

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

Introduction

The Supply Surplus Protocol Work Group investigated the various considerations and methods to manage the supply-demand balance when the Alberta system marginal price (SMP) is at \$0 as defined in the Scope of Work in the Terms of Reference (see Appendix A, which also contains the list of Work Group members) and is recommending the following to the AESO for inclusion and updates to OPP 103 Dispatching Multiple \$0 Offers. Although this Work Group is struck as part of the AESO Wind Integration initiative, it must be noted that OPP 103 is applicable to all participants and the Work Group recommendations may affect all market participants.

Background

The AESO in Sept 2007 issued a Market and Operational Framework (MOF) for wind power integration in Alberta. The AESO initiated several work streams to implement the MOF and one of those work streams is supply surplus management. With respect to supply surplus management, the AESO indicates in the MOF the following.

“In general, wind generators may face risk of power management due to insufficient resources to accommodate either the actual or forecasted wind generation. This may occur during the following conditions:

- a. Forecast loss of wind and insufficient ancillary services or ramping services*
- b. Supply surplus conditions (out of market \$0 offer dispatch) - thermal units will not be dispatched below the minimum stable operating limit.*
- c. Insufficient ancillary services due to market conditions or emergency conditions (e.g. SCADA failure)*
- d. Unforeseen (i.e. not forecasted) wind conditions such as a microburst*

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

e. Disturbance and emergency conditions – wind may be dispatched off during islanding conditions or system emergency where wind variability cannot be tolerated”

”The Energy Market Merit Order (EMMO) is the primary mechanism by which the relative economic merit of supply offers are evaluated and dispatched to meet load requirements.”

”Wind is not fully dispatchable. As a result, supplier of wind power will not offer their supply into the market or be able to set price. The wind forecast will establish energy schedules priced at \$0 and wind suppliers will be 'price takers'.”

The AESO also identified in the Implementation Considerations in MOF, that one of the areas of work that will need to be completed was:

”Review and revise/develop rules and/or operational practices, procedures (OPPs) and cost recovery mechanisms necessary to implement wind power management, wind power forecasting and other aspects of the framework. For example, OPP 103 defines the policies and procedures for the System Controller to dispatch multiple zero-dollar offers when system marginal price is at \$0, currently exempts all wind generation. However, this exemption can not be maintained at higher levels of wind penetration and OPP 103 will need to be modified accordingly.”

In order to fully implement the MOF, the AESO assembled industry work groups of which one was the Supply Surplus Management Work Group. Terms of Reference were developed for the Work Group and the purpose of the Work Group is described as:

”The Work Group will assist the AESO’s MOF implementation by developing technically feasible and reasonable recommendations to the AESO on "how" and "which" supply offers from generation facilities and the interconnections will be dispatched in accordance to an amended OPP 103 by the System Controller to maintain supply-demand balance when the Alberta system marginal price is at \$0.”

The scope of work for the Work Group includes:

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

- *Consideration of all electric energy produced and/or energy offered to the Alberta energy market from generation facilities and imports.*
- *Consideration of export interchange schedules as contemplated in the ISO Rules.*
- *Consideration of load response.*
- *Consideration of generation facilities and interconnections that are providing ancillary services.*
- *Consideration of operating constraints. For example:*
 - *minimum stable operation*
 - *dispatches resulting in a facility becoming a 'net load'*
 - *safety and environmental hazards concerns*

The following issue has been raised in the Work Group discussions but is deemed to be out of scope for this Work Group. It is listed here for AESO's future consideration:

- Negative offer pricing for generation energy

Summary of Current OPP 103 Dispatching Multiple \$0 Offers

The current methodology on dispatching \$0 offers, as documented in OPP 103, is summarized as follows:

- Certain assets, including wind power facilities, are exempt from the \$0 offers management procedures.
- The following procedures are taken sequentially to manage the \$0 offers blocks in order to maintain system supply-demand balance:
 1. Flexible \$0 offer blocks are dispatched for partial volumes, on a pro-rata basis.
 2. Current hour import transactions are curtailed.

