Dispatch Tool (DT)	Dispatch energy merit order, Dispatch Ancillary services merit order, issue AS directives, Real-time compliance, Issue ADaMS dispatch, Issue ADaMS messaging, Real-time price forecast (6 hour), Intra-hour load forecast (6 hour), Short Term Adequacy assessment (7 day)
MARGO	RT monitoring of BCTC/SPC TTC, RT monitoring of SOK flow, Forecast BCTC/SPC TTC, Forecast SOK flow, Posts BCTC/TTC to AESO Website
System \ Function	Grid Operations
Ranger	SCADA, AGC, Dispatcher load flow, State estimation, Contingency analysis, Unit Commitment, Resource Scheduling, Dispatcher Training Simulator, Alarming
SC Workbook	Monitors Calgary area dynamic MVar reserves, SOK, KEG area operation, SW area operation Total DOS usage, Note STS usage, WECC USF matrix, Area Load & Load shed calculation, Calculates V curve data for MVAR dispatch.
Topview	Third part alarming application that can use PI tags
Processbook	Third part application that uses PI tags, can create displace dashboard with dynamic attributes and alarming, trend analog points.
System \ Function	Data Interface
Load Forecast	6 month and 10 day load forecasts
EMS PI Database	Ranger (Grid Operations) Historian

Appendix 3 – DOE Market Policy Components

Table 1: DOE - Detailed Market Policies²³⁴
<p>Transmission</p> <ul style="list-style-type: none"> • Unconstrained transmission infrastructure supported by policy and implementing agencies working together to provide timely interconnection and system access. • Reduced complexity of operations through consistent and well designed policies for congestion management including TMR contracts for temporary or economic constraints, operating policies for grid operations, outage coordination, and unconstrained market prices. • Resolution of transmission backlog and forward planning for future needs including sufficient intertie capacity to ensure access to other markets. • Reasonable access rates for participants through tariff terms including Postage Stamp rates for loads, capital contribution and locational losses for generation.
<p>Markets (Design and Operation)</p> <ul style="list-style-type: none"> • Energy Only Market(s) (EOM) with following characteristics: • Optimization by participants through bids and offers • Operating Reserves market that are aligned with EOM • Convergence of price signals that reflect market conditions in a consistent fashion. • Clear rules to mitigate against abuse of market power. • Effective market design to provide incentives for market solutions, and clear rules and practices for grid operations guided by market inputs and OPPs for both market and “emergency” situations. • Rules for visibility of supply and clear rules for directives of assets if required. • The impact of significant additions of intermittent resources on the system is that the value of dispatchability increases and is reflected in market signals.
<p>Non discriminatory access for all participants including:</p> <ul style="list-style-type: none"> • Clear rules regarding supplier obligations within market including integration of intermittent resources. • Efficient and effective rules for alignment of intertie offers. • Clear rules for Industrial Systems and Behind the Fence generation. • Effective interconnection application process at implementing agencies. • Options and products to enhance demand response.
<p>Market Structure is flexible and sustainable</p> <ul style="list-style-type: none"> • Effective long term rules for market power mitigation • Clear and effective ISO Rules and Orders. • Participant access to market information. • Agency roles are transparent. Clear and effective compliance with AESO as monitoring agent, MSA as prosecuting agent, and AUC as adjudication agent. • Market is flexible, but provides stability by defining a “high bar” test for future changes.

² See EUA Section 5 and 6 for agencies roles, mandates and market structure.

³ See Transmission Development Policy (2003), Transmission Regulations (2004, and 2007)

⁴ See Market Policy (June 2005)