



Enhanced Combined Cycle Logic

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Agenda

- Brief History of Project
- Overview of Enhancement
- Lessons Learned
- Market and Future Enhancement Impacts

Brief Project History

- Originally scheduled to be included with initial implementation of Day-2 Market in March 2014
- Early on in the requirements phase it was pulled and delayed to a second phase due to increased risk to rest of implementation
 - Scheduled for 3/1/2015, one year after expected go-live date for first phase
- Reg Comp (Order 755) and M2M with MISO mandated by FERC for 3/1/2015.
 - Summer of 2014 it was determined that the FERC mandated projects would be at risk based on progress on ECC project
 - Board suspended project until October 2015 for a 3/1/2017 go-live date.

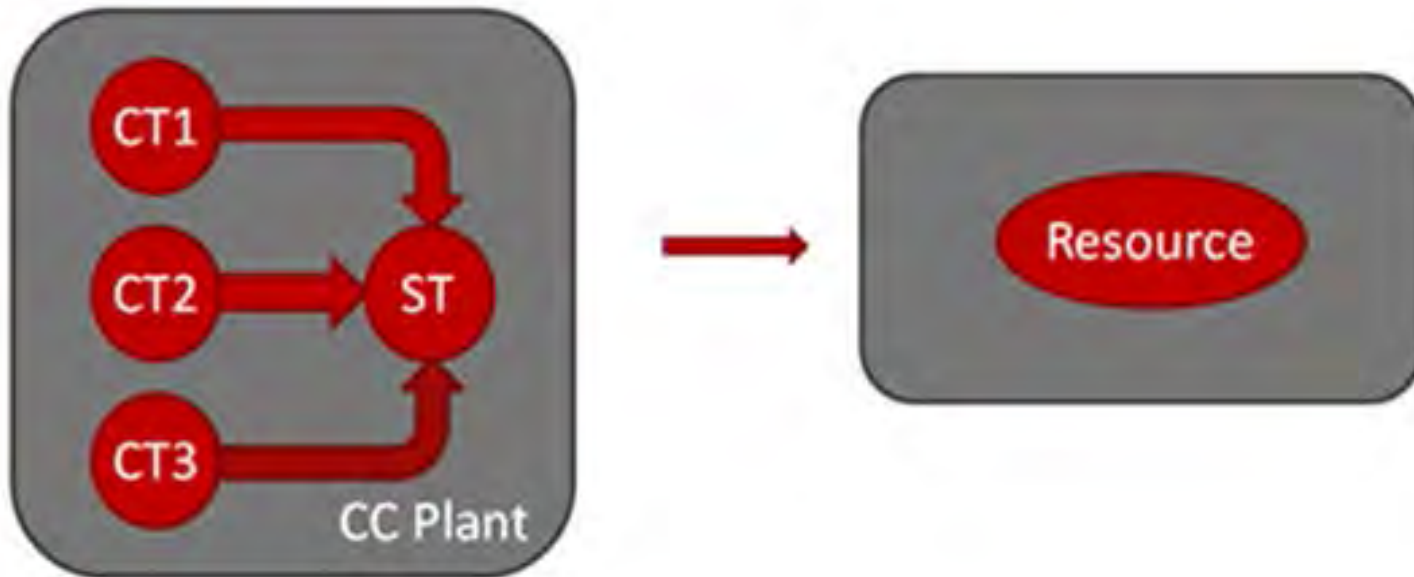
Enhancement Overview: Targeted Goals

- Simplify Combined Cycle(CC) Offer Creation
 - MPs no longer determining which logical configuration day to day and hour to hour
- DAMKT and RUC processes should optimize:
 - Commitment of CC configurations
 - Transitions between CC configurations
- Improve Market System modeling of CC physical capabilities

Modeling Today

Current Modeling Option 1

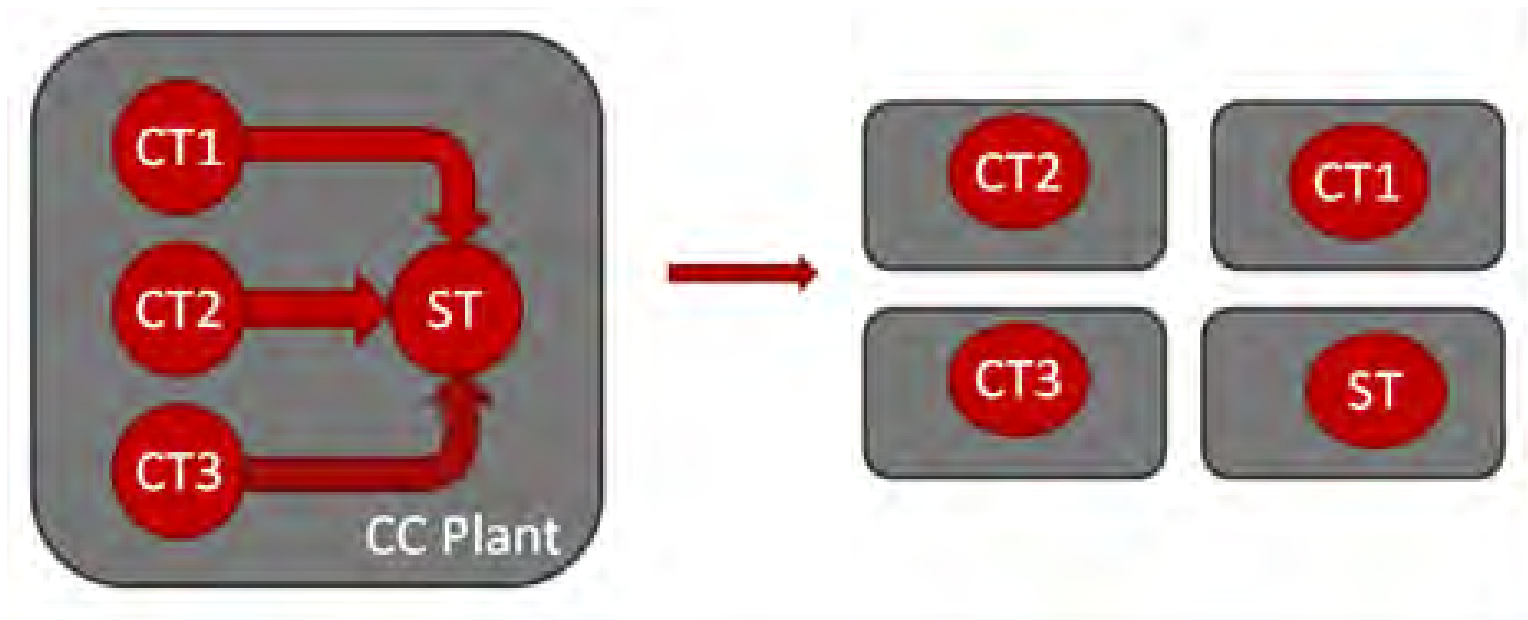
Aggregate Model



Modeling Today

Current Modeling Option 2

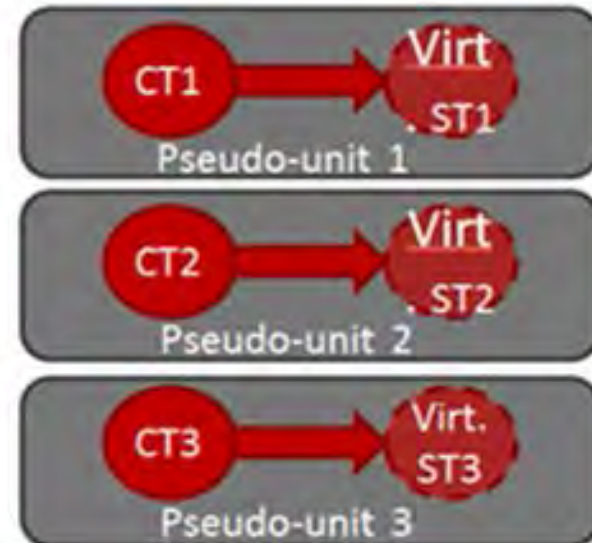
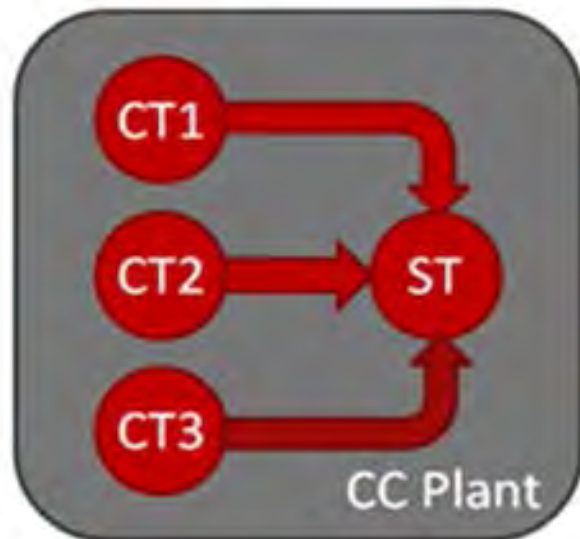
Individual Components



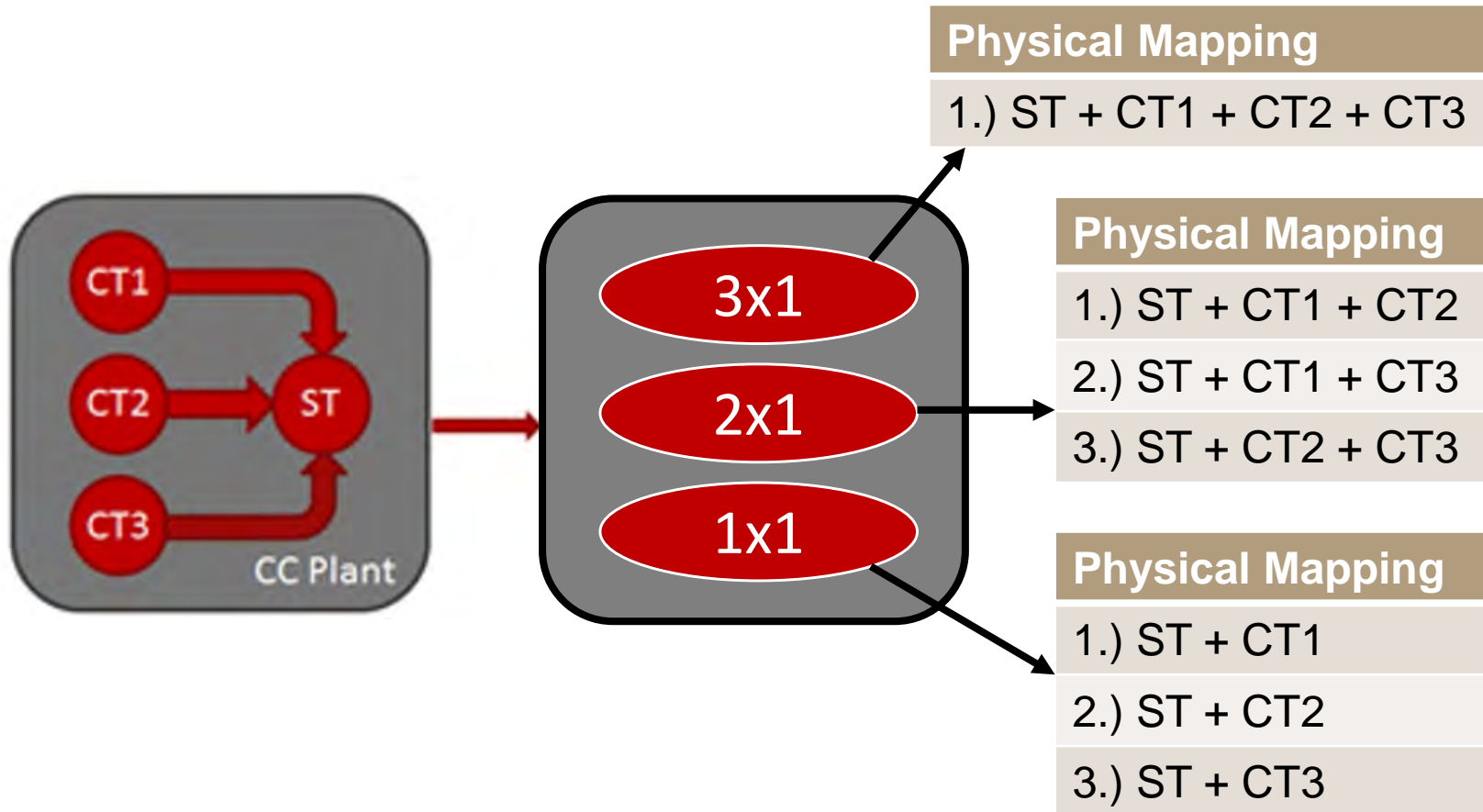
Modeling Today

Current Modeling Option 3

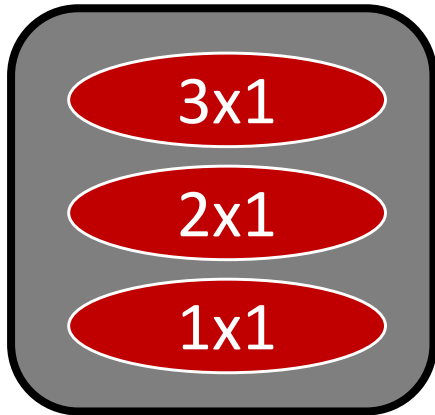
Pseudo-Units Model



Enhancement Overview: Configuration-Based



Enhancement Overview: Configuration-Based (cont'd.)



Trans Time	To: 1x1	To:2x1	To: 3x1
From: 1x1	---	45 min	---
From: 2x1	45 min	---	20 min
From: 3x1	---	20 min	---



Trans Cost	To: 1x1	To:2x1	To: 3x1
From: 1x1	---	\$700	---
From: 2x1	\$0	---	\$700
From: 3x1	---	---	---



Trans Enabled	To: 1x1	To:2x1	To: 3x1
From: 1x1	---	Yes	---
From: 2x1	Yes		Yes
From: 3x1	---	Yes	---

Enhancement Overview: Registration Changes

- New Optional Resource Type
 - Multi-Configuration Combined Cycle Resource (MCR)
- Map Physical Equipment to registered configurations
- Transition Matrix Definitions
 - Valid from/to configuration pairs
- MCR Group Definitions
 - Sets of configurations that share a common operational limitation
 - Group Minimum Runtime is the only group constraint defined for initial implementation
- Expand offline Supplemental Reserve qualification to include MCRs capable of providing supplemental Reserve by transitioning into a higher capacity configuration.

Enhancement Overview: Offer Changes

- MCR-Specific Offer Parameters:
 - Group Min Run Time
 - Plant Min Run Time
 - Transition Cost
 - Transition Time
 - Maximum Transition State Supplemental Reserve Resource Response Limit

Enhancement Overview: Market Clearing Engine Changes

- MCR configurations are treated as an individual Resource
 - Configurations at the same plant are linked together in the formulation with handful of Combined Cycle specific constraints
 - Integrated Mitigation logic changes to mimic Settlement Changed related to Make-Whole Payment
- Cost Avoidance
 - MCR costs for startup and transition changes are included in the commitment processes
- For RUC, MCRs may be committed to a higher capacity configuration than what was cleared in DAMKT
 - MCRs may only be committed to a lower capacity configuration than what was cleared in DAMKT under an Emergency

Enhancement Overview: Market Clearing Engine Changes

DAMKT

- MCRs are ineligible to clear Regulation Up/Down in any hour transitioning
- MCRs are ineligible to clear Spinning or Supplemental Reserve in any hour transitioning greater than or equal to half the hour

Real-Time

- MCRs are ineligible to clear any Operating Reserve Products while transitioning
- Are not selected for Regulation in any hour scheduled to transition

Enhancement Overview: Settlements Changes

- There was a strong desire from the membership to have any changes only impact participants using the new functionality.
- Enhanced Combined Cycle logic introduced different and complex commitment scenarios
 - Overlapping eligibility periods now possible.
 - Led to situations where MCRs and non-MCRs would be settled differently for similar if not identical behavior.
- Make-Whole Payment cost calculations were modified to a 'netting' approach where RUC costs are determined taking into account DAMKT clearing and SELF commits.
 - Similar changes occur nearly anywhere where cost is calculated.

Lessons Learned

- The logic gets very complex very quickly!
- When we removed ECC from the initial Day-2 Market scope we also removed it from the design decisions.
 - One of our Markets foundational design principals is that a Resource is as granular as it gets.
 - Least invasive changes added significant complexity
- Focus on the question the participants want answered.
 - We had to make numerous simplifications to ensure adequate performance
 - Limit to 3 configurations per plant
 - All configurations can start/stop
 - One configuration can offer offline Supplemental
 - One Transition per FROM configuration can offer Transitional Supplemental
- Most expensive hardware not always best
 - We anticipate 20-30% runtime reduction when we move to new physical servers
 - Not expensive, just fast clock-rate

Questions