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

3. Each inflexible \$0 offer blocks are curtailed to the asset's minimum stable generation (MSG) level, one at a time, as required.

Recommended changes to OPP 103

The Supply Surplus Work Group has had the opportunity to discuss the issues relating to managing a supply surplus, or \$0 SMP dispatching, situation and proposes the following recommendations to the AESO for consideration:

1. Include wind power facilities and Co-generation facilities in the OPP 103 procedures

With the increasing integration of wind power generation into the Alberta system, the Work Group considers it prudent to include wind power facilities in the management procedures for dispatching \$0 offers. Even though the wind power MW is not formally offered into the energy market, their actual MW production contributes to the total Alberta \$0 energy volume. Most Alberta wind power facilities, and all of those installed since 2003, are capable of applying power management. The Work Group recommends these wind power facilities be included in the \$0 SMP management protocol (see following Recommendation #5) and the curtailment allocation be applied using the Wind Power Management Protocol¹.

Similarly, the Work Group considers it prudent to include the co-generation facilities in the \$0 SMP management steps as long as the Work Group's recommendation #2 (see following) is adopted to address the co-generation facilities concerns regarding operating constraints.

2. Establish a Minimum Operating Level (MOL) for each asset

Currently the AESO requires the asset owner to define a minimum stable generation (MSG) level for each generating asset, which represents the minimum generation level that the asset can be continuously operated at

¹ The Wind Power Management Protocol is another work stream in the AESO Wind Integration initiative. An industry work group has also been struck to develop recommendations to the AESO.

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

without becoming unstable.² Normally, an asset will not be dispatched or directed to below its MSG.

The Work Group considers it necessary to create a new definition which includes additional constraints that affect the asset's ability to operate at or below a certain threshold. The Work Group proposes that a new term, the minimum operating level (MOL), be used to define a physical operating limit (note that this is not an economic limit) for the asset that is constrained by legal/regulatory, environmental, health and safety, equipment reliability, operating level required to serve dispatched ancillary services, or operating level required to prevent damages to third party equipment³.

The Work Group has identified and discussed examples of physical operating constraints for various types of generation and import/export. These are included in Appendix B.

The Work Group acknowledges that the AESO will need to develop a mechanism to allow pool participants to declare and submit the MOLs to the AESO. While MOLs are rarely changed for most assets, some assets such as co-generation facilities and hydro generators may need to update their MOLs more frequently. The Work Group deems that, if it can be implemented in a practical manner, that it would be reasonable to allow a MOL update by the market participant; however the protocol for such updates (e.g. maximum per day, timing, etc) will need to be defined.

As can be seen later in the following recommendations the MOL is a key factor in \$0 SMP management.

3. Revise the "inflexible block" definition

The Work Group proposes that when dispatching \$0 offers, where possible, the assets should not be dispatched to below their respective MOL (details

² ISO Rules Part One, Section G1 Definitions

³ Examples include a co-generation facility when operating below a certain level may cause damage to the host equipment, and a hydro generator when operating below a certain level may have downstream effects such as irrigation equipment failure or cause protection devices to operation on low suction head.

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

provided in Recommendation #5). The Work Group has reviewed the current definitions for "flexible block" and "inflexible block"⁴:

"flexible block" means a block of energy that may be partially or fully dispatched on.

"inflexible block" means a block of energy that may be dispatched on or dispatched off, but not partially dispatched on.

The Work Group recognizes that the current definition of "flexible block" does not require any changes since it accommodates the proposed \$0 SMP management protocol. The definition of "inflexible block" will need to be amended as follows:

"inflexible block" means a block of energy that may be dispatched on or dispatched off, but not partially dispatched on, ***except for a \$0 offer block it may be dispatched to the asset's minimum operating level (MOL).***

4. Provide indications to market on supply surplus situation

The Work Group recommends that the market be provided an indication regarding supply surplus situation (similar to indications provided on the supply adequacy situation). This will allow market participants an opportunity to take voluntary actions in anticipation of a potential \$0 SMP or supply surplus as well as to become aware that an out-of-market dispatch from the SC (needed to clear the energy imbalance) could be forthcoming at the \$0 SMP.

5. \$0 SMP management steps by the System Controller

The Work Group recommends that, after the voluntary market actions have been taken or if immediate actions are required to reduce generation supply

⁴ISO Rules Part One, Section G1 Definitions

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

in a \$0 SMP situation, the System Controller will first curtail some or all of the import blocks by using the normal curtailment procedures⁵.

After all import blocks have been curtailed and if further action is needed to correct an over-supply situation, then curtailment directives will be issued to intra-Alberta generation. The Work Group appreciates the complexities in design of the specific procedures involved in the determining the curtailments as well as the need for the curtailments to be practical and effective. The Work Group recommends that the following principles be applied in the design of the procedures:

- a) As stated in Recommendation #1, that wind power facilities and co-generation power facilities should be included in the curtailment steps.
- b) Inflexible \$0 offer block, flexible \$0 offer block and wind power facilities should share the burden of curtailments in a fair and effective manner.
- c) Curtailments to wind power facilities should follow the wind power management protocol.
- d) An asset should not be curtailed to below its MOL, if possible.

The Work Group proposes the following as a possible protocol:

Step 1. Curtail import transactions.

Step 2. Take the following actions, taking into account the transmission system operating and reliability constraints and an objective of rotating the curtailments amongst market participants where possible:

- a. Curtail flexible \$0 blocks, by pro-rata assignment,
- b. Where wind generation is required to be curtailed pursuant to (a), assign the curtailment amongst each individual wind power facility using the wind power management protocol,

⁵ OPP 303 Alberta-BC Interconnection Operation and OPP 306 Reliability Curtailments to Alberta-Saskatchewan Transactions.

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

c. Curtail inflexible \$0 blocks to the asset's MOL.

Step 3. Curtail an asset to 0 MW (go off line), considering the asset's minimum off time.

6. Assess impacts on market participants tariff charges (e.g. DTS demand ratchet)

The Work Group discussion identified that a potential consequence of the Supply Surplus protocol could be to trigger increases in DTS charges, specifically in respect of the demand ratchets for co-generation facilities. For example, the protocol could trigger higher DTS charges if the curtailment of generation during a \$0 SMP event was to a level where it is required to consume electric power from the grid that exceeds facilities contracted DTS level (or existing billing capacity). Whether this consequence is possible will depend on the co-generation's MOL and the contracted DTS levels and therefore needs to be considered on a case by case basis. The Work Group therefore recommends that a part of the broad stakeholder consultation in respect of this protocol the AESO seek specific feedback from co-generation facilities with "behind the fence load" to review their potential MOL and to determine if a dispatch to this level would impact the DTS charges, and based on this review, identify the existing tariff terms that may need to be addressed as result of implementing the proposed supply surplus protocol.

APPENDIX A

Supply Surplus Protocol Industry Work Group – Terms of Reference

INTRODUCTION TO WORK GROUP TERMS OF REFERENCE

On September 26, 2007, the AESO issued the final Market and Operational Framework for Wind Integration in Alberta (“**MOF**”) and at the October 19 stakeholder session announced the development of various work streams to implement the MOF. To assist with the implementation of specific technical/complex initiatives in the MOF, the AESO will set up specialized industry work groups to provide the AESO with expert advice for the development of recommendations that may be used by the AESO in its completion of the full stakeholder consultation contemplated in the MOF. Discussion papers and work groups will be used for implementation of the MOF.

Work groups’ recommendations that are acceptable to the AESO will be issued for stakeholder consultation through existing AESO consultation processes⁶.

One of the mitigating tools included in the MOF was “wind power management”. The wind power management work stream was envisioned to have three separate but interrelated work groups. Those being;

- Supply Surplus Protocol⁷ work group
- Wind Power Management Protocol work group
- Wind Power Technical Requirements work group

The attached Terms of Reference for the Supply Surplus Protocol Work Group (“**Work Group**”) is intended to ensure the Work Group understands its purpose, scope and responsibilities.

⁶ AESO Rules, OPPs, Tariff and Standard consultation processes.

⁷ Where Protocol describes what will be done, when, how, and why.

PURPOSE

The Work Group will assist the AESO's MOF implementation by developing technically feasible and reasonable recommendations to the AESO on "how" and "which" supply offers from generation facilities and the interconnections⁸ will be dispatched in accordance to an amended OPP-103 by the System Controller to maintain supply-demand balance when the Alberta system marginal price is at \$0.

Work Group recommendations may be used by the AESO in amending OPP-103 to include a reasonable and practical procedure that will maintain supply-demand balance when the Alberta System Marginal Price is at \$0.

SCOPE OF WORK FOR THE WORK GROUP

The Scope of work for the **Work Group** includes:

- Consideration of all electric energy produced and/or energy offered to the Alberta energy market from generation facilities and imports.
- Consideration of export interchange schedules⁹ as contemplated in the ISO Rules.
- Consideration of load response.
- Consideration of generation facilities and interconnections that are providing ancillary services¹⁰.
- Consideration of operating constraints. For example;
 - minimum stable operation
 - dispatches resulting in a facility becoming a 'net load'
 - safety and environmental hazards concerns

⁸ Interconnection as defined in the AESO Rules

⁹ Interchange schedule as defined in the AESO Rules

¹⁰For example the current statement in OPP-103: "If an asset, due to its operating characteristics, is running at a higher generation level than its minimum stable level because it is providing regulating reserve (RR), then an assessment will be made if it should be dispatched off for RR. include whether another asset has offered and has not been dispatched for RR and will not require running at a generation level higher than its minimum stable level."

RESPONSIBILITIES

Responsibilities of the AESO

The AESO's responsibilities include:

- Coordination of the Work Group to its timely completion. The AESO will determine when the Work Group is to be concluded.
- Chairing the Work Group, which will be comprised of a cross section of industry participants in the technical, operational and market domains.
- The AESO Chair shall make reasonable efforts to ensure that there is "balance" on industry representation and balance on the recommendations or options provided to industry.
- While consensus on some issues may not be possible, the AESO will encourage full discussion in order to ensure that all views are understood and to allow the development of balanced and reasonable recommendations.
- The AESO Chair will ensure that meeting notes are recorded and circulated to all members Power Management work groups (Supply Surplus Work Group, Wind Power Management Protocol Work Group and Wind Power Management Technical Requirements Work Group).
- Points of concern raised that are outside the Scope of the Work Group will be logged by the AESO Chair and provided to the AESO to be addressed in a timely manner.
- Provide and request logistical support and resources as necessary.
- Ensure Work Group recommendations align with other AESO initiatives and protocols.
- Coordinate Work Group communication with the rest of industry.
- Review recommendations and determine inclusion of same in AESO industry consultation.

Responsibilities of the Work Group members

The Work Group member's responsibilities include:

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

- Attendance at and constructive participation in all meetings.
- Providing reasonable and competent input to Work Group activities and communications.
- Providing logistical support and resources as necessary.
- Promoting the Purpose of the Work Group.
- Advise and assist the AESO by developing technically feasible and reasonable recommendations in accordance with these Terms of Reference.
- Provision of input as requested and in a timely manner and will most likely represent the views of their industry sector¹¹.

In addition:

- In order to be acceptable to the AESO, all Work Group recommendations must be reasonable and must consider the AESO's mandate as per the *Electric Utilities Act* and its regulations, as well as other AESO initiatives and protocols. In addition, all Work Group recommendations must be consistent with the MOF.
- The Work Group is not a forum to debate the implementation of the MOF or develop recommendations that amend the intent of the MOF¹².
- Participation as a Work Group member does not imply agreement to recommendations produced by the Work Group.
- Work Group members are not precluded from participating in any AESO industry consultation.

¹¹ For example, a Work Group member from a coal fired generation facility is assumed to not only represents the views of their facility but other coal fired generation facilities.

¹² I.e. the MOF indicates that wind power facilities are not eligible to set a non-zero pool price, thus a Work Group recommendation where wind power can set price will not be accepted by the AESO.

SUPPLY SURPLUS PROTOCOL STRATEGY

Process

The Work Group shall meet as required by the AESO to achieve the following target dates.

Target Dates

Terms of Reference	Complete by Dec 31, 2007
Work Group recommendations	Complete by March 31, 2008

Communication of Documents and Information

All Work Group communication to the industry will be through the AESO. As documents are approved by the AESO they will be posted onto the AESO website. The AESO will take reasonable efforts to ensure that Work Group members' comments and submissions will remain confidential to the Work Group and will not be posted or otherwise distributed, except as otherwise contemplated in these Terms of Reference. Work Group members must treat all documentation and information circulated to them as confidential information.

WORK GROUP MEMBERS

- Alberta Electric System Operator (Chair)
- Airtricity
- Alberta Consumer Advocate
- Balancing Pool
- Natural Power Consulting
- Naturener
- Powerex
- TransAlta Wind
- TransCanada
- Shell Canada Limited
- Valeo Power

APPENDIX B

Examples of operating constraints for various types of supply discussed by the Work Group

1. Hydro Generation

Run of River hydro facilities: Several of the Hydro facilities in the Bow River system have little or no storage and whatever inflow comes into the facility must be passed through. These facilities are analogous to a wind generating facility; the fuel is passing through and the generators either use it or waste it. Energy from these facilities is offered as must run at \$0.

Management of water levels at storage reservoirs within operating guidelines: The operating rules for the major storage reservoirs have been developed to balance water flows through the river systems over the annual hydrologic cycle. Base energy production to manage reservoir levels within the operating rules is offered as must run at \$0. Flood situations represent a special situation within this category. At many facilities, use of the generators is an integral part of the flood management procedure required to ensure dam safety.

Management of river ice conditions downstream of hydro facilities: Managing the development of river ice packs downstream of hydro facilities requires flexibility in operation. In certain circumstances, higher flows must be maintained to ensure the ice pack builds in at a high enough level to permit operating flexibility through the rest of the winter. In other circumstances, minimum flows absolutely must be maintained to prevent collapse of the ice cover. Use of spillways to manage ice conditions is extremely problematic so flexibility in generator operation is essential. Energy required to manage ice conditions is offered as must run at \$0.

Minimum stable operating levels when dispatched for ancillary service provision: Provision of regulating range and spinning reserve requires that units be on line and generating. All of the hydro units have minimum stable operating levels which must be maintained in order to supply ancillary services. This energy is offered as must run at \$0.

Environmental considerations: At several hydro facilities, the physical configuration of the facility requires that the generating units must be operating to ensure continuous minimum flow to the downstream river channel. Dispatch down on these generating units would create a stopped flow situation in the river channel and result in charges under various legislation including the Canada Fisheries Act and the Canada Navigable Waters Protection Act.

Water Rights considerations: The operating licences at virtually all of TransAlta's Hydro facilities are issued under the Alberta Water Act. That Act establishes water rights priorities based on the principle of "first in time, first in right". On the Bow River System, there are three Irrigation Districts located downstream of Calgary with very large licence allocations which are senior in right to TransAlta. Under law, TransAlta must pass water downstream to these senior licence holders. The physical configuration of many of the Hydro facilities is such that use of the generating units is the only means to pass water during the period of the year when the Irrigation Districts require it. This energy is offered as must run at \$0 and a dispatch down on the generating units would place TransAlta in contravention of the Alberta Water Act.

Contractual considerations: There are no contractual arrangements which create a need to maintain must run Hydro energy.

PPA considerations: The Hydro PPA establishes financial obligations for specified volumes of energy, regulating range, spinning reserve and supplemental reserve for every hour of the year. The first three of these products require units to be on line and dispatch down could place TransAlta in a financial penalty situation under the PPA.

2. Coal Fired Generation

- When a coal fired generator is directed to operate below its minimum stable generation, for example as stated in the PPA, then the generator may be required to use alternate fuel which would be an economic disadvantage to the PPA owner. The extra costs will be borne by the PPA owner and there is no mechanism to negotiate between the PPA owner and PPA buyer on the costs. In addition, when operating in this mode, there is an increased risk for the generator to trip off and hence this mode is not intended for sustained operation.
- Governor valve problems
- Safety valve problems: These are primarily the boiler safety release valves. These safety valves can operate and release steam to the atmosphere in the event that the boiler steam pressure exceeds limits and could risk damaging the generating unit.
- Control issues: Coal fired plants have numerous controls ranging from pulverizing the coal, maintaining a fireball, maintaining steam conditions to producing MWs.

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

- Time to cool down and then restart: If a large coal fired generators is taken off-line it could be several hours before it could come back on line and ramp to full load. As a rule of thumb, the time the generating unit is off-line will be the same amount of time to reheat the generator to synchronize and then 2 or more hours to ramp up to full load.
- Emission issues: Generators may need to operate at a stable load level (no ramping up or down) to stabilize emission issues.
- PPA restrictions: Cannot direct below Min Stable. There is an economic minimum and a physical minimum. For example on a large coal fired generator, a economic minimum could be 200 MW whereas a physical minimum could be 150 MW

3. Co-Gens

Co-gens' primary purpose is to provide steam to host. If generation is curtailed it may affect the host process. Co-gens are usually sized for the steam requirement and there may not be a lot of flexibility in generation output and would not cause negative impact to host process. There may be some alternative means to reduce the need for generation output to produce steam such as duct firing. Another major consideration is the element of balance - which refers to the overall site conditions not just the balance of the electricity components and parts.

One key area is water. The quantity and quality of the steam is quickly affected when the units are ramped. This may affect the water treatment areas of the host facility.

Another issue important to cogen units is the distance between sites. The quality and quantity of the steam need to be maintained to balance the system needs over large distances.

These are just some illustrations of the overall complexity and the careful balance of the site. Each different cogen site will offer a different set of systems that are in balance and have different challenges. Additionally the long-term contractual obligations signed between parties will add further complexity. The difficult question is where to draw the line on potential down stream effects and contractual liability.

4. Import – Exports

Market participants will import into, or export from the AESO when they anticipate the basis will cover transmission, losses, and transactional costs plus whatever trade risk premium they attach. In conditions of supply

Supply Surplus (\$0 SMP) Protocol Work Group Recommendation

surplus (with prices approaching and then at \$0), it is safe to assume that under most conditions, the export ATC will be fully subscribed. It is also a safe assumption that in most instances, it is unlikely that market participants would be importing into a potential supply surplus condition.

However, there are certain market conditions in which these assumptions will not always hold true. This is most likely to be true during the spring freshet in the northwest. The bilateral market in the northwest and the California ISO market allow for negative bidding. This means two things – (1) the balancing authorities that might otherwise be able to absorb supply surplus energy may have limited to no space if there are cheaper alternatives for whatever energy they can take, and (2) the PNW to AESO spread may be positive, leading market participants to import even in conditions approaching supply surplus.

In conditions other than the spring freshet, the other consideration for import/export treatment is what (if anything) the AESO may want to consider regarding the T-2 constraint. If market participants have not anticipated a supply surplus condition (the export ATC is not fully subscribed), and the AESO experiences a dramatic upward ramp of wind inside the T-2 window, export participants will not be able to help mitigate a SS condition through exports.

Export ATC could be fully optimized if there was an exemption to the T-2 window in conditions of supply surplus.

5. Wind

Wind power is generated when the wind speeds exceed a minimum threshold of approximately 4 m/s (unique to each turbine type). Each turbine type has a unique power curve that determines the output of the turbine at various wind speeds. Wind turbines are not capable of black start capability and require power in order to initiate the rotor turn prior to the wind catching the blades. While wind turbines can be dispatched or curtailed down, they cannot be dispatched down. The wind speeds within a wind farm vary therefore not all turbine will necessarily start producing power at the same time.

Control systems for wind turbines have advanced in recent years allowing for reduction in power in fast order.