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Economic Consulting

Review of Efficient Treatment of Ramping in the Context of the Ontario Electricity Market



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April 7, 2006
Toronto, Ontario

How Markets WorkSM

NERA's Assignment



- Review current treatment of ramping with respect to generator compensation in Ontario
- Review alternative treatments of ramping with respect to generator compensation
- Evaluate current and alternative ramping treatments against criteria
- Identify from review generalized principles that may apply to other pricing issues

Alternatives Examined



Energy Price Determination

- Current -- 12X myopic
- 1x myopic
- 1 times multi interval optimization

Specific Ramping Compensation

- None
- Market-based
- Administered value

There is a Distinction Between Ramping Affecting Energy Price and Ramping Compensation



- To the extent that ramp impacts are significant they will change the way that the system is dispatched and the marginal value of energy
- In principle, pricing that most closely tracks the actual marginal value of energy will result in the most efficient use of resources and encourage the most efficient investment decisions
- All else equal the energy price should reflect the actual marginal value of energy which is influenced by ramp constraints
- The impact of ramp on energy prices is distinct from the issue of whether ramp is a separate service that should be compensated

The Primary Evaluation Criteria Employed



- Allocative efficiency -- resource usage and consumption decisions
- Dynamic efficiency -- resource investment
- Cost
- Applicability given other deviations -- second best concerns

The Criteria Lead to Several Broad Findings



- Energy Pricing Should Reflect the Marginal Resource Value Resulting from the Actual System Dispatch as this Will Promote Allocative and Dynamic Efficiency
- Efficient Exploitation of Interchange Opportunities Further Requires that Energy Prices Should Reflect Actual Dispatch Optimization and Actual Marginal Value of Energy to Ontario
- However Aligning Any One Element of Energy Pricing with Actual Dispatch While Other Significant Elements Are Not Aligned Should, but Will Not Necessarily Improve Efficiency

Implications for the Ontario Market



- Dispatch in Ontario uses correct principles, which assures a reasonable level of allocative efficiency but can sometimes lead to:
 - “Non-intuitive” dispatch: operating instructions which are not well understood (eg. Reversals, dispatch in opposite direction to demand change)
 - Ramping dispatch: units taken out of order or dispatched at less than full load in order to prepare for future ramp
- To the extent that these lead to higher costs for generators, these costs should be included in offers. As a general proposition, side payments to account for these problems represent an inferior solution

Implications for Ontario Market (cont'd)



- Given the distance between pricing methodology and dispatch methodology today, adjustments to reflect ramp rates are probably of lower-order importance and might even work in a counter-intuitive direction
- Explicit ramping payments do nothing to enhance allocative efficiency or dynamic efficiency, particularly when the level of ramping payment is arbitrary

Pricing Should Reflect Dispatch



- IESO finds least-cost dispatch, taking offers as indicative of **all** relevant costs
- Shadow prices of least-cost dispatches are efficient: the marginal cost of energy tells us what society must pay for another kWh, so long as the dispatch knew what the costs were
 - Correct allocative decisions in the short-run
 - Correct entry/retirement decisions in the long-run
- CMSC payments are the symptom of the violation of this principle that price should reflect dispatch
- The IESO uses a transmission constrained multi interval optimization (MIO) for actual dispatch that also considers ramp constraints
- Prices that promoted efficiency to the maximum extent would result from using the same method to determine energy prices

Interchange Opportunities Should Reflect Dispatch Opportunities



- The interconnected nature of the system makes efficient dispatch even more important
- Price quoted for export should reflect total price paid at the margin for increased output, including CMSC payments
 - Failure to adhere to this principle causes Ontario to subsidize interconnected areas at the margin
- Energy prices that deviate from the shadow prices of the algorithms used to operate the system (i.e., that ignore ramp and transmission constraints) will lead to these results

How We Got Here



- Original Vision:
 - Myopic 1X Dispatch with all relevant constraints
 - Pricing according to dispatch
 - Generator arbitrage through bid adjustment - myopia conquered through generator action
 - No CMSC payments

- Problems:
 - LMP politically infeasible
 - Market trials ignoring generator arbitrage generated high morning ramp prices, leading to 12X
 - CMSC payments and operator intervention (later became MIO dispatch) required to adjust

Neither Myopic Dispatch Nor 12X Ramp Rate Reflect Actual Dispatch



- System is run using a MIO dispatch
- System is run using a 1X or actual ramp rate
- Both a myopic 1X dispatch and 12X ramp rate are distortions
- In principle, if all elements of pricing were done close to actual dispatch, neither 12X nor 1X myopic would produce an efficient result
- This could lead to inefficient results, including inefficient interchange schedules

1X MIO Pricing under MIO Dispatch



- Obviously better under the first principle – pricing reflecting dispatch
- Will require generators who feel under-compensated to increase their bids. The only reflection of the costs of ramping or change in set points comes from generator's bids
- Make-whole payments may be required over the MIO cycle
 - possible interactions with transmission CMSC
- However, possible second-best interactions with remaining unconstrained pricing

Fixing One Pricing Problem In the Presence of Others Will Not Necessarily Improve Efficiency



- Theory of the Second-Best: Changes to improve one aspect of a system may make the overall system work worse.
- There is no proposal currently on the table to add transmission pricing to the Ontario market, although the system dispatch reflects transmission constraints
- Consequently, any change to energy pricing to reflect other dispatch concerns should, but will not necessarily improve efficiency

1X Myopic Pricing



- Not aligned with system dispatch
- Dynamically inefficient
 - Favors baseload units, whether they can ramp or not, making the system excessively baseload
 - Overcompensates mid-merit units which cannot ramp, making it less likely that they will invest in ramping capability
- Overvalues energy by undervaluing dynamic operator action
- Will induce generator arbitrage, with unknown net impact

1X MIO Pricing Is Probably Best



- Very little incremental cost to implement
- Efficient signals under the full constrained dispatch
- May not be efficient under the unconstrained dispatch, but effects are probably fairly small
- If ramp becomes a significant problem in Ontario, will signal very high energy prices

Should Ramp Be Compensated?



- Ramping is a part of providing energy in Ontario. Units can ensure they do not ramp by either low offers (to be taken at full load or compensated via constrained-off payments if held back to ramp later) or by high offers (to avoid being taken at all).
- “Ordinary” regularly recurring ramp should be priced into the offers of generators. It is no different than any other cost of generation.
- While a make-whole payment for non-recurring extraordinary ramp requests might seem reasonable, the regulatory costs of implementation are likely to be excessive.

Incorporating Ramp Costs in Energy Offers



- Generators do not necessarily know they will be called to ramp or change output. Thus, the costs imposed are probabilistic
- Costs may include heat rate changes and increased wear-and-tear
- But many generator costs are probabilistic, particularly opportunity costs. Bidding these costs is a management decision
- Recurring changes allow statistical estimation of the true costs

Generators Must Integrate Their Costs with the Compensation Scheme And Offer Accordingly



- Generators are in the best position to know their own costs
- If unbid costs cause generators to incur a loss, they should increase their bids, or possibly lower them
- If they are not dispatched (or ramped) when they do so, they should not have been dispatched (or ramped)
- Optimal generator bids are tied to the compensation structure and the dispatch algorithm
- There has never been a principle in the Ontario market that generators should bid a narrow definition of short-run costs

Ramp Payments – Version 1



- Difference between 12X and 1X energy price, paid only to those changing output
- Unrelated to system operation
- Output changes may not necessarily reflect ramping values
- Price differences imperfectly correlated with time at which system needs ramp

Ramp Payments: Version 2



- Fixed Price per Set Change
- Ideally Requires change to dispatch algorithm to recognize cost
- Arbitrary
 - All ramp providers are paid the same price which leads to over-compensation in some cases and under-compensation in others
 - No obvious methodology to align this payment with actual cost
- Unnecessary – can be accomplished through change in generator offers
- Neither version would optimize these payments
 - To do so would require significant changes to the dispatch algorithm