



## **Item 5.2: Real-Time Co-Optimization Implementation Update**

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Technology and Security Committee Meeting

ERCOT Public

August 19, 2024

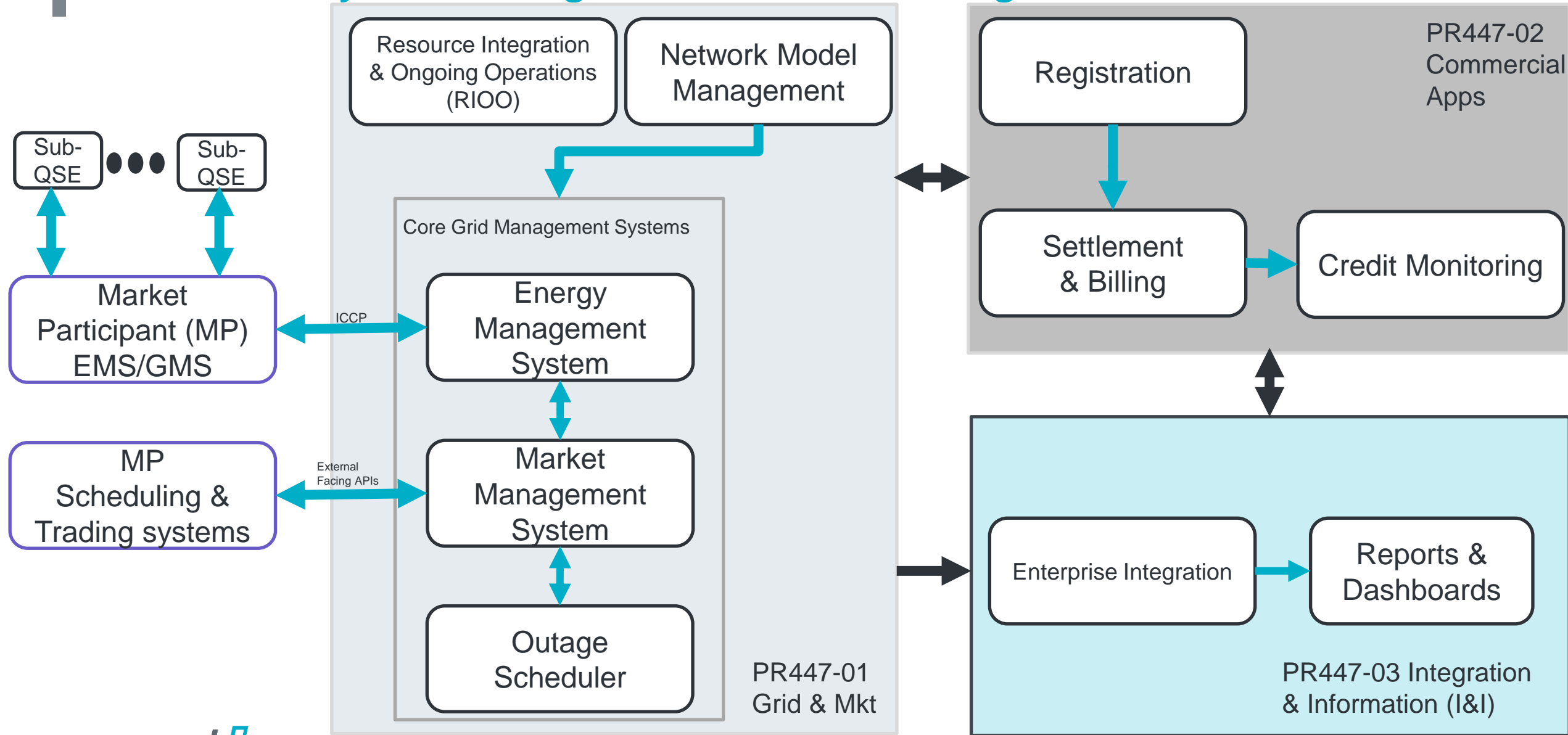
# What is RTC+B+SOC

- **RTC (NPRR1007-1013)**
  - Current Real-Time Market (RTM) finds most effective set of Resources for providing Energy (but not Ancillary Services).
  - Real-Time Co-optimization would help find the most effective set of Resources for providing Energy & Ancillary Services.
  - Brings Operational and Economic Benefits - \$1.6B per year in energy cost reduction + more (see information in Appendix)
- **Batteries – Single Model for Batteries (NPRR1014)**
  - Switching Batteries from the current “Combo Model” to a “Single Model” in ERCOT core systems.
  - To implement “single-model” is to unify into single ESR
    - Better Modeling and the ESR is represented as it is, as one Resource
    - Single set of telemetry; “bid/offer curve” submittal; Performance Monitoring; and Settlements
