

# Single Schedule Market Pricing Issues

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**Phase 2 - Session 2  
Module G: Market Power Mitigation Options**

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## **G. Market Power Mitigation**

1. Review of Market Power Mitigation
2. Overview of Key Mitigation Design Choices
3. Market Power Test Design
4. Test and Mitigation Timing
5. Determination of Ex Ante Reference Prices
6. Margins and Thresholds

# **1. Review of Market Power Mitigation**

Avoiding the exercise of significant market power is an important goal both from both the standpoint of maintaining efficient electricity markets and of avoiding undue wealth transfers.

The exercise of local market power typically entails economically or physically withholding some supply from the market in order to raise the price at which the remaining supply is sold.

- **Economic withholding:** to offer a portion of or all available capacity at a high price so that it is not scheduled
- **Physical withholding:** to not offer a portion of or all available capacity into the market

In single schedule electricity markets with uplift payments and multi-settlement systems, there is also the potential for the exercise of market power to depress the prices at which deviations from day-ahead market schedules are settled or to inflate uplift payments.

Market power mitigation is intended to ensure that electricity markets are not impacted by the exercise of significant market power through:

- Submission of high offer prices and/or restrictive operating parameters intended to raise the price of energy or operating reserve
- Submission of low offer prices and/or operating parameters intended to depress the price of energy
- Submission of high start-up or minimum load costs and/or restrictive operating parameters intended to inflate uplift payments

Market power mitigation attempts to approximate competitive market outcomes in the presence of local market power.

- Typically applied by replacing offers that materially depart from estimated short-run marginal costs (including opportunity costs) with an estimate of a cost based offer (referred to as a reference price)
- Mitigation designs differ in complexity, effectiveness, market impact, and transparency

All North American ISOs (other than Alberta) apply local market power mitigation in which:

- Offer prices, and non-price bid parameters can be replaced with estimates of competitive values
- Offer price floors and caps are sometimes used

The exercise of local market power is currently addressed in the IESO energy markets through various controls:

- An after-the-fact review process (based on a **pivotal supplier test**) which can clawback CMSC payments
- Eligibility requirements that limit CMSC payments
- Limits on constrained-off CMSC payments for intertie transactions
- Replacement offer price floors used to calculate CMSC payments for suppliers, constrained on dispatchable loads, and constrained on exports
- Offer cap of \$2,000

The current local market power mitigation process only impacts CMSC payments to resources dispatched up or down relative to the uniform price (not settlement prices for the market). It can therefore be applied after-the-fact.

- In single schedule markets the exercise of local market power can impact the dispatch and clearing prices for other buyers and sellers (as well as for other resources owned by the same resource operator)
- After-the-fact mitigation would entail resettling the entire market
  - This is not a reasonable outcome

ISOs coordinating markets based on single schedule pricing generally apply local market power mitigation on an ex-ante (before the event) basis:

- Offers are tested for market power and mitigation applied before day-ahead or real-time schedules and nodal prices are calculated
- The main exception to the ex ante application of mitigation is mitigation applied to the calculation of uplift payments for resources committed out of merit which can be applied after the fact because it does not impact clearing prices

There are two core approaches for applying ex-ante mitigation in single schedule markets:

- **Pivotal supplier** tests evaluate the potential for the exercise of local market power based on whether particular firms, or groups of firms, are “pivotal”. That is, at least some of their output is needed to manage transmission congestion (e.g. to avoid overloads) on a particular transmission constraint
- **Conduct and impact** tests evaluate whether offer prices likely reflect the exercise of local market power based on whether the offer price of particular resources would materially impact either energy or reserve clearing prices or uplift payments

## SSM Market Power Mitigation

## Review - Designs

ISO	Pivotal Supplier	Conduct & Impact	Pivotal Supplier and Other
PJM	Yes (3)		
NYISO		Yes	
ISO-NE		Yes	
MISO		Yes	
SPP		Yes	
CAISO	Yes (3)		
ERCOT			Yes

All North American ISOs coordinating single schedule markets (except Alberta) also designate some locations or types of dispatch instructions as inherently non-competitive and either offers or clearing prices are automatically subject to some form of mitigation.

- Resources dispatched or committed outside the normal market process to maintain system or local reliability (mitigation for out-of-merit dispatch is applied ex-post as it does not impact market clearing prices)
- Non-competitive proxy buses (New York ISO)

- For a single schedule market design, the IESO could continue to base local market power mitigation on a **single pivotal supplier test**
- The IESO would, however, need to make some fundamental changes in the current process in order to apply mitigation before prices are calculated
- The current IESO single pivotal supplier test differs from the pivotal supplier tests applied by PJM and the California ISO in a number of important respects because it is applied after the fact, based on the actual dispatch

## **2. Overview of Key Mitigation Design Choices**

## Key Design Choices

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The key mitigation design choices impacting stakeholders are:

1. What test will be used to assess the need for, and trigger, mitigation?
2. When will the test and mitigation be applied?
3. How will reference prices be computed?
4. What margins and thresholds will be used in triggering and applying mitigation?

The initial discussion will focus on the **first three choices**. The determination of the margins and thresholds used in triggering and applying mitigation are best discussed after these initial design choices have been made, avoiding the need for detailed discussion of options that are not selected.

## **Key Design Choices**

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After these key design choices have been made the IESO will need to work through many implementation details.

Some details of the implementation design choices may need to be worked out in conjunction with discussions with potential software vendors.

## **3. Market Power Test Design**

The current IESO market power mitigation design combines aspects of a pivotal supplier test with aspects of a conduct and impact test to identify resource owners potentially able to exercise local market power.

- The pivotal supplier test is currently applied after the fact (ex-post) by the IESO
- Identified suppliers are subject to having their CMSC payments recalculated using estimated cost based offers
- Because the IESO applies the pivotal supplier test after the fact, it is able to apply materiality thresholds to mitigation. Hence, the current IESO mitigation design includes an impact test
- The current IESO mitigation design also includes a conduct threshold which examines how much participant's offers have varied from a historical norm

Both the PJM and California ISO use ex ante pivotal supplier tests combined with a conduct test, allowing offers that are within a margin of the estimated competitive offer to go unmitigated, but neither applies an impact test.

The New York ISO, ISO New England, MISO and SPP all use conduct and impact tests.

The fundamental options with respect to the design of the market power test are whether to employ:

1. A pivotal supplier test
2. A conduct and impact test

Pivotal supplier tests evaluate the potential for the exercise of local market power based on whether particular firms, or groups of firms, are “pivotal”.

### **Advantages:**

- Links an assessment of whether a particular supplier possesses local market power to the competitive structure
- Applied separately to each transmission constraint and to each supplier or combination of suppliers
- The IESO has been using this type of market power test for many years

### **Complications:**

The conceptual description of a pivotal supplier test does not describe the actual methods used to carry out the test in ex ante market power mitigation designs such as those used by PJM and the California ISO.

- Pivotal supplier tests are not carried out by dispatching resources to meet load in a security constrained dispatch but use simplified approximations
- Testing each resource would require multiple dispatch solutions for each binding constraint, which would require far too much time to be carried out either in the day-ahead market or real-time.
- Therefore, the IESO would (like PJM, ERCOT and California ISO) need to use simplified approximations to apply the test on an ex ante basis

The IESO currently applies a **single pivotal supplier test**. Firms pass this test if none of their capacity is needed to relieve the transmission constraint being tested.

- The California ISO and PJM both use a **three pivotal supplier test**. Firms pass this test if none of their, or the two other largest suppliers', capacity is needed to relieve the transmission constraint being tested
- One rationale for using a three pivotal supplier test is that the single supplier test is more likely to fail to identify the potential for the exercise of market power because of the approximations required to apply the test on an ex ante basis

The three pivotal supplier test is an extremely restrictive test and can trigger mitigation when there is little potential for the exercise of market power.

- No matter how small the amount of congestion relief controlled by the firm being tested, it will fail a three pivotal supplier test unless none of the capacity of the two largest suppliers is needed to relieve the constraint being tested
- The firm being tested would fail and be subject to mitigation even if the two largest suppliers offered their supply at or below the estimated competitive offer price

The PJM market monitor (Monitoring Analytics) publishes data showing the frequency with which firms pass or fail the test for a set of large interface constraints.

- These data reflect the restrictiveness of the three pivotal supplier tests as almost all firms fail the test even on constraints with many suppliers able to provide counterflow

## PJM 2016

Constraint	Time	Average # of Suppliers	Average # of Suppliers Failing Test
AEP-DOM	On-Peak	10	10
	Off-Peak	10	10
AP-South	On-Peak	11	8
	Off-Peak	12	4
Bedington-Black Oak	On-Peak	12	9
	Off-Peak	10	8
Western	On-Peak	12	8
	Off-Peak	11	10

Source: Monitoring Analytics, 2016 State of the Market Report for PJM, March 9, 2017 Table 3-26 p. 124

The California ISO market monitor (Department of Market Monitoring) publishes data showing the frequency with which constraints bind and are found to be competitive or non-competitive using the three pivotal supplier test.

- When any supplier fails the pivotal supplier test for a constraint in California, all suppliers able to relieve the constraint fail and will have their offer prices capped

## California 2016

<b>Market</b>	<b>Average # of Constraints Tested</b>	<b>Percentage Passing</b>
Day-Ahead	2.36	77.65%
15-Minute	1.85	77.1%
5-Minute	2.19	76.9%

Source: California ISO, Department of Market Monitoring, 2016 Annual Report on Market Issues & Performance, May 2017, Tables 7-3, 7-4, 7-5, and 7-6

The conduct and impact test has three components:

- **Scope:** What is the region within which the test is applied?
- **Conduct:** Do the offer prices or other bid components of any resource exceed the estimated competitive offer price level by the amount of the conduct threshold?
- **Impact:** Does the use of offer prices and other bid components (that violate the conduct threshold) to clear the market raise the projected market price at any location by more than the impact threshold?

The **impact** test is applied by comparing the LMPs and uplift payments between two scenarios:

- Scenario #1: Dispatch and pricing is solved based on the submitted offers/bids and non-price parameters
- Scenario #2: Dispatch and pricing is solved substituting reference level offers and non-price parameters for the offers and parameter values that exceed the conduct threshold

If the LMPs and/or uplift payments calculated in scenario #1 exceed those calculated for scenario #2 by the amount of the **impact threshold**, the offers or non-price parameters exceeding the **conduct threshold** are replaced with the reference values in the actual dispatch.

### Advantages:

The conduct and impact test does not have to rely on complicated approximations in accounting for:

- The cost effectiveness of the supply provided generation outside the group being tested
- The impact of transmission constraints that may limit the output of the competitive fringe
- Supply that is offered at low prices or as price taking supply by a supplier potentially able to exercise market power
- The impact of commitment costs or ramp rate limits of fringe suppliers
- The impact of non-price bid parameters on prices

### Limitations:

- Because of solution time constraints, the impact test must be applied collectively to all bids and offers that violate the conduct threshold (without regard to the impact of individual resource offers).
- Even when applied collectively to all suppliers, the conduct and impact test requires two or possibly three full executions of the unit commitment and dispatch software, requiring more solution time to carry out.
  - This can require applying the test further in advance of real-time

## Comparison of Pivotal Supplier and Conduct & Impact tests

Test	Examines each supplier separately?	Full dispatch to estimate impact?	Uses conduct trigger?	Which units mitigation applied to	Examines each constraint separately?	Must be applied ex ante in SSM?
<b>Pivotal Supplier</b>	YES	No, simplified approaches necessary for implementation	Possible	Pivotal units (PJM) All units impacting constraint (CAISO)	YES	YES
<b>Conduct and Impact</b>	NO	YES	YES	All units failing conduct test if impact test is failed.	NO	YES

## **4. Test and Mitigation Timing**

## Test Timing

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The introduction of SSM pricing will require the IESO to apply market power mitigation on an ex ante basis.

Applying market power mitigation tests on an ex ante basis is a foundational feature of a single schedule market. There is only one viable option for this design element.

1. Apply market power mitigation ex ante

## Test Timing

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Like most other ISOs coordinating single schedule markets, the IESO will need to apply ex ante market power mitigation to offers used in the day-ahead market, in commitment processes following the day-ahead market, and in the real-time dispatch.

## Test Timing

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### Applies Mitigation

	<b>Day-Ahead Market</b>	<b>Real-Time Commitment</b>	<b>Real-Time Dispatch</b>
PJM	Yes	Yes	Yes
New York ISO	Yes	Yes	Yes
ISO New England	Yes	Yes	Yes
MISO	Yes	Yes	Yes
SPP	Yes	Yes	Yes
California ISO	Yes	Yes	Yes
ERCOT	No	Yes	Yes

# **5. Determination of Ex Ante Reference Prices**

Both the pivotal supplier and conduct and impact tests utilize “reference prices” to approximate the competitive cost level.

- The IESO’s current after-the-fact review and recovery of CMSC is also based on reference prices
- The reference prices used in the current process are based on offer prices, prevailing energy market prices, and marginal/opportunity costs
- Reference prices for “commitment costs” will be discussed in the Enhanced Real-Time Unit Commitment (ERUC) workstream

There are two high level options to consider:

1. Apply the principles used today to determine reference prices in an SSM market
2. Develop new principles to apply when determining some or all reference prices in an SSM market

U.S. ISOs coordinating single schedule markets with ex-ante market power mitigation use a variety of methods to determine reference prices:

- Gas price indexes
- Prior offer prices, (sometimes adjusted for changes in fuel prices)
- Prior market clearing prices (sometimes adjusted for changes in fuel prices)
- Agreed upon reference prices reflecting opportunity costs
- Formulas/models used to estimate commitment costs and opportunity costs
- Review of market participant models used to estimate opportunity costs (such as for complex hydro system opportunity cost models)

A major issue with the market power mitigation designs of other ISOs has been the determination of the appropriate gas price to use for mitigation.

- This has especially been an issue during winter months when natural gas infrastructure is most likely to be under stress - leading to volatile gas prices'

Another issue with market power mitigation designs has been accounting for the opportunity costs of energy limited resources, including pondage hydro and pumped storage resources.

Increasing reliance on gas fired generation has lead some ISOs to shift to designs in which the market participant can submit offers reflecting current spot fuel prices subject to after the fact mitigation.

- The NYISO implemented this kind of design in Mid 2014<sup>1</sup>
- ISO New England implemented this kind of design in December 2014<sup>2</sup>
- The California ISO is currently stakeholdering such a design<sup>3</sup>

1. see Docket ER14-1735

2. See Docket ER13-1877

3. see  
[http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCosts\\_DefaultEnergyBidEnhancement.s.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCosts_DefaultEnergyBidEnhancement.s.aspx)

# **6. Margins and Thresholds**

The application of either a pivotal supplier or conduct and impact test will require the specification of a variety of cost margins, conduct thresholds, and impact thresholds used in carrying out the tests.

- We described many of the thresholds used by U.S. ISOs in the June 29 Appendix to the mitigation foundations presentation.
- Additional information can be presented to aid discussion once a basic mitigation design (pivotal or conduct & impact) has been tentatively decided on