# Performance Impact of Multi-Schedule Model Market Clearing - Packages

Keyur Patel

Market Design

MIC-Special Session

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The following design components will remain as Status Quo in Package A:

- Submission of offers

- Available offers for commitment and dispatch purpose

- Eligible offers for commitment and dispatch purpose

- Components of Offer

  - ➢ Operating parameters of offer

  - ➢ Economic component of offer

## The following design component will change from Status Quo in Package A:

- Offer Selection Approach

  ➢ Status Quo for Real-Time Market (RT) – Formulaic approach

  ➢ Introduce a formulaic approach for Day-ahead Market (DA) based on following formula

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**DISPATCH COST FOR THE APPLICABLE HOUR =**
[(Incremental energy offer@economic minimum for the hour [$/mwh]*economic minimum
for the hour[mw]) + no-load cost for the hour ($/h)]

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**TOTAL DISPATCH COST =**
Sum of hourly dispatch cost* over a resource's minimum run time($) + start-up cost ($)

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The offer type that results in the lowest Total Dispatch Cost will be selected for commitment and dispatch purpose.

\* Total hourly dispatch cost will use the highest hourly cost for equivalent hours as minimum run time.

## The following design component will change from Status Quo in Package A:

- Application of Offer Selection Approach (Both DA and RT)

  ➤ For all resource types other than those use configuration based models - Apply the formulaic approach as described in slide 3

  ➤ For Combined Cycle Model – Apply the formulaic approach described in slide 3 on the highest configuration that can start from plant offline state. The offer type selected on highest configuration will be used for all configurations

  ➤ For Energy Storage and Hybrid Resource Model - Apply the formulaic approach as described in slide 3 on discharge side of the offer curve

The following design components will remain as Status Quo in Package B:

- Submission of offers

- Available offers for commitment and dispatch purpose

- Components of Offer

  - ➢ Operating parameters of offer

  - ➢ Economic component of offer

The following design components will change from Status Quo in Package B:

- Eligible offers for commitment and dispatch purpose

- Offer selection approach (DA, RT – Status Quo)

  ➢ Application of offer selection approach (Both DA and RT)

# Package B (Conti..) – Eligible offers for commitment and dispatch purpose (Price-based resources)

|  |  | **Fail TPS test** | **Does not Fail TPS test** |
|---|---|---|---|
| **Non-emergency Conditions** | Capacity resource | • Cost-based offer(s) | • Price-based offer |
| | Energy-only resource | • Cost-based offer(s) | • Price-based offer |
| **Emergency Conditions** | Capacity resource | • Cost-based offer(s) | • Price-based PLS offer |
| | Energy-only resource | • Cost-based offer(s) | • Price-based offer |

- All Cost based offer(s) will be used for cost-based resources under all conditions (i.e. emergency conditions, non-emergency conditions, resource fails TPS test, resource doesn't fail TPS test). If price-based offer is not submitted for price-based resource then price-based PLS offer will be used.

## The Offer selection approach will change for Day-ahead Market

- Day-ahead Market will use similar formulaic approach as Real-Time Market

> **DISPATCH COST FOR THE APPLICABLE HOUR =**
> [(Incremental energy offer@economic minimum for the hour [$/mwh]*economic minimum for the hour[mw]) + no-load cost for the hour ($/h)]

> **TOTAL DISPATCH COST =**
> Sum of hourly dispatch cost* over a resource's minimum run time($) + start-up cost ($)

The offer type that results in the lowest Total Dispatch Cost will be selected for commitment and dispatch purpose.

\* Total hourly dispatch cost will use the highest hourly cost for equivalent hours as minimum run time.

➢ For all resource types other than those use configuration based models - Apply the formulaic approach as described in slide 8.

➢ For Combined Cycle Model – Apply the formulaic approach described in slide 8 on the highest configuration that can start from plant offline state. The offer type selected on highest configuration will be used for all configurations

➢ For Energy Storage and Hybrid Resource Model - Apply the formulaic approach as described in slide 8 on discharge side of the offer curve

Facilitator:
Nikki Militello, Nikki.Militello@pjm.com

Secretary:
Amanda Martin, Amanda.Martin@pjm.com

Presenter:
Keyur Patel, Keyur.Patel@pjm.com

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

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# Appendix

- The formulaic approach will be applied to highest configuration* that can be started from plant offline state. In this example, the assumption is that all of the available configuration can be started from offline state i.e. CT1+CT2+Steam configuration will be used to determine the cheapest schedule type.

- Once cheapest schedule type is determined, the same schedule type will be considered for all of the available configurations for commitment and dispatch purpose.

*Highest Configuration will typically have the highest MW available from the plant offline state and is more efficient in terms of cost.

- The following information (current and next slide) is needed from data submitted for Combined Cycle Plant to apply the formulaic approach

| Components of Combined Cycle Plant | Minimum Run Time (Hrs) | | |
|---|---|---|---|
| | Price Schedule | Price PLS Schedule | Cost Schedule |
| CT1 | 3 | 2 | 1 |
| CT2 | 3 | 1 | 1 |
| Steam | 6 | 4 | 3 |

*For the purpose of calculating Total Dispatch Cost, the minimum run time for CT1+CT2+Steam configuration will be equal to 6,4, and 3 for Price, Price PLS, and Cost Schedule respectively.

# Example – Application of formulaic approach for Configuration Based Model (Combined Cycle)

- The following information is needed from data submitted for Combined Cycle Plant to apply the formulaic approach

| Configurations | Incremental Energy Offers ($/MWh) | | | EcoMin (MW) | EcoMax (MW) | No-load Cost ($/Hr) | Start-up Cost ($) |
|---|---|---|---|---|---|---|---|
| | Price Schedule | Price PLS Schedule | Cost Schedule | | | | |
| CT1 | 20 | 20 | 15 | 100 | 100 | 1000 | 10000 |
| CT2 | 20 | 20 | 15 | 100 | 100 | 1000 | 10000 |
| CT1+CT2 | 15 | 17 | 12 | 200 | 200 | 2000 | 15000 |
| CT1+Steam | 15 | 17 | 12 | 100 | 300 | 1500 | 15000 |
| CT2+Steam | 20 | 20 | 13 | 100 | 300 | 1500 | 15000 |
| CT1+CT2+Steam | 15 | 14 | 11 | 200 | 400 | 1500 | 20000 |

*EcoMin, EcoMax, No-load Cost, Start-up Cost are also at schedule level but to simplify the example, it is considered as one value for each configuration.

*The Incremental Energy Offers, EcoMin, No-load Cost and Start-up Cost of CT1+CT2+Steam configuration will be used in calculation of hourly and Total Dispatch Cost formula under this example.

*In this example, it is assumed that all of the configurations can be started from offline state.