- **State of Charge (SOC) Management (NPRR1204)**
  - Accounting for SOC (MWh) in Reliability Unit Commitment (RUC) and Security-Constrained Economic Dispatch (SCED).

**\*\*Links to additional materials on concepts of RTC, Single Model and SOC concepts available in Appendix.**

**Key Takeaway:** Co-optimize Ancillary Services in Real-Time; Accurate representation for Batteries; and Better accounting for ESR State of Charge.

# Overview of System Changes – RTC+B+SOC Program



# RTC+B+SOC Program Structure

Project	Total Budget	Actuals	Trend	Description
PR447-00 Program Control	\$13.9M	\$2,073,040	●	Includes Hardware \$6.7M, Software \$4.5M
PR447-01 Grid & Markets	\$24.8M	\$2,128,620	●	MMS/EMS/OTS/NMMS/RIOO/PI/OS/GridGeo
PR447-02 Commercial Apps	\$5.8M	\$849,929	●	S&B,CMM,Registration
PR447-03 Integration & Information (I&I)	\$5.3M	\$383,073	●	Middleware, dashboards, reports, data warehouse
<b>Total</b>	<b>\$49.9M</b>	<b>\$5,434,662</b>		

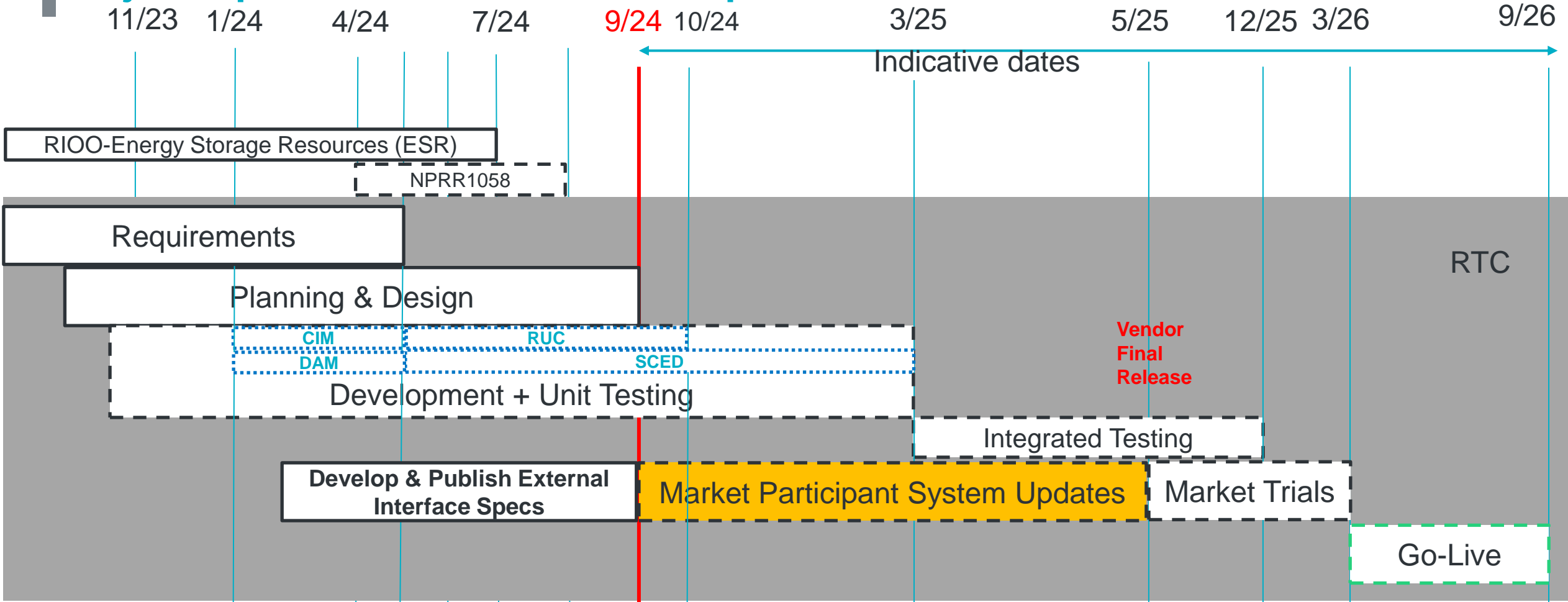
- Total budget may not foot due to rounding
- Actuals as of July 30, 2024

●	Not Tracking to Plan
●	At Risk
●	Tracking to Plan

**Key Takeaway:** Centralized Program Control structure with 3 project tracks.



# Major Dependencies in our critical path



 Vendor Deliverables



## Review - Major Short-term milestones for Aug '24 T&S Committee Meeting

Task	Due by	Status
PR447-01 MMS Application Testing Begin (CIM Importer/DAM)	Jun 14, 2024	Complete
PR447-03 EMS Detailed Integration Specifications required for I&I Wave 3	Jun 28, 2024	Complete
PR447-00 External Specifications (KR – Stretch goal)	Jun 28, 2024	Complete
PR447-03 I&I Wave 3 Planned CCR (establish remaining planning milestones)	TBD	Sep 06, 2024
PR447-01 Operator Training Simulator (OTS) Design	Jun 28, 2024	Complete
PR447-00 RTC+B Implementation Plan Draft (for internal review)	Jul 15, 2024	Complete
PR447-00 Publish the planned release for RTC+B Go-Live (KR - Stretch Goal)	Jul 31, 2024	Missed, on-track for Target goal
PR447-00 Publish the planned release for RTC+B Go-Live (KR - Target Goal)	Sep 30, 2024	On-Track

**Key Takeaway:** RTC project plan on track to completing planning and design by 9/24

# Major Short-term milestones for Oct '24 T&S Committee Meeting

Task	Due by
PR447-01 GMS Project - Gate to Execution	Aug 21, 2024
PR447-03 I&I Wave 3 Planned CCR (establish remaining planning milestones)	Sep 06, 2024
PR447-00 RTC+B FAT EMS/MMS Servers Builds	Sep 06, 2024
PR447-00 Publish the planned release for RTC+B Go-Live (KR - Target Goal)	Sep 30, 2024

## Other on-going activities include:

- Initial version of execution schedule from PR447-01 RTC+B Grid & Markets delivered with key dependency dates for PR447-03 I&I, being reviewed internally and to be finalized.
- Work sequencing and resource planning for overall Program in-progress.
- Draft entry & exit criteria definition for each Market Trial phase has been published, along with the Market Trials sequence plan
- QSE attestation requests sent out, seeking acknowledgement of the following (due by August 12<sup>th</sup>, 2024):
  - RTC+B Interface specifications publication by ERCOT.
  - RTC+B Market Trial could potentially begin as early as May 2025 & will be required for continued qualification of QSEs and sub-QSEs.
- RIOO ESR Project updates:
  - Went live in July 2024, with Single Model for Batteries\*.
  - Conversion of existing combo model ESRs to Single Model in RIOO is in-progress.

\*Transitioned from Phase A to Phase B, as illustrated on slide 14



## RTC+B KR: Publish external specifications

- Requirements Complete
  - Target Goal is 9/30
  - **Stretch Goal 6/28 – Achieved**
- Goal was to expedite release of external specifications to partially mitigate Market Readiness Risk.
- Key components included:
  - Series of technical workshops conducted between April & June on:
    - ICCP telemetry/EMS SCADA/AGC changes
    - ICCP Configurations for parallel testing and cutover
    - Market interface design specifications
  - Published EIP External Specifications for RTC+B QSE Market submissions
  - Published ICCP handbook with RTC+B updates



## RTC+B KR: Publish the planned release for RTC+B Go-Live

- Requirements Complete
  - Stretch: 07/31/24 - **Missed**
  - Target: 9/30/24 - **On-track**
- Key components included:
  - Publish Market Trials Plan, entry/exit criteria – Complete
  - Finalize PR447-01 Grid & Markets execution plan – In-review
  - PR447-03 I&I identification and validation of upstream dependencies – In-progress
  - Work sequencing and resource planning for overall Program – In-progress
  - Testing, deployment plan & release coordination – In-progress
  - Finalize PR447-02 Commercial Apps execution plan – Pending

# Impact of Adding New Substantial Requirements

If PUC and stakeholders want to consider the IMM's proposals, then the following two Scenarios reflect the impact to the RTC project.

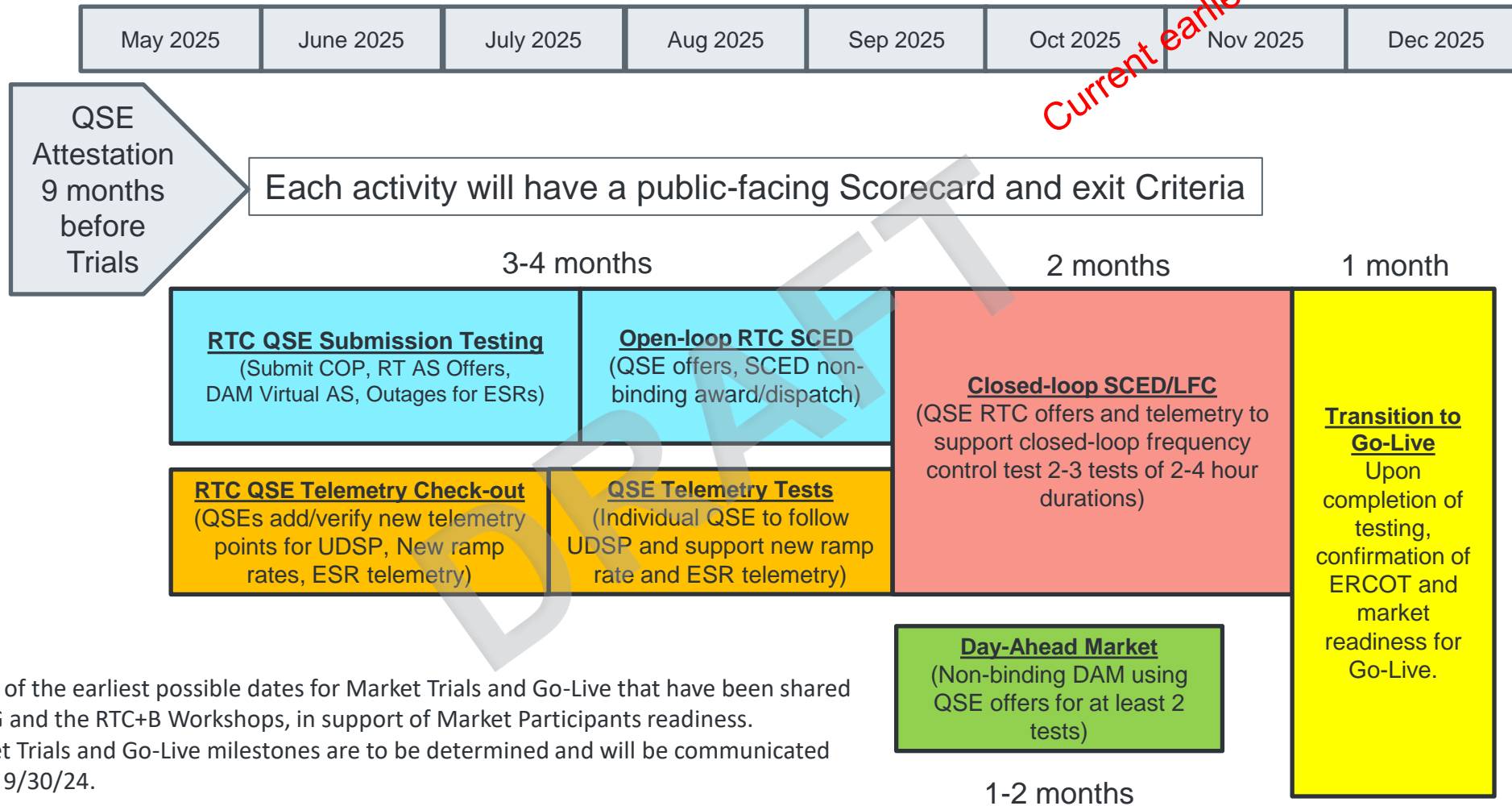
**Scenario 1 :** Implement changes as post go-live functionality

**Scenario 2 :** Pause RTC and implement Real-Time & Day-Ahead Market changes after protocol revisions and approval by PUCT. We expect the stakeholder process to take at least 18 months followed by a 36-month implementation window.

Scenario	2025	2026	2027	2028	3 Year Benefits
Scenario 1	implementation	\$1.6 B	\$1.6 B	\$1.6 B	\$4.8 B
Scenario 2	Pause for NPRR	Implementation	Implementation	Implementation	\$0 B

**Key Takeaway:** Best case scenario is to have RTC go live at end of 2025 and follow up with substantial changes over the released version of RTC.

# Sequence and Potential Dates for Market Trials (dates subject to change while in Planning phase)



- Current draft of the earliest possible dates for Market Trials and Go-Live that have been shared through TWG and the RTC+B Workshops, in support of Market Participants readiness.
- Actual Market Trials and Go-Live milestones are to be determined and will be communicated no later than 9/30/24.

# Appendix

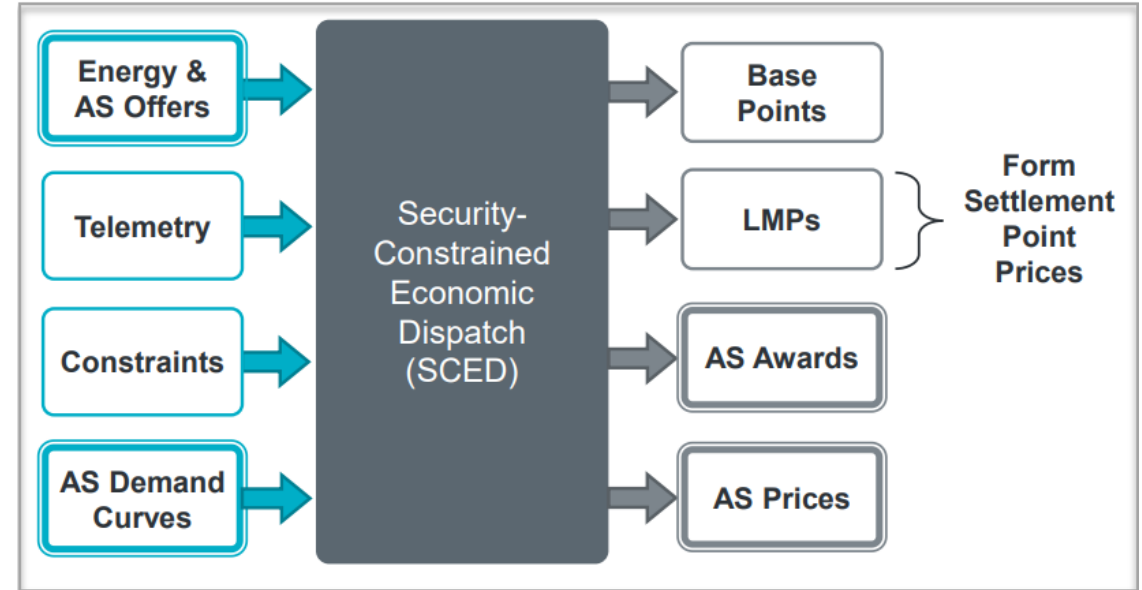
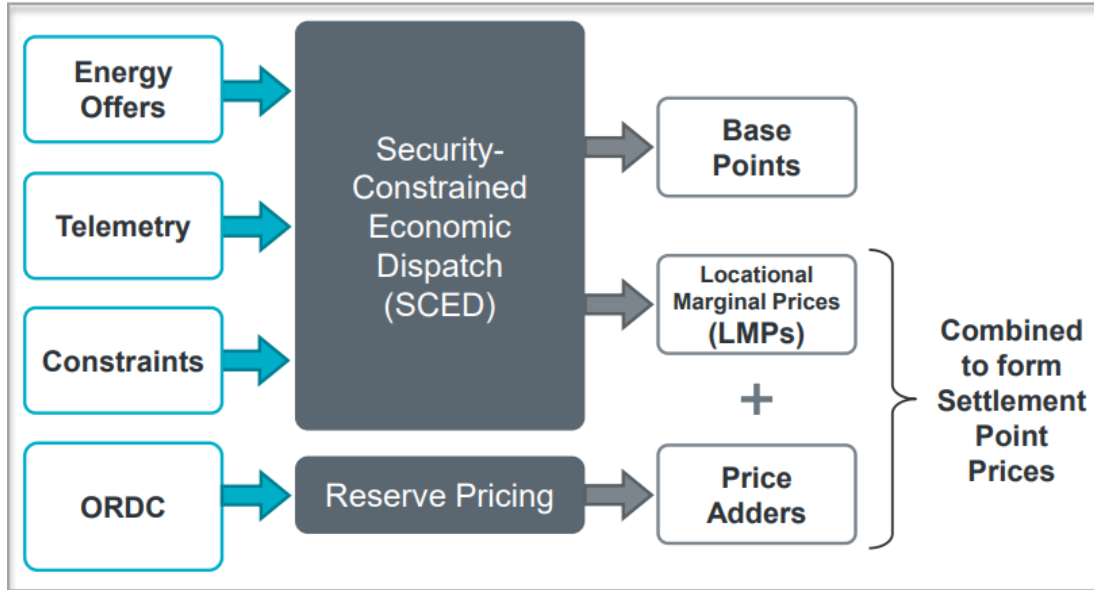
## Links to educational material on the mechanics of RTC, Single Model and State of Charge:

- [RTC Updates to Reliability and Markets Committee - Overview of market design concepts & benefits](#)
- [RTCBTF - Refreshers on RTC Key Principles, Single Model and SOC](#)

## Links to associated key documents:

- [RTC Key Principles](#)
- [NPRR1186 Interim SOC - Key Documents](#)
- [NPRR1204 SOC Considerations with RTC - Key Documents](#)

# Today's market vs RTC

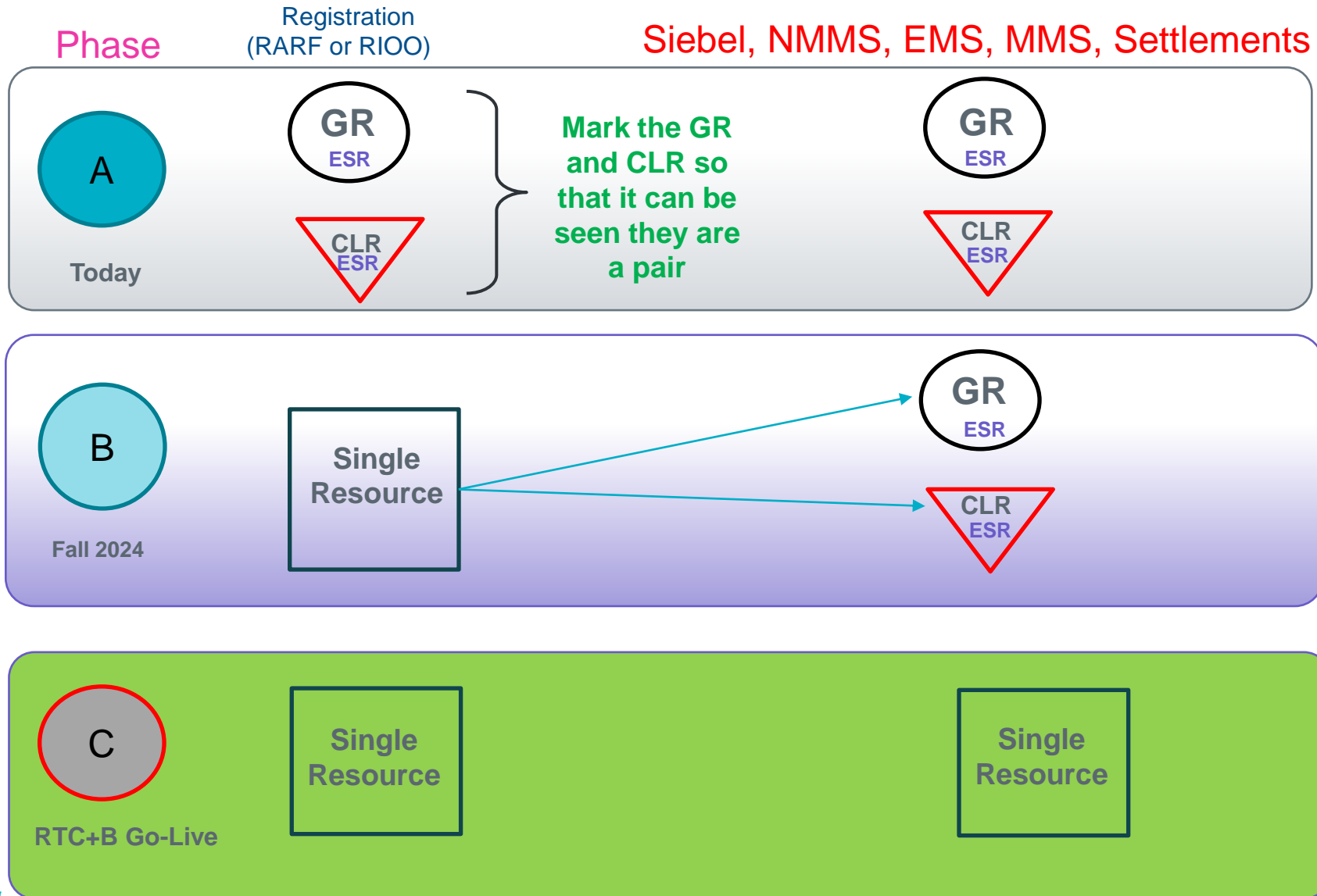


- Today's market:
  - Is designed to reflect scarcity through a process that is outside of the optimization.
  - Cost of AS is reflected in the form of Price Adders, not factored into LMP.
  - The ORDC sets the value of ERCOT System reserves.
- RTC:
  - Is designed to reflect scarcity within the optimization.
  - Cost of AS is factored directly into LMPs
  - Instead of using ORDC, individual AS Demand Curves (ASDCs) for each AS product (NSPIN, Reg-Up, RRS, ECRS).
    - Helps better distinguish and prioritize between various AS products.
    - Eliminates need for Supplemental Ancillary Services Market (SASM), co-optimized RUC and RTM will fulfill this role.

# Operational & Economic Benefits of RTC

- Operational Benefits – The reliability benefits of RTC derive from our ability to:
  - Replace and replenish Ancillary Services every 5 minutes;
  - Effectively manage Resource-specific capabilities that can change rapidly and significantly in Real-Time and the hours leading up to Real-Time;
    - This includes Energy Storage Resources (ESRs), but is applicable to all Resource types (thermal, renewable, and demand-side Resources).
  - Dynamically adjust Ancillary Service quantities all the way up to Real-Time as uncertainties on the grid change over the day;
  - Better manage and reduce transmission congestion without sacrificing on our Ancillary Service needs;
  - Prioritize Ancillary Services to preserve the most critical capacity (i.e., capacity that can respond to frequency deviations) in cases where grid conditions become scarce; and
  - Automate many process that must be managed manually by Control Room staff today.
- Economic Benefits – These reliability benefits also equate to economic benefits for the end-use customer.
  - The Independent Market Monitor (IMM) released a report in 2018 that included its evaluation of the impacts of RTC on the ERCOT market.
  - Using 2017 as their simulated operating year, they found:
    - A \$1.6 billion reduction in total energy costs, which equates to a ~\$4/MWh reduction in price;
    - An \$11.6 million reduction in production costs to serve load;
    - An improvement in reliability due to a reduced overloading of transmission constraints and a reduced use of the Regulation Up Ancillary Service equating to \$4.3 million;
    - A \$257 million reduction in congestion costs; and
    - A \$155 million reduction in Ancillary Service costs.
  - As with the reliability benefits, these cost benefits are also likely increasing over time.

# ERCOT Evolution for Battery Energy Storage Resources



# ERCOT Evolