

Near Term Options – Hourly Differentiated Ramp Rates & Soak Time Tariff and Manual Changes

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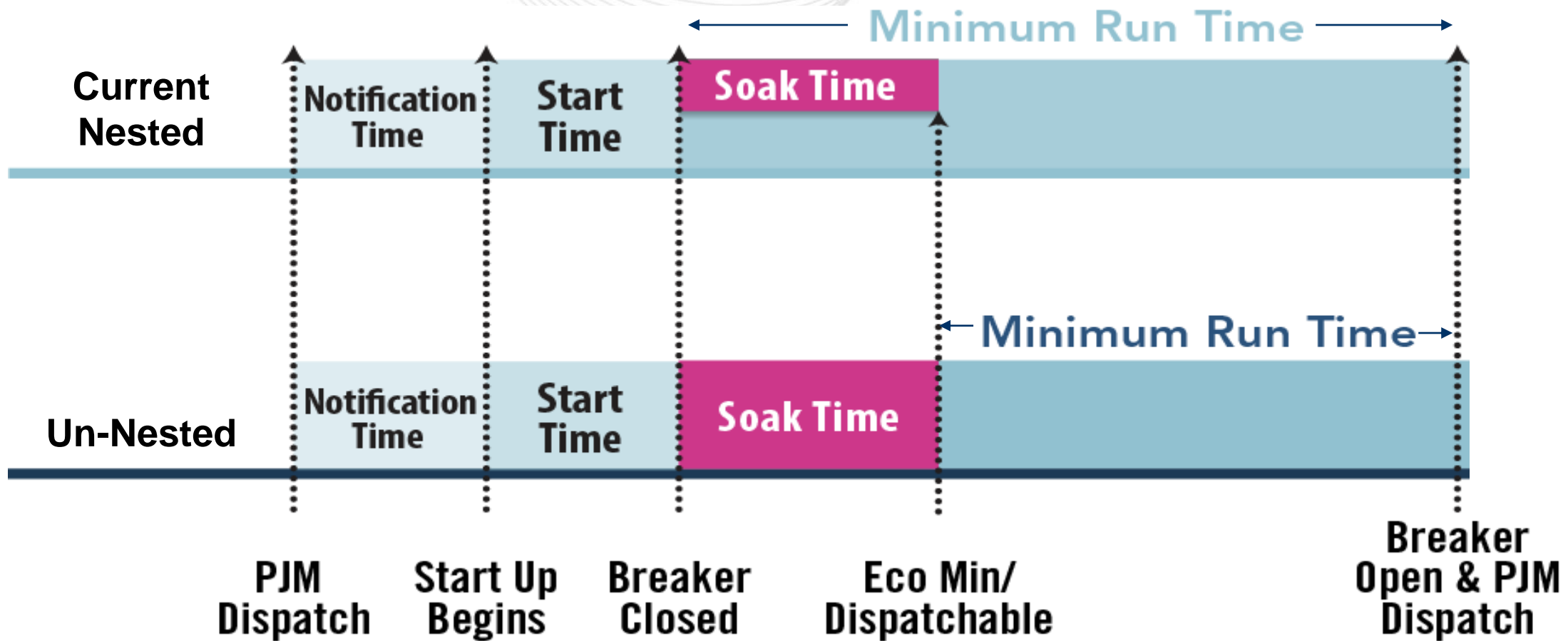
- Option 1 – Provide market participants with the ability to submit Hourly Differentiated Segmented Ramp Rates
 - Medium complex solution with implementation possible in 2020
 - Tariff and manual language will need to be approved
 - A FERC filing and FERC approval will be required prior to implementation
- Option 2 - Implement Soak Time
 - Highly complex solution with implementation possible in 2022
 - Soak Time Tariff and manual language (except M15) has already been approved through the Members Committee
 - PJM has identified additional Tariff, Operating Agreement, and manual(s) changes as a result of other market system enhancements such as hourly offers and fast start pricing impacts to soak time and soak cost
 - A FERC filing and FERC approval will be required prior to implementation

- Allow hourly differentiated segmented ramp rates in both the Day Ahead and Real Time Markets
- Provide the ability to change segmented ramp rate Intraday
- Follow existing Intraday logic rules
 - Updates permitted after the Reliability Assurance Commitment (RAC) run up to 65 minutes prior to operating hour
 - Intraday updates can be submitted for multiple hours

- Manuals
 - M11 Energy & Ancillary Services Market Operation
 - Sections 2.3.7 & 9.1
- Open Access Transmission Tariff
 - Attachment K – Appendix
- Operating Agreement
 - Schedule 1
- Markets Gateway User Guide

- Soak Time Manual (except M15) and Tariff changes were approved at the January 26, 2017 MRC and the February 23, 2017 MC.
- PJM has identified additional Tariff, Operating Agreement, and manual(s) changes as a result of other market system enhancements such as hourly offers and fast start pricing impacts to soak time and soak cost
- PJM would file these changes with FERC approximately six (6) months before implementation.

Un-nested Soak Time Proposal



- **Hot/Warm/Cold Soak Time (hour)** — *The minimum number of hours a unit must run, in real-time operations, from the time after generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero to the time the unit is dispatchable. For Combined Cycle units this is the minimum number of hours from the time just after the first combustion turbine generator breaker closure which is typically indicated by telemetered or aggregated state estimator MWs greater than zero and the time the unit is dispatchable.*
(Un-nested and new PLS Parameter)

Minimum Run Time (hour) — *The minimum number of hours a unit must run, in real-time operations, from the time after ~~generator breaker-closure-which-is-typically-indicated-by-telemetered-or-aggregated state estimator MWs greater than zero~~ the unit is dispatchable to the time of generator breaker opening, as measured by PJM's state estimator. For Combined Cycle units this is the time period after ~~the-first-combustion-turbine-generator-breaker-closure which-is-typically-indicated-by-telemetered-or-aggregated-state estimator MWs greater than zero~~ and the unit is dispatchable to the time of the last generator breaker opening as measured by PJM's state estimator.*

- Manuals
 - M11 Energy & Ancillary Services Market Operation
 - Sections 2.3.3, 2.3.4, 2.3.6, 2.3.7, 2.3.10, 4.1, 4.2.6, & 11.2.2
 - M12 Balancing Operations
 - Section 4.6.12
 - M15 Cost Development Guidelines
 - Section 2.4, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 9.5, 10.5, 11.5
 - M28 Operating Agreement Accounting
 - Sections 5.2.1 & 5.2.7
- Markets Gateway User Guide

- Open Access Transmission Tariff
 - Section 1
 - Attachment K – Appendix
 - Schedule 6A
- Operating Agreement
 - Section 1
 - Schedule 1
 - **Schedule 2**

- Manual 15 has been revised to include a new Soak Cost Section

2.5.1 Soak Cost Definitions

- **Soak Cost** (\$/MWh) – the hourly hot, intermediate, and cold temperature state costs to operate a the boiler, turbine, and generator during the soak period after breaker closure to dispatchable and is determined based on the unit’s soak heat input, total fuel-related cost, Performance Factor, Soak MWh, maintenance adder, operating costs, and emissions adders.

SoakCost (\$/Start)_h=

$$\begin{aligned} & \{ \text{SoakHeatInput (Mbtu/(hr))}_h * \text{PerformanceFactor} + \text{MaintenanceAdder}(\$/\text{Mbtu}) \\ & + \text{OperatingCost}(\$/\text{Mbtu}) \} * \text{TFRC}(\$/\text{Mbtu}) + \text{MaintenanceAdder}(\$/\text{Hr}) \} / \text{Soak MWh}_h \\ & + [\text{MaintenanceAdder}(\$/\text{MWh}) + \text{OperatingCost}(\$/\text{MWh})] \\ & + \text{EmissionsCosts}(\$/\text{MWh}) \end{aligned}$$

- **Soak Heat Input** – Hourly fuel consumed from breaker closing to unit dispatchable
- **Soak MWh** – Hourly MWh produced from breaker closing to unit dispatchable
- **Maintenance Adder** – See Section 2.6
- **Operating Cost** – See Section 2.3.7
- **Emissions Costs** – See Section 2.3.5.