MA Scarcity Pricing Proposal: Price Targets and Related Issues

SPWG

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Scarcity Pricing: MA position

- **Scarcity pricing is an important part of market design**
- **Scarcity pricing does not mean prices over $1,000**

The Purpose of the Scarcity Pricing Signal

- **Purpose is to signal scarcity**
- **Purpose is to incent participation**
- **Setting the resulting energy price too high will result in a wealth transfer, rather than meaningful increase in participation**
- **Determines the opportunity cost for reserves during scarcity**

MA vs. PJM Basic Mechanics Comparison

Operational	MA	PJM
ORDC	Yes	Yes
Penalty factors drive dispatch in and out of shortage	Yes	Yes
Co-optimization of energy and reserves	Yes	Yes
Opportunity Cost based on LMP	Yes	Yes
Increases and maintains LMP during scarcity	Yes	Yes
Maintain's co-optimization during scarcity	Yes	Yes
Prices signals/compensation consistent with dispatch solution	Yes	Yes

The PJM and MA Proposals: Conceptually and Operationally Identical

- **Concept: Add reserve constraints to the optimization model**
- **LMP is the incremental cost to serve incremental load at a location while controlling for *all* related constraints**
- **Reserves are additional constraints to the optimization.**
- **LMP = Energy + Marginal Losses + Congestion + "Scarcity Adder"**
- **"Scarcity Adder" is an administrative contribution to marginal bus LMP(s) when short reserves**

Example: Synchronized Reserve Target

- **If system runs short of synchronized reserves:**
  - **LMP at the marginal unit buses set equal to $1,000.**
  - **Resulting opportunity costs determined relative to LMP**
  - **Reserve constraint(s) relaxed, penalty factor of $1,000 is maintained**
    - **Dispatch optimization continues**
  - **Max opportunity cost for reserves = $1,000**
  - **Hour ahead market for reserves incorporates opportunity cost in clearing price**

Two approaches, same mechanism

- **Use of Operating Reserve Penalty Factor Curve to drive within hour dispatch and optimization**
  - **PJM**
    - **Two cumulative fixed $850 penalty factors that drive dispatch (within each reserve region)**
    - **Penalty factor(s) applied to marginal bus LMP (max price $2,700) during reserve scarcity**
  - **MA**
    - **$1,000 penalty factor(s) that drive dispatch**
    - **Defined LMP targets (max price $1,000) on marginal buses during reserve scarcity**
    - **Reserve constraint is relaxed to maintain dispatch signal**
    - **Adder to marginal bus endogenously determined**
    - **Maintains indifference between LMP and opportunity cost for reserves**

“MA Approach” vs. “PJM Approach”

	MC	Max Energy	Max Reserve
Gen A	20	400	50
Gen B	60	400	50
Gen C	800	400	50

Reserve Requirement = 100 MW

MA: LMP goes to $1000 when scarce, Max Price for Reserves = $1000

PJM: Penalty Factor = $850

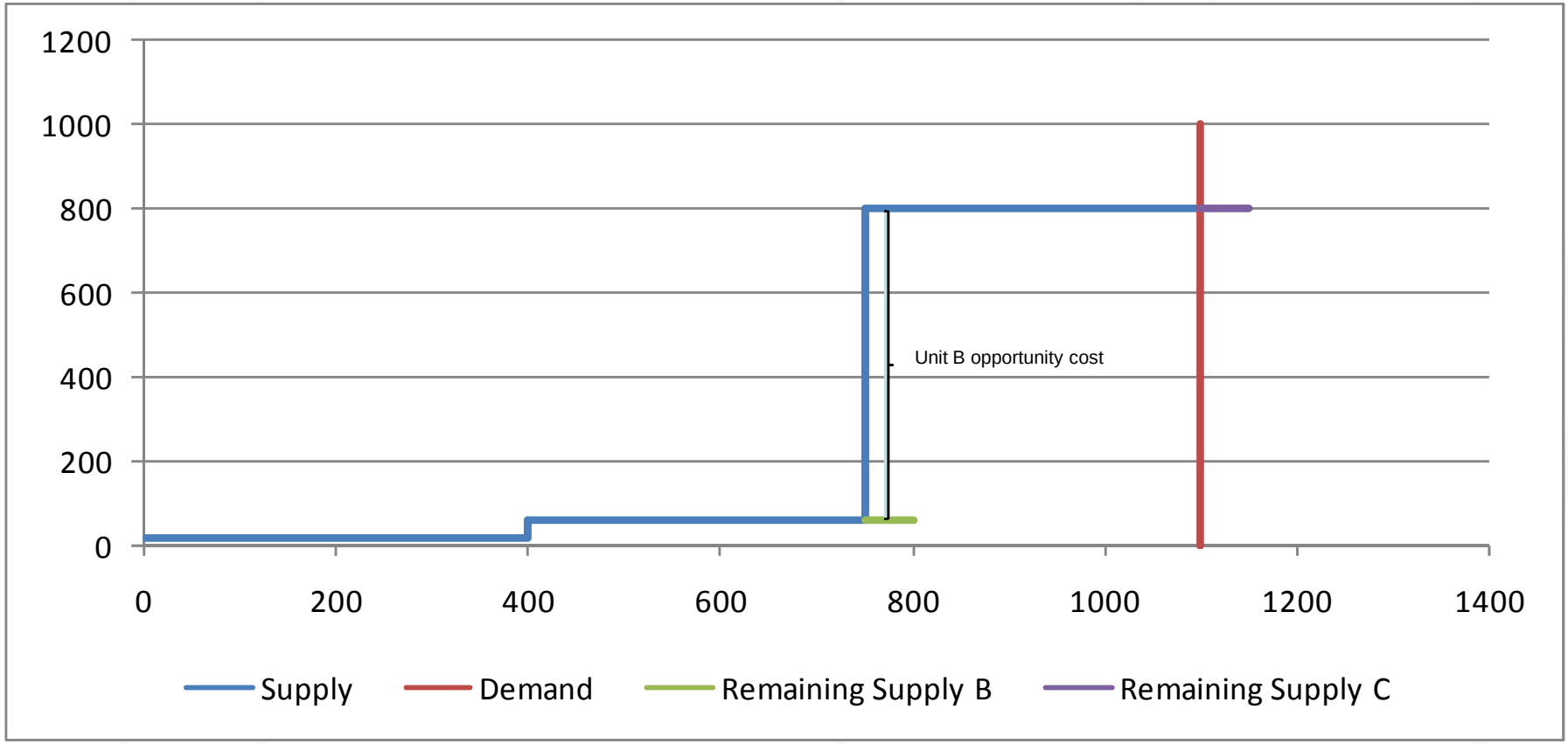
MA Approach

Market Prices				Dispatch						
Total Load/ Energy	System Reserve	Energy Price (LMP)	"Scarcity Adder"	MU	Energy A	Reserves A	Energy B	Reserves B	Energy C	Reserves C
350	100	$60		B	400	0	350	50	0	50
800	100	$800		C	400	0	350	50	50	50
1100	100	$800		C	400	0	350	50	350	50
1110	90	$1,000	$940	B	400	0	360	40	350	50
1170	30	$1,000	$200	C	400	0	400	0	370	30

PJM Approach

Market Prices				Dispatch						
Total Load/ Energy	System Reserve	Energy Price (LMP)	"Scarcity Adder"	MU	Energy A	Reserves A	Energy B	Reserves B	Energy C	Reserves C
350	100	$60		B	400	0	350	50	0	50
800	100	$800		C	400	0	350	50	50	50
1100	100	$800		C	400	0	350	50	350	50
1110	90	$910	$850	B	400	0	360	40	350	50
1170	30	$1,650	$850	C	400	0	400	0	370	30

MA Approach: LMP



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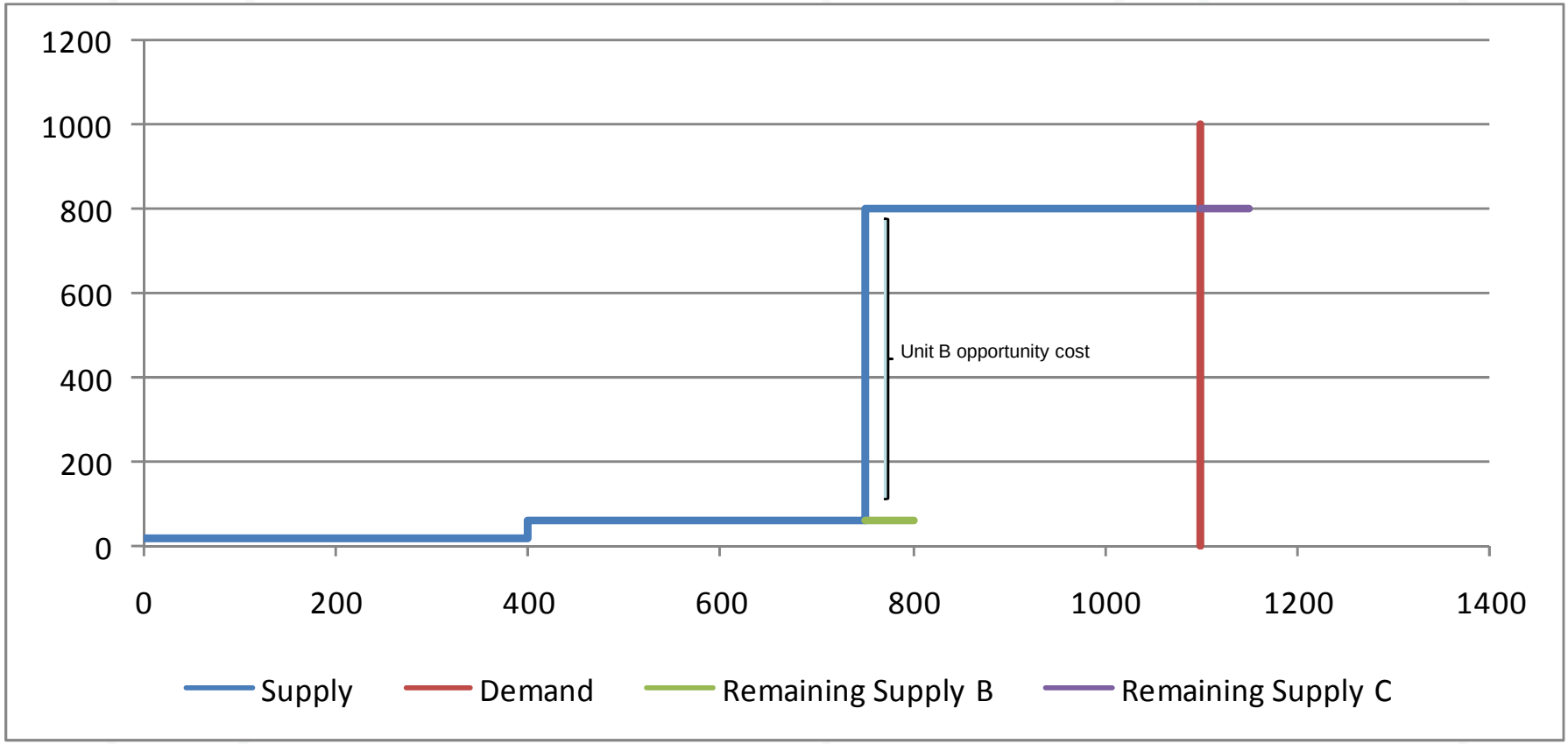
PJM Approach: LMP



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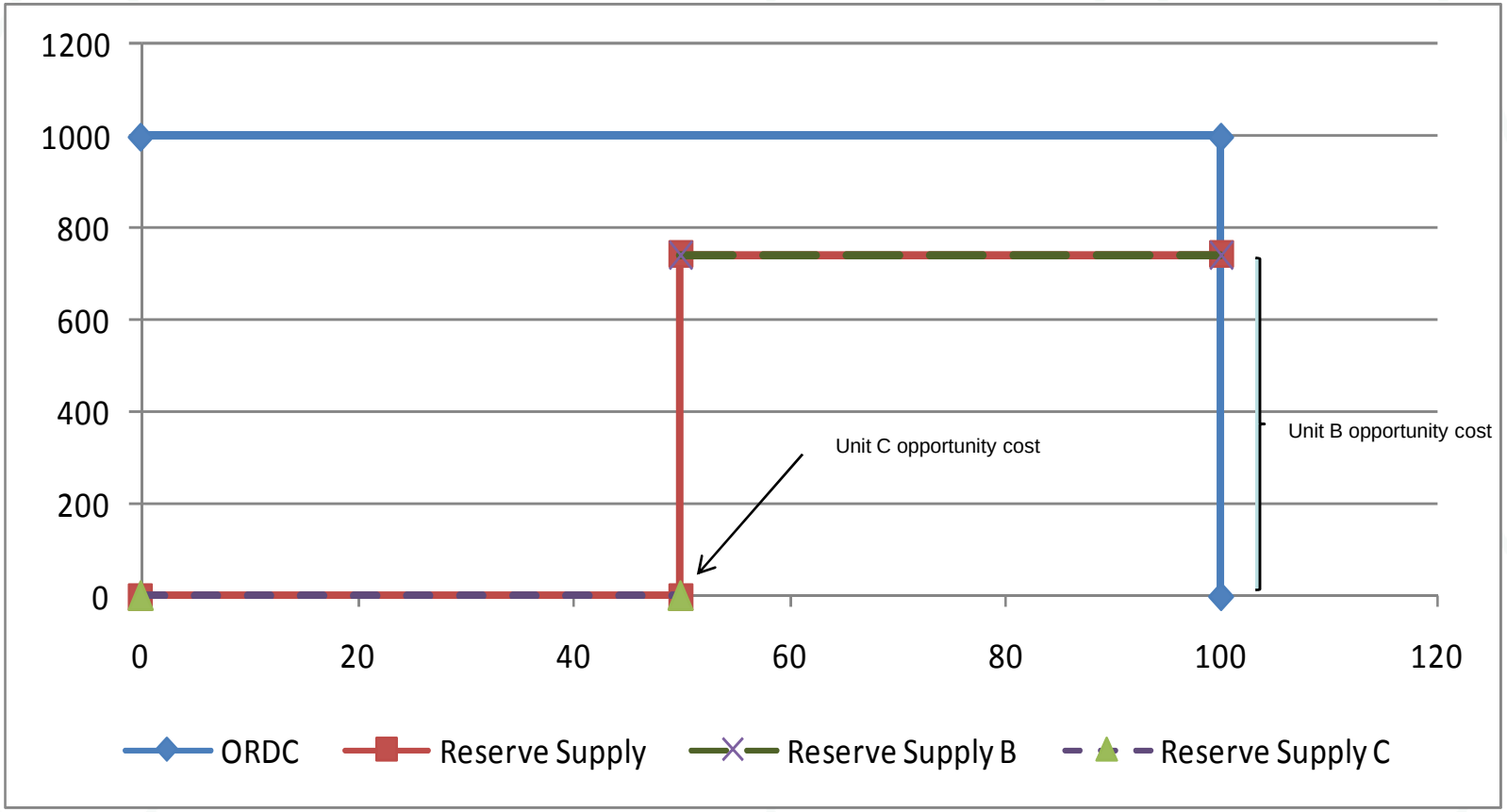
MA Approach: Opportunity Cost for Reserves/Penalty Factor



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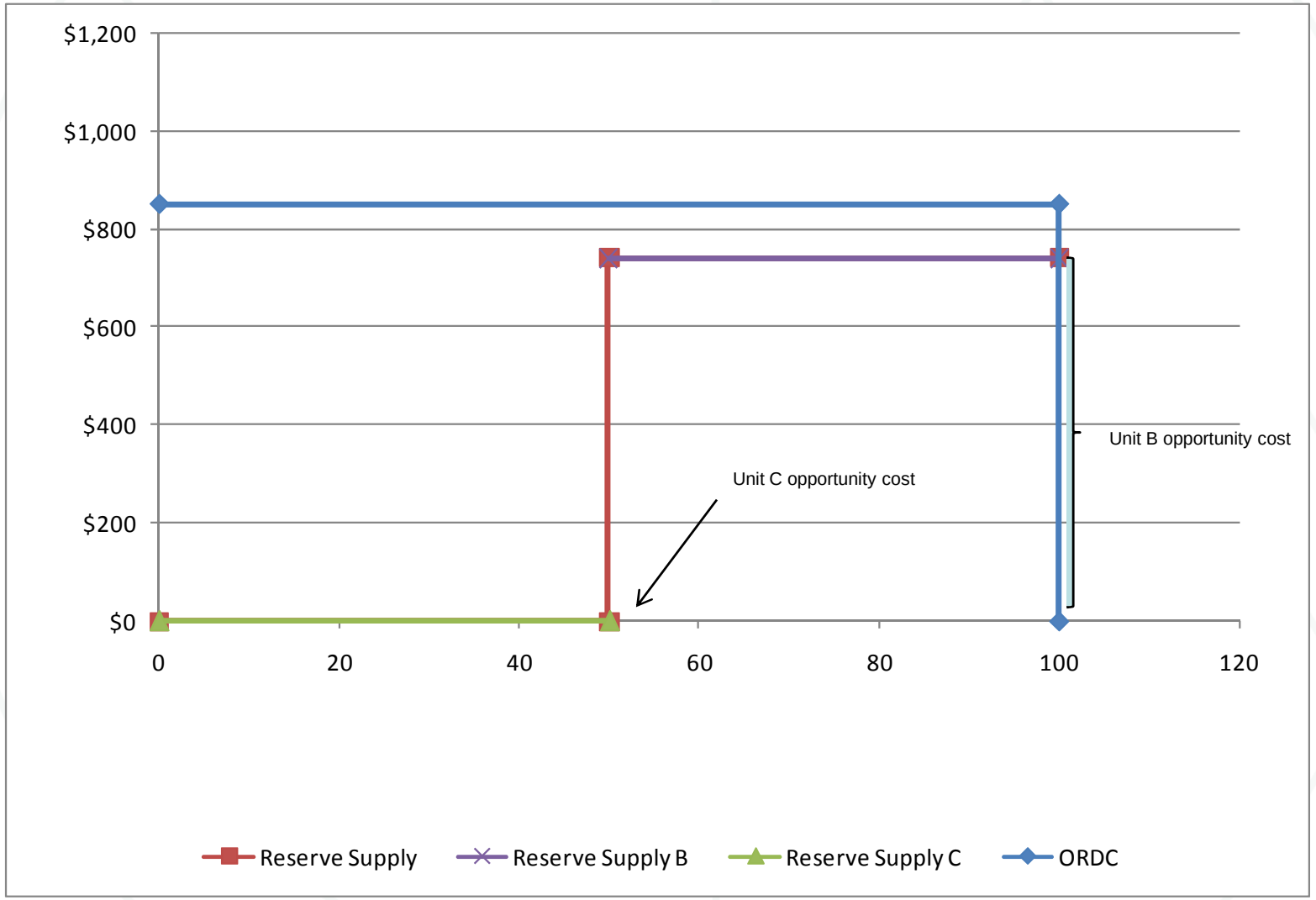
PJM Approach: Opportunity Cost for Reserves/Penalty Factor



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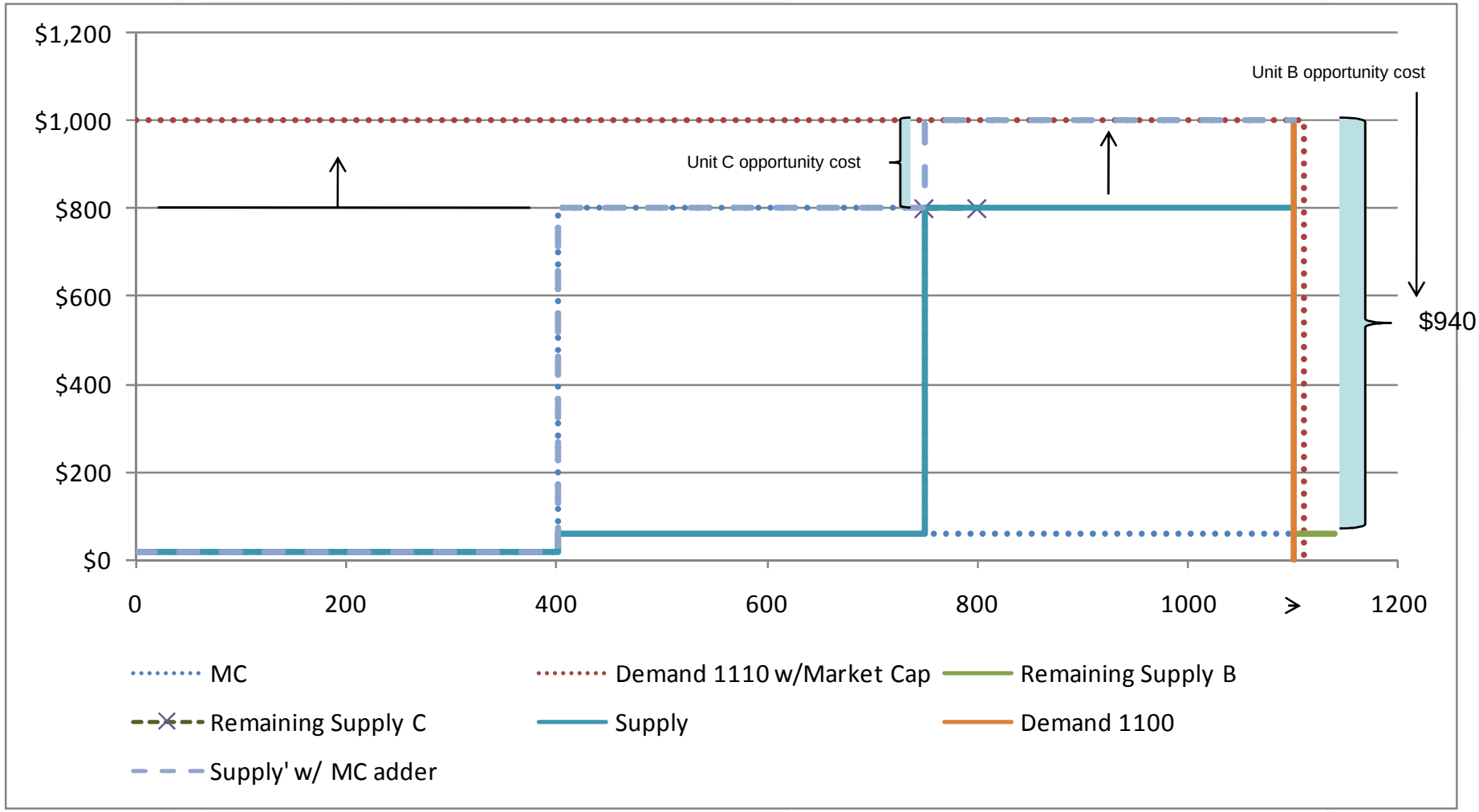
MA Approach: LMP under Scarcity



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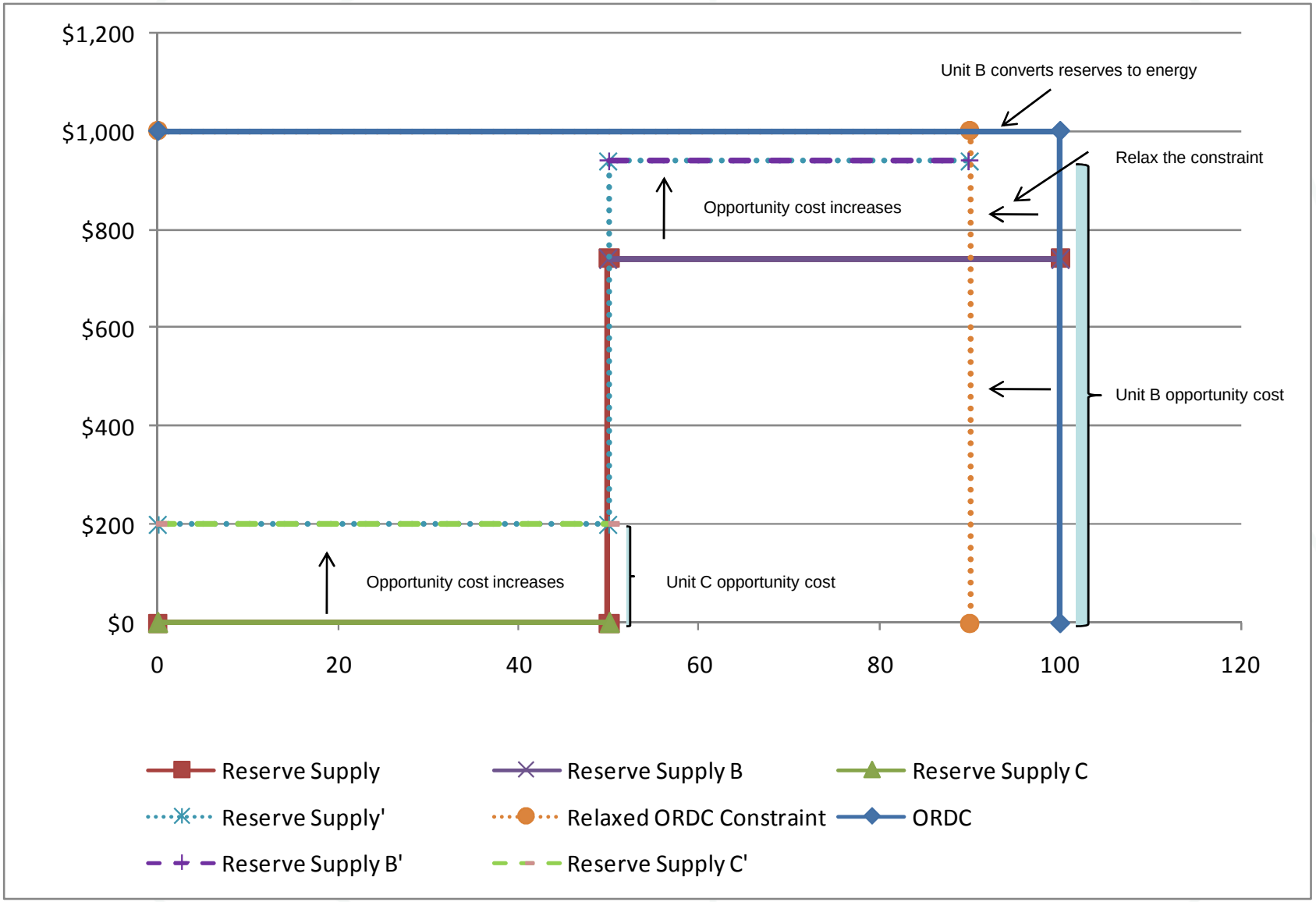
MA Approach: Opportunity Cost/Scarcity



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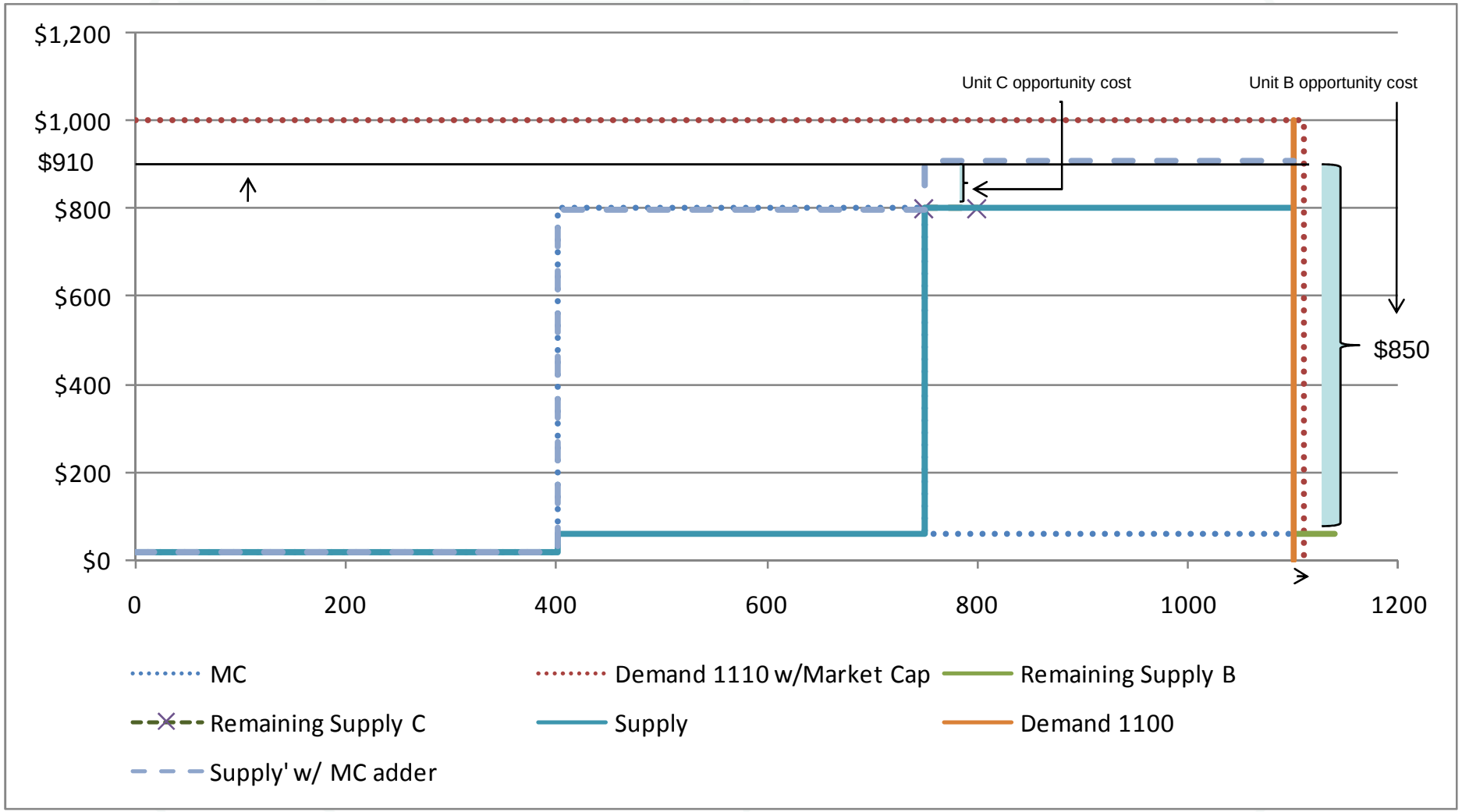
PJM Approach: LMP under Scarcity



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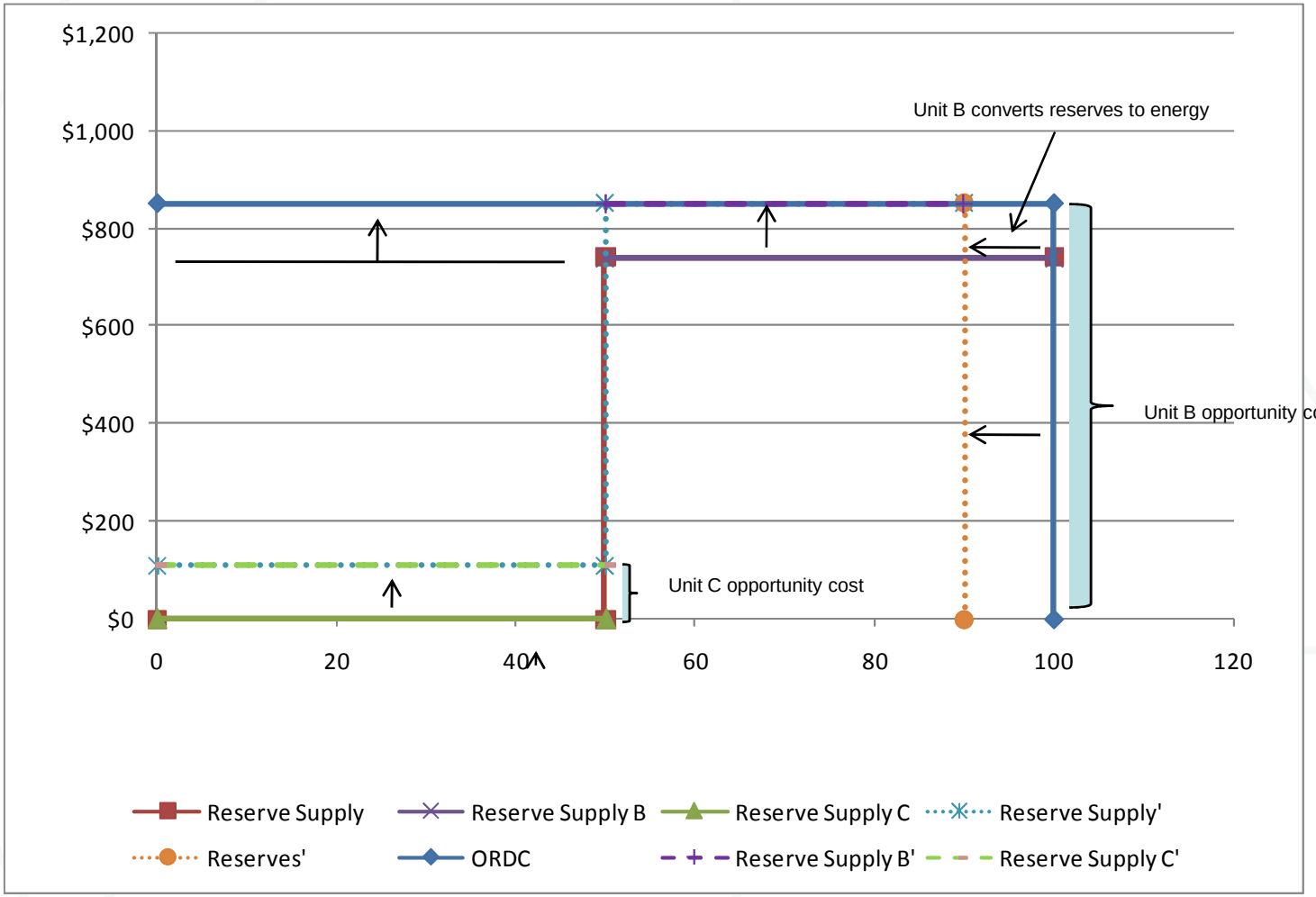
PJM Approach: Opportunity Cost/Scarcity



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MA vs. PJM Approach: Functionally the Same

- **Using the same reserve targets, the unit specific operational dispatch signals are identical**
  - **Using different targets will cause different potential outcomes**
- **Both mechanisms would move PJM from manual within hour dispatch for reserves to automated within hour dispatch for reserves**
- ***Both* represent a *change* from current operations**
- **Both would result in a change in what is considered to be “optimal” dispatch**

MA approach is operationally feasible

- **PJM proposes to use constraint relaxation to avoid "false positives"**
  - **allows continued co-optimization under conditions of reserve shortage without having penalty factors affect LMP**
  - **Internally consistent dispatch result before/after**
- **PJM has shown that relaxing the constraint is operationally feasible**
  - **Basis of MA approach, as shown in the example**

MA approach is operationally feasible

- **MA's proposal would use constraint relaxation to allow continued co-optimization of energy and reserves during reserve shortage**
  - **Like PJM proposal, allows continued co-optimization under conditions of reserve shortage without having penalty factors affect LMP**
  - **Approach is internally consistent before and during reserve shortage**
  - **Does not require "suspension" of co-optimization when providing a scarcity price**
  - **Constraint relaxation is the basis of the MA approach**

MA approach is operationally feasible

- **MA's proposed use of constraint relaxation to allow continued co-optimization of energy and reserves during reserve shortage allows**
  - **Scarcity pricing ($1,000) that is consistent with PJM current market design (DA vs. RT) and with the ORDC approach**
  - **Allows for the gradual adoption of higher price caps *if* need is identified**

MA vs. PJM approach: $1,000 vs. $2,700

Market Design Issues ($1,000 vs. $2,700)	MA	PJM
Market Results compatible with PJM's current market rules/caps	Yes	Not in scarcity
Compatible with RT/DA market design (arbitrage, scheduling)	Yes	No
Would require changes to DA market/Design/Rules	No	Yes
Market Power concerns w/ DA Market Fixes	No	Yes
Internally consistent rules during a transition	Yes	No

Pricing Under Scarcity: $1,000 vs. $2,700

- **No evidence that the scarcity signal in the energy market must exceed $1,000 in order to maintain reliability**

Pricing Under Scarcity: $1,000 vs. $2,700

- **Capping the market price at $1,000**
  - **Makes it possible to arbitrage between DA and RT**
  - **Not possible to arbitrage between DA and RT at $2,700 without substantially changing the DA market and introducing market power issues**
  - **Allows participants to better manage risks in DA market**
    - **Missed load prediction**
    - **Tripped unit**
  - **Is consistent with PJM's current market design**
    - **$2,700 in RT is not consistent with PJM's current market design and offer caps**
  - **Does not require reworking of the DA market**

Pricing Under Scarcity: $1,000 vs. $2,700

- **Capping the market price at $1,000**
  - **Would set LMP consistently with current resource offer caps and current market design**
  - **Would ensure full resource stack is dispatched**

Differences between MA and PJM pricing approaches

- **Scarcity price level**
  - **Price target vs. Fixed adder**
  - **Not a relevant difference to the core ORDC concept**
  - **Policy issue**
    - Market structure compatibility issue
- **One or two reserve targets**
  - **MA proposes one (Sync)**
  - **ORDC (either MA or PJM) approach can handle one or two (or more)**
- **Structure of Tier 2 market**
  - **Hour ahead structure and 5 minute optimization vs. 5 minute only optimization**
    - Limiting assignment/compensation to 5 minute optimization/hourly integrated pricing may reduce reserves/participation

Challenge under either approach: False Positives

- **Morning pickup/min gen events**
  - **Relaxing the constraint will work**
  - **Issues:**
    - Need rules around when to trigger price effects under either approach
    - Frequency of events