

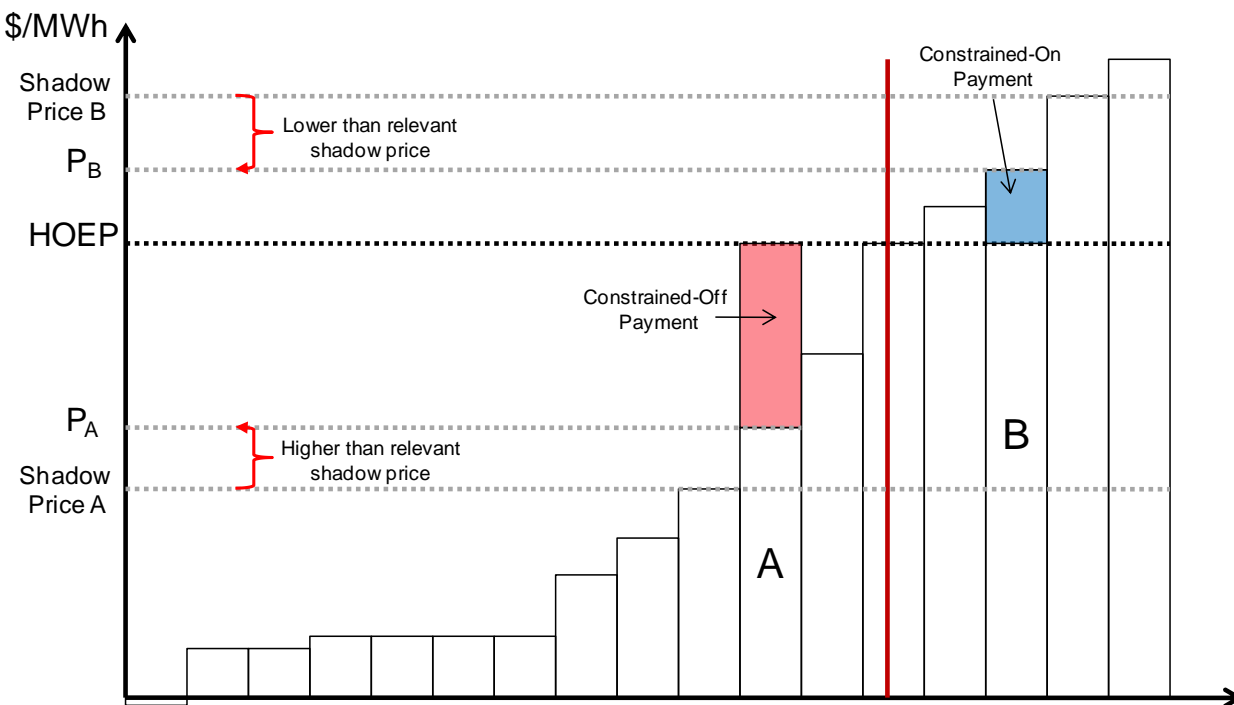
More Efficient Uniform Price

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Market Pricing Working Group
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- Scope of the More Efficient Uniform Price study
- CMSC Calculation
- Pay-as-Bid Pricing v Uniform Pricing
- Pay-as-Bid Outcomes
- Examples of Undesirable Outcomes
- CSMC statistics

- The IESO has defined the problem as three-fold:
 1. Differences between the constrained and unconstrained schedules results in two payment streams for market participants, creating pay-as-bid incentives and leading to undesirable outcomes.
 2. The two-schedule system can undermine the incentives for investment for both supply and demand in different parts of the province.
 3. There are costs incurred by stakeholders and the IESO that can be attributed to having to monitor, analyze and administer a two-schedule system.



Under the two-schedule system, a participant may receive a payment other than the uniform market price.

CMSC is intended to restore the participant to the operating profit they would have received based on the unconstrained schedule.

CMSC assumes that participants offer or bid at their marginal cost or benefit.

CMSC Payment for Generators & Imports

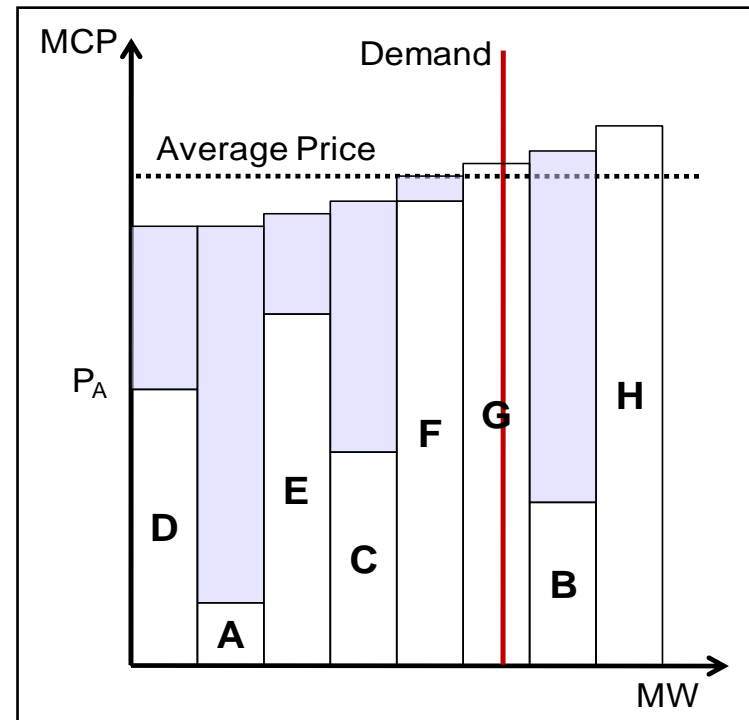
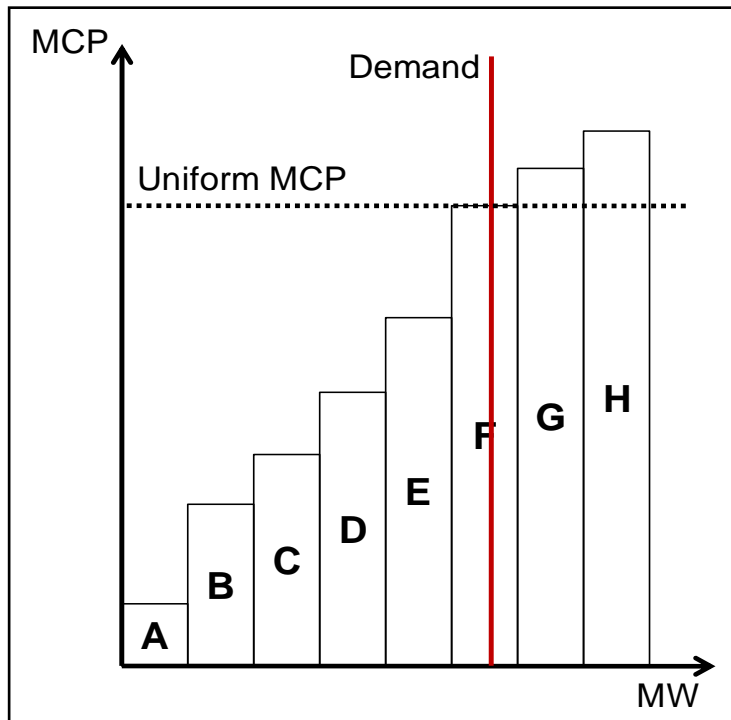
$$\text{CMSC} = (\text{MCP} - \text{Offer}) \times (\text{MQSI} - \text{DQSI})$$

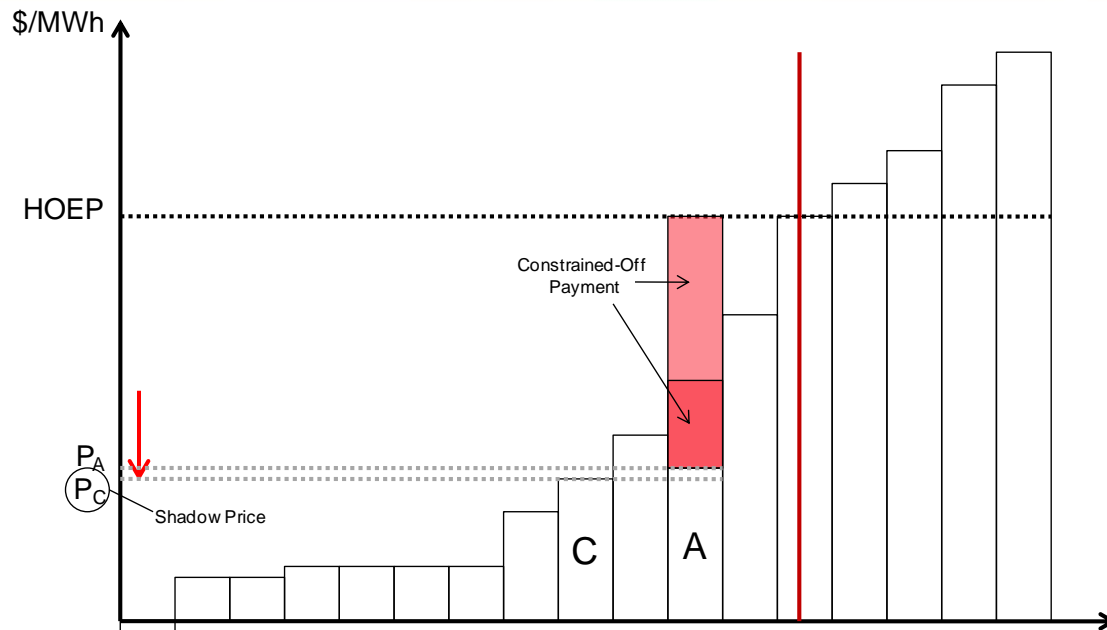
CMSC Payment for Loads & Exports

$$\text{CMSC} = (\text{Bid} - \text{MCP}) \times (\text{MQSW} - \text{DQSW})$$

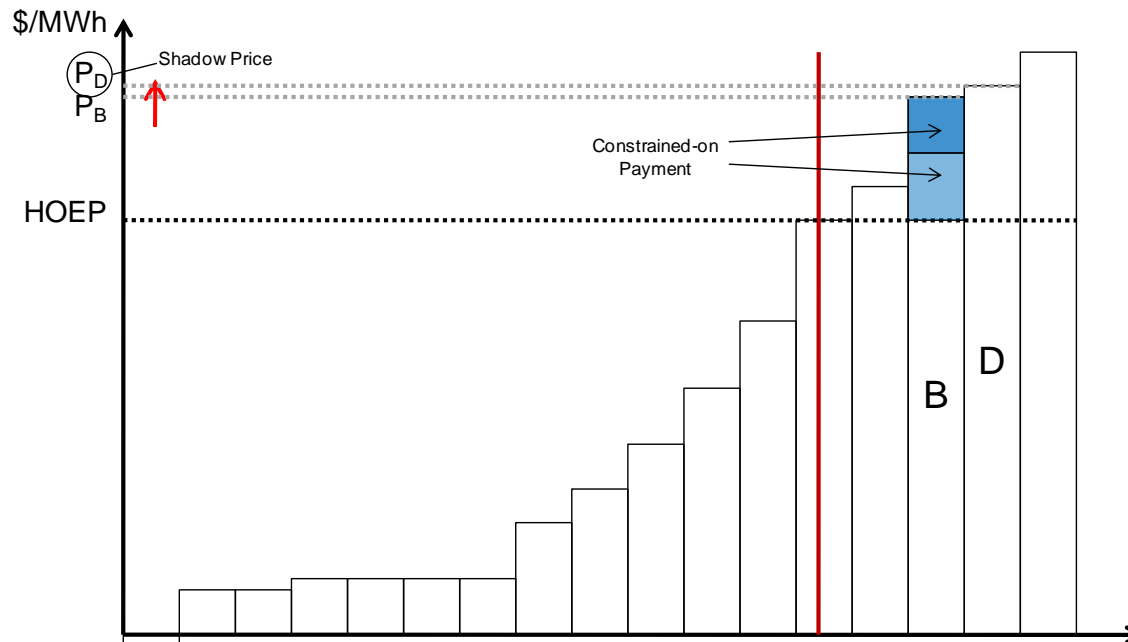
- Pay-as-bid incentives result in three types of undesirable outcomes;
 1. “Guessing” close to the MCP creates profitable opportunities, with incentives to play “Inc” and “Dec” games to maximize CMSC. This can lead to inappropriate side payments.
 2. If a low-cost generator (consumer) “guesses” wrong and offers above (bids below) the MCP, a more (less) expensive resource will be scheduled. This results in inefficient out-of-merit dispatch.
 3. Strategic bids or offers no longer reflect their marginal cost of production. This can create distortions in the price signal resulting in inefficient production and consumption decisions.

- With pay-as-bid pricing, the bidder's incentive is to bid as close to the expected clearing price as possible.
 - “Guess the Market Clearing Price” Game

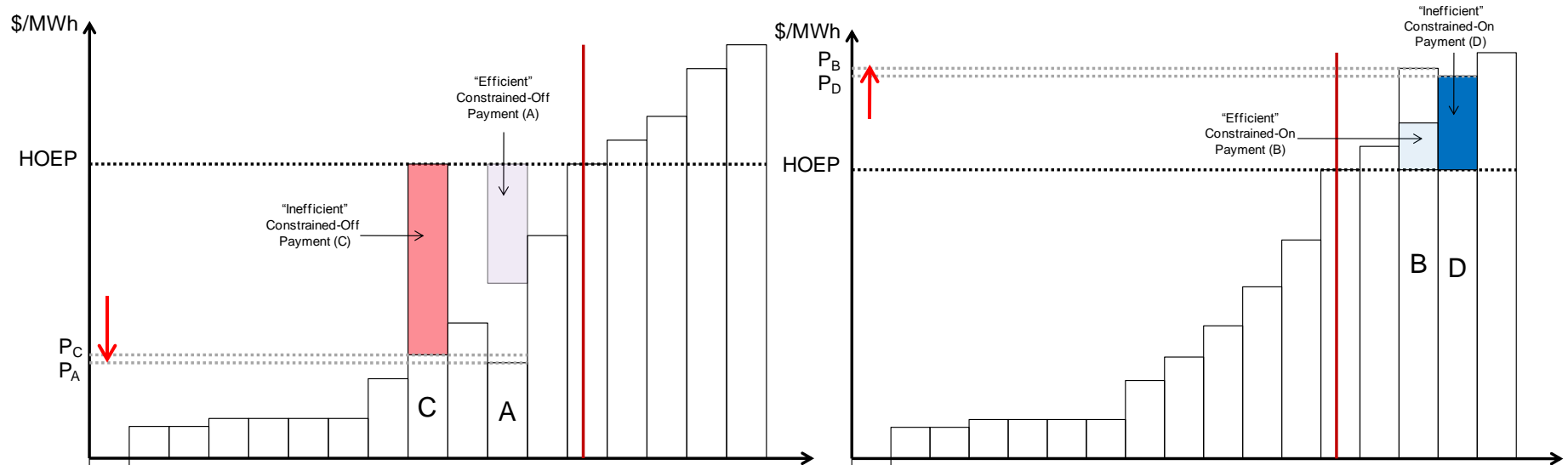




- Resources A and C are located in the same constrained zone.
- Res C is accepted in the constrained schedule and will set the local shadow price. Res A is not scheduled in the constrained run and expects to be constrained-off.
- Res A has the incentive to lower its offer, below its incremental cost, to just above where they expect Res C will offer.
- This will result in a higher CMSC payment to Res A than if they had offered at their true cost.

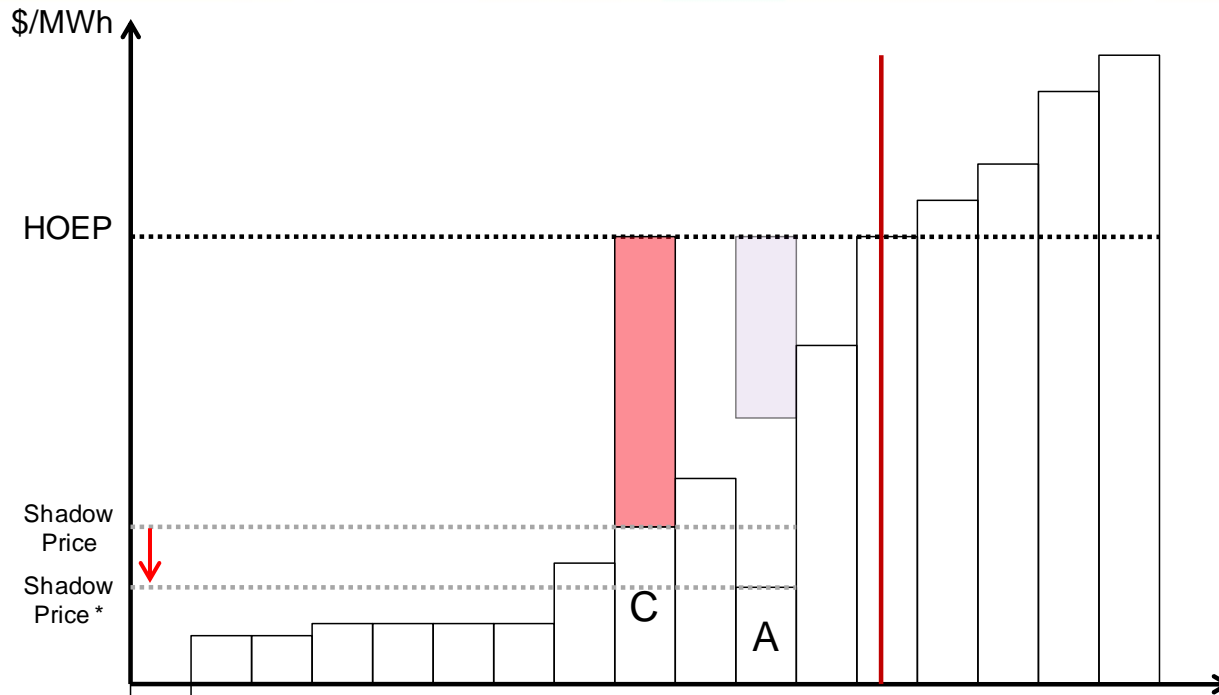


- Resources B and D are located in the same constrained zone.
- Here, both Res B and D are constrained-on and Res D will set the shadow price.
- Res B has the incentive to raise its offer above its incremental cost, to just below where they expect Res D will offer.
- This will result in a higher CMSC payment to Res B.



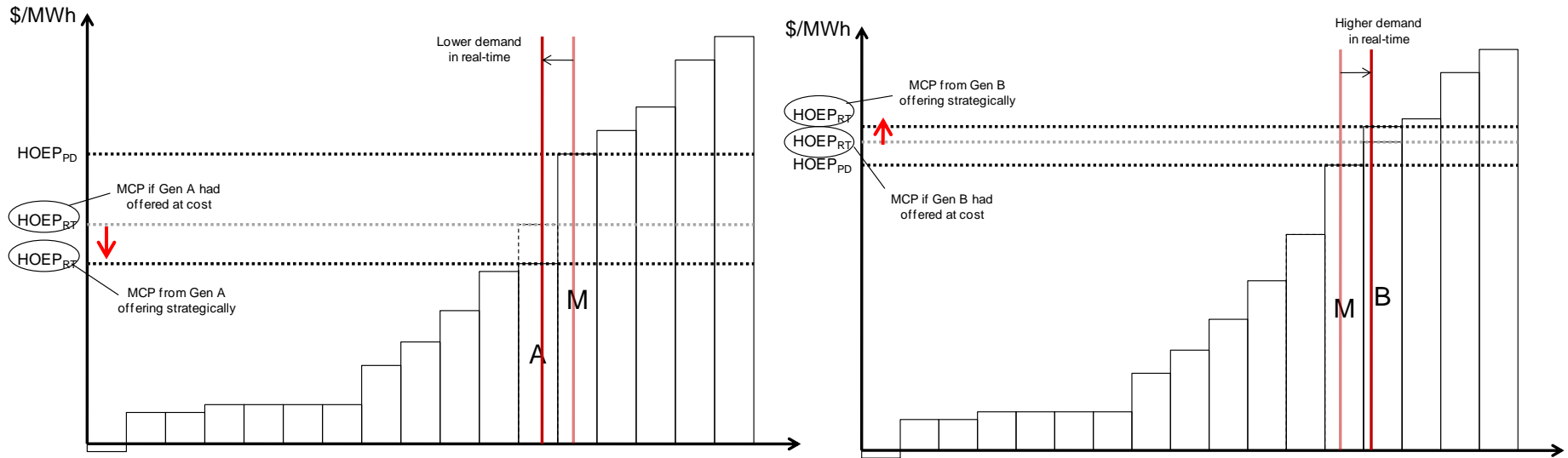
- If Res A “guesses” wrong and offers below Res C, it will be dispatched in the constrained schedule.
- Res C will now be constrained-off, even though it has a lower cost than Res A.
- The inefficiency is the difference between the cost of production of Res A and Res C.
- This out-of-merit dispatch outcome can also be shown for an “Inc” game.

Price Distortions (Shadow Price)



- Res A offering strategically can potentially lead to a lower shadow price in a zone with constrained-off supply. Similarly, a higher shadow price could occur in a zone that is frequently constrained-on.
- Strategic offers or bids also result in higher CMSC payments, which raises the effective price of consumption (HOEP + uplifts) to all consumers.
- Distorted prices can lead to inefficient production and consumption decisions.

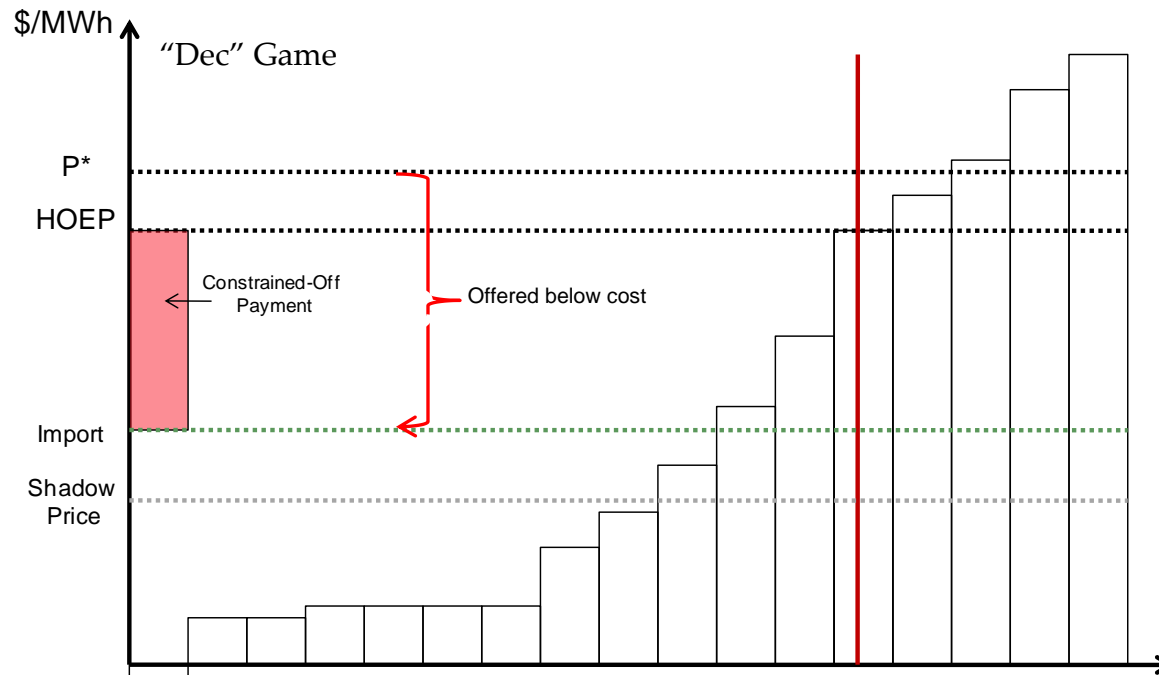
Price Distortions (HOEP)



- Strategic offers can also affect the uniform market clearing price (HOEP).
- Res M is expected to be the marginal unit in pre-dispatch.
- Res A, anticipating to be constrained-off, offers strategically to maximize CMSC.
- In real-time, demand comes in lower than expected. Res A is now the marginal unit and sets the uniform market price. HOEP is lower than if Res A had offered at cost.
- Conversely, demand could come in higher than expected. Res B, anticipating to be constrained-on, has offered strategically. HOEP will be “artificially” higher.

- The MSP has identified several undesirable outcomes in the Ontario market that can be characterized as result of pay-as-bid incentives.
- The MDC also acknowledged several undesirable outcomes that could occur in their discussion of wholesale market design.
- While several of these examples involve import/export transactions, it can be envisioned that similar opportunities exist for domestic generators or loads.
 - An external reference price enables the identification for pay-as-bid incented behaviour with inter-jurisdictional transactions. This is more difficult for domestic resources in establishing an appropriate or fair CSMC adjustment.

1. Fictional Imports
2. Fictional Exports
3. Inefficient Exports
4. Simultaneous Import/Export
5. Exports at Uncontested Interties
6. Negative Offers in Surplus Zones
7. Self-Induced CMSC
8. Locational Investment
9. Uplift

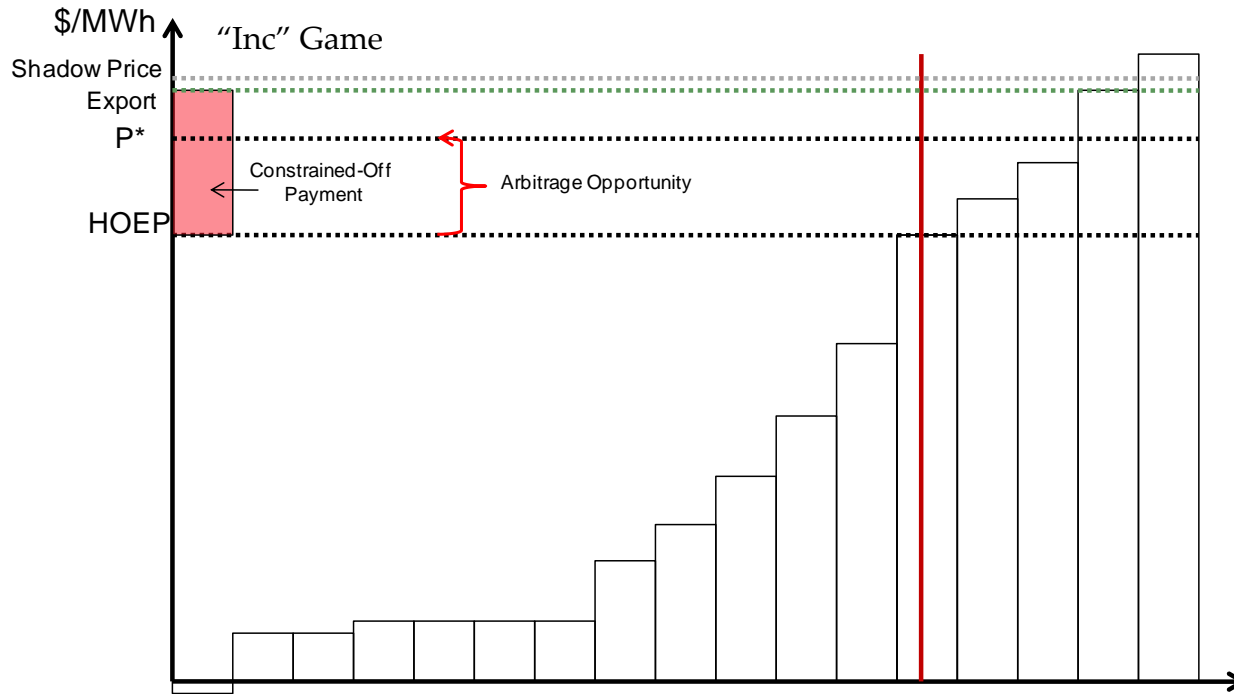


Previously Identified:
Market Design Committee
MSP Report – Dec 05, June 06,
Dec 06,
SE-10,
MR-00306

Example:
Import from Manitoba
into Northwest zone

Estimated Magnitude
Apr 05 – Sept 05: \$7M

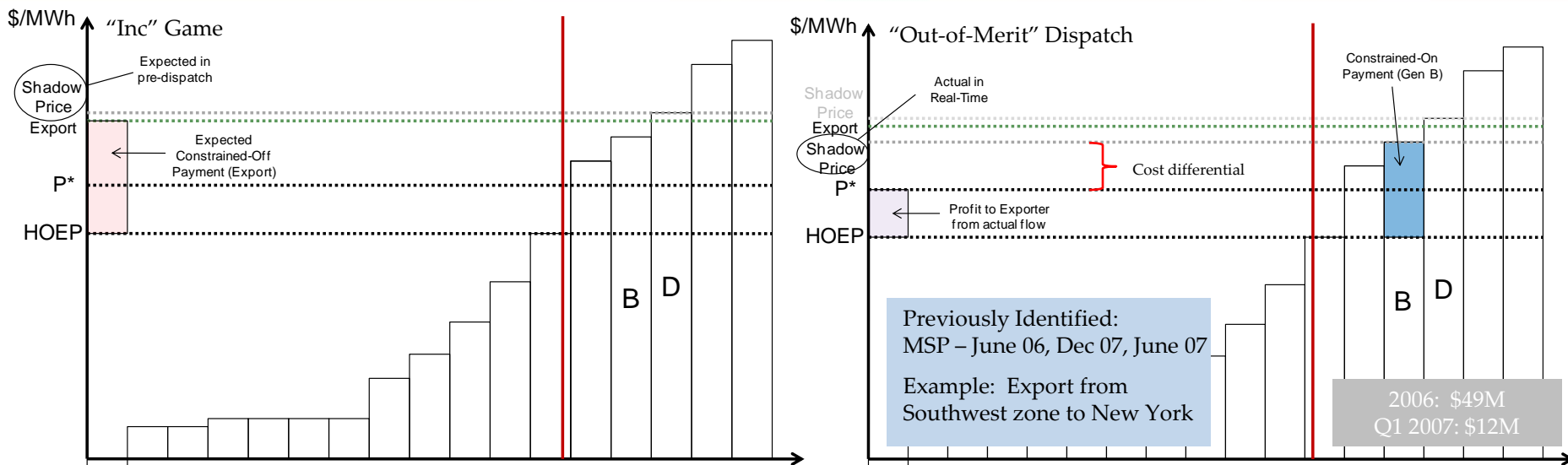
- An import is offered into a zone between the uniform price and the shadow price in the zone, anticipating to receive a constrained-off payment (“Dec” game).
- Though the import is selected in the unconstrained schedule, there is little expectation of delivery as its offer exceeds the shadow price.
- The import offer can be structured independently of any arbitrage opportunity between the two markets. It can be offered below the foreign cost of supply.



Previously Identified:
Market Design Committee
MSP Report – Dec 05, June 06,
Dec 06,
SE-10,
MR-00306

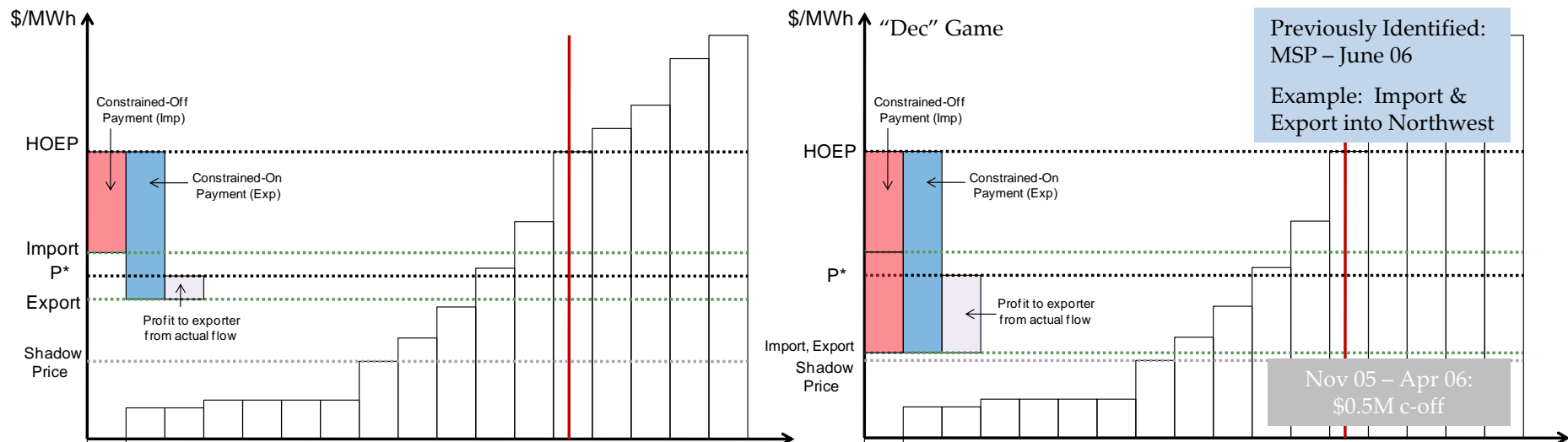
Example:
Export from Southwest
zone to New York

- An export is bid into a zone between the uniform price and the shadow price, anticipating to receive a constrained-off payment (“Inc” game).
- Though the export is selected in the unconstrained schedule, there is little expectation of delivery as its bid is less the shadow price.
- The export bid can be structured independently of any arbitrage opportunity between the two markets. Actual flow does not have to be economic.



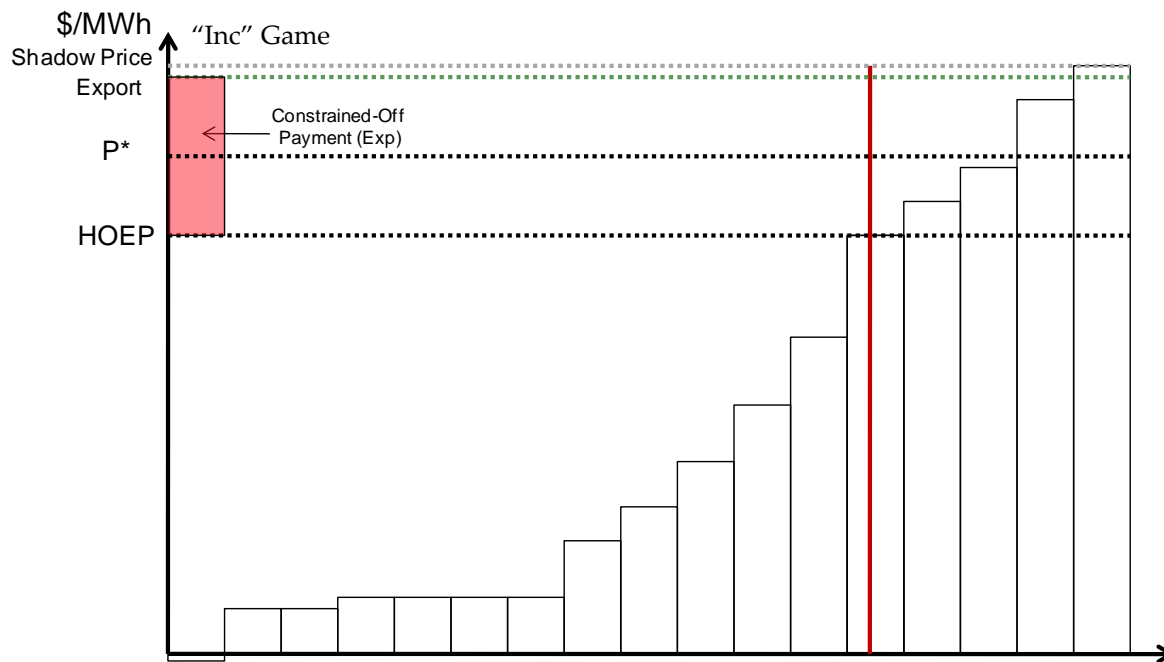
- Similar to "fictional" exports, a profit maximizing export could bid above P^* and below the expected shadow price attempting to maximize CMSC payment.
- In real-time, the shadow price may be lower (Res D is not dispatched).
- The export, expecting to be constrained-off, will now flow as its bid exceeds the shadow price in the zone. This flow is profitable to the exporter ($P^* > \text{HOEP}$).
- Res B is constrained-on to supply the export. The incremental cost of production exceeds the foreign delivered price (presumably the foreign cost of production).
- This is an inefficient trade flow and a cross-subsidy from Ontario to foreign loads.

Simultaneous C-On/C-Off Payments



- An import and an export can be offered in the same zone by the same participant, such that they simultaneously receive both a constrained-off and constrained-on payment.
- The participant may offer the import just above the shadow price to maximize CMSC. It will be accepted in the unconstrained schedule, but constrained off.
- The export could be bid just above the shadow price to maximize the profit on its export transaction. It will not be accepted in the unconstrained schedule, but will be constrained-on for a profit of $[P^* - (HOEP - CMSC)]$

“Uncontested” Export Interties

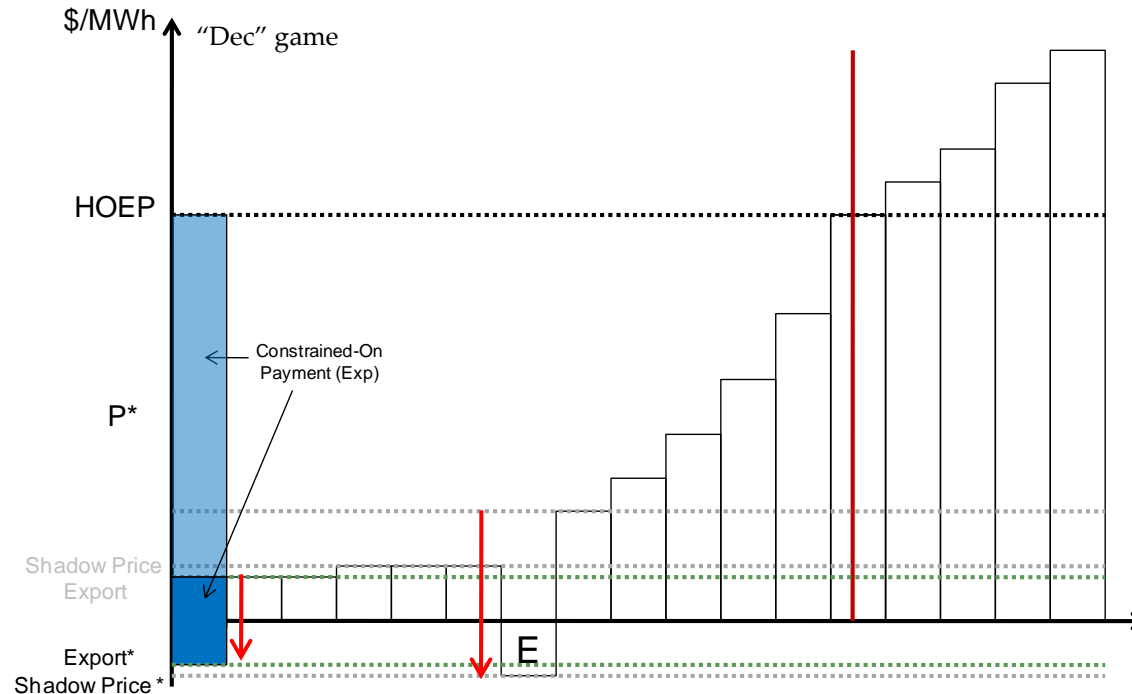


Previously Identified:
MSP Report– Dec 03,
MR-00243

Example:
MBSI, PQHZ, PQDA

- An uncontested export intertie exists when competition for energy withdrawals on the interface is limited or non-existent. Participant can control whether congestion occurs on this intertie and is assured of paying HOEP regardless of its bid price.
- Participant increases export bid to ensure being selected in unconstrained schedule.
- Due to insufficient local adequacy, these exports are constrained-off in dispatch schedule. These payments can become very high as bid prices increase.
- The export bid can be structured independently of any arbitrage opportunity.

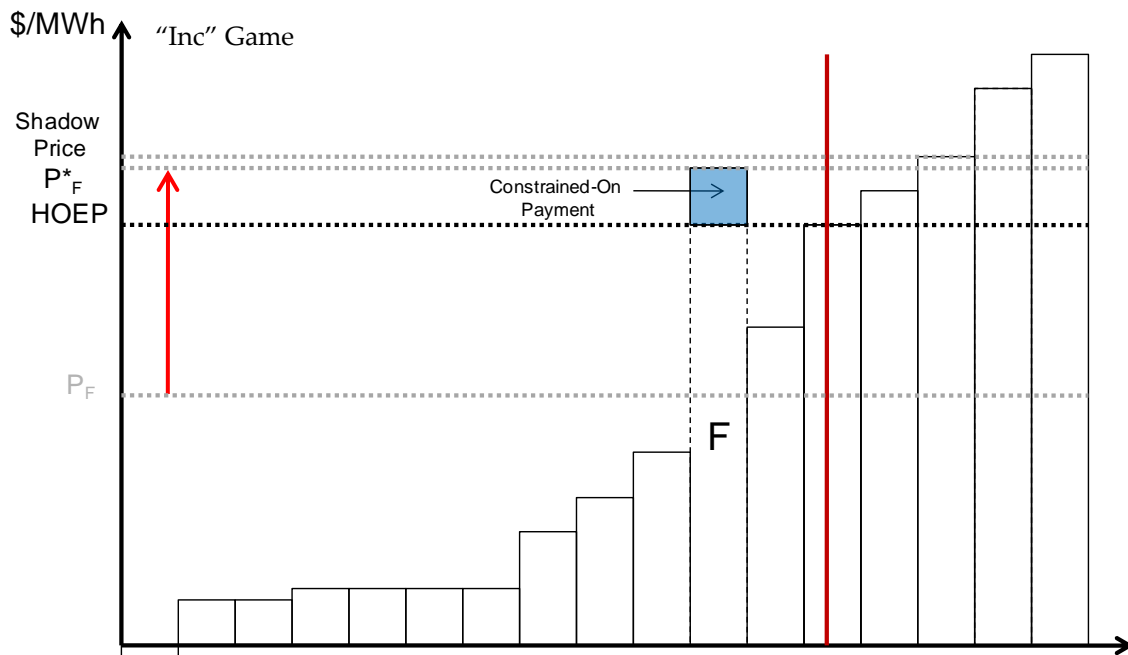
Negative Offer In Surplus Zone



Previously Identified:
MSP - Oct 02, Dec 03
MR-0239

Example:
Northwest

- Res E is located in a zone with surplus supply and wants to avoid being constrained-off. To ensure they are dispatched, Res E offers negatively.
- This can result in a negative shadow price in the zone. An export that would have been previously rejected, will now be accepted in the constrained schedule and receive a constrained-on payment.
- Export could bid strategically lower, to maximize CMSC payment.

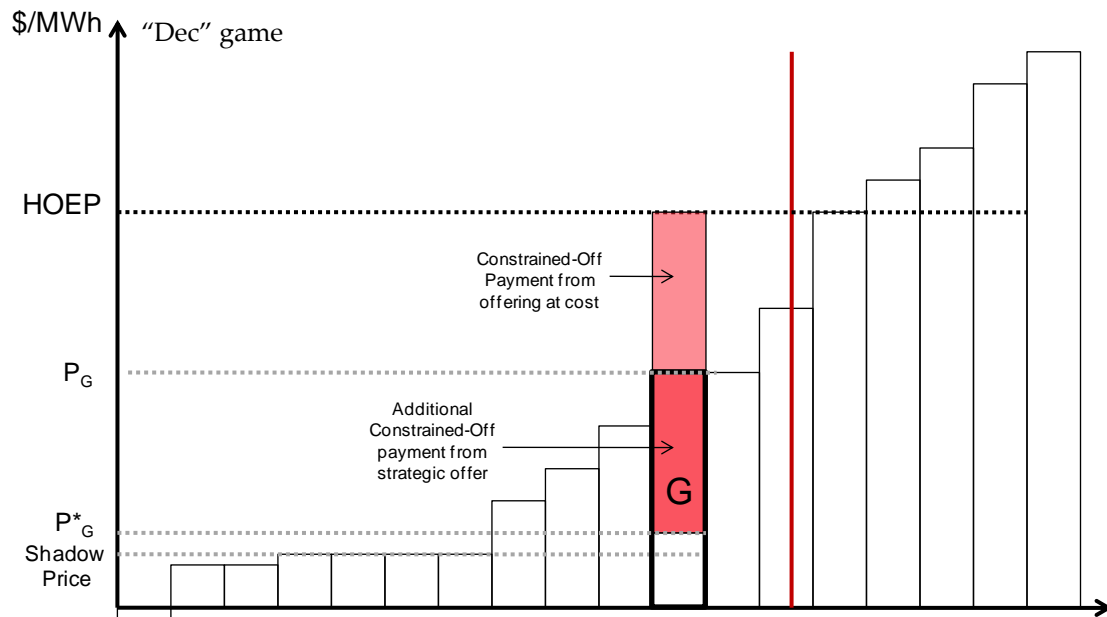


Previously Identified:
MSP – CMSC Disc. Paper,
Dec 07, Dec 08
MR-00252

Example:
Toronto, Southwest

Nov 06 – Oct 08:
Coal: \$0.835 M
Gas: \$6.9M

- Slow-ramping generators have technical limitations affecting the time it takes to ramp down. The unconstrained schedule uses a 3x ramp rate, while the constrained uses the actual ramp rate.
- Instead of removing offer, a slow ramping generator will raise its offer price.
- Offers of constrained-on units are intended to be out well out of the money and not reflective of their costs.
- Divergence between market and dispatch schedule results in a CMSC payment.



Previously Identified:
MDC, MSP – Dec 02, June 06,
Dec 06, CMSC discussion paper
MPWG – Issue 23

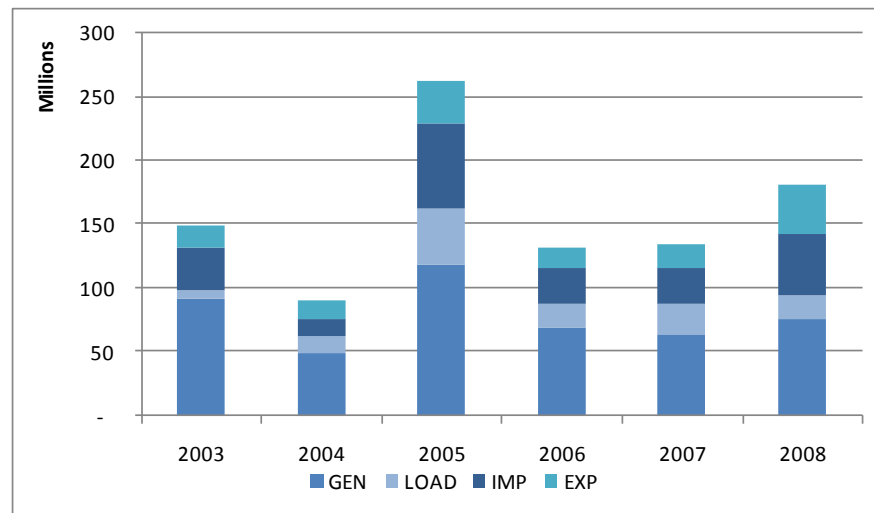
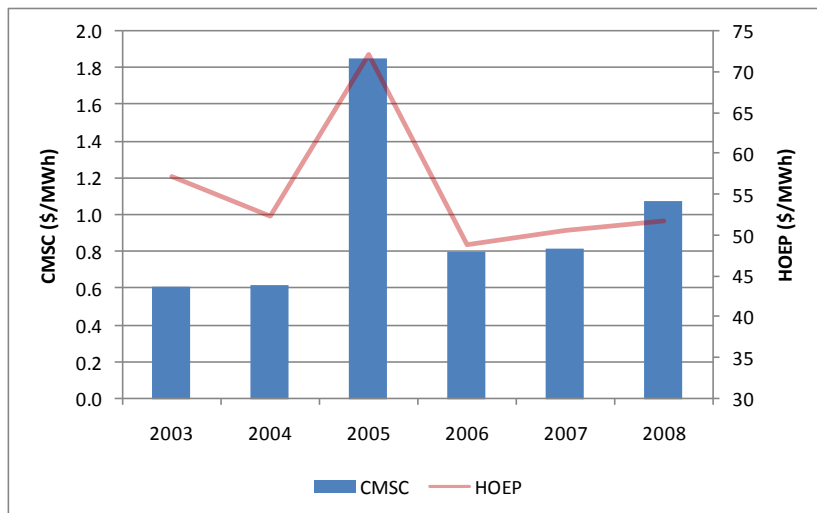
Example:
Northwest Zone

- CMSC payments do not provide sufficient signals to the market about the desired location of new investment. Payments due to specific transmission constraints cannot be accurately observed by market participants.
- Discourages generators from advocating or paying for transmission expansions.
- Constrained-off payments could make a potential investor indifferent to transmission system conditions when choosing a location for new generation.
- It would be potentially profitable to build a new plant (Res G) where there is little likelihood output would be dispatched (“Fictional” generator).

- Node loss factor: increase in total system (line) losses when an additional MW is injected at that node. Actual loss factors within power system change continuously.
- Transmission line losses are modelled and accounted for as static penalty factors [$PF = 1.0 / (1 - \text{loss factor})$]. In the constrained schedule, these penalty factors adjust bid and offer prices used in the dispatch calculation.
- Dispatch of resources takes into account effect of incremental losses, which are reflected in the shadow price of each node. Incremental losses are normally higher than actual losses.
- Shadow prices require true-ups through hourly uplift to account for the difference between incremental and actual losses.
- The different treatment of losses contributes to the observed difference between the uniform prices and nodal prices calculated and published. This reduces price transparency and blunts efficient market signals.

Previously Identified:

MDC, MPWG – Issue 18 (Pricing and Allocation of Line Losses),
Issue 19 (Node Loss Factors), Issue 22 (Pricing Physical Constraints)



- In 2008, CMSC uplift was \$1.08/MWh or a total of \$182 million.
- 48% of CMSC payments were made to import or export transactions.
- Of total payments made to generators and loads (excluding imp/exp), over half was paid to MPs located in the North (NW – 26%, NE - 27%).
- Constrained-off payments (68%) were more than double constrained-on (32%).
- The Manitoba interface was most likely to have imports constrained-off. The Minnesota interface was most likely to have exports constrained-on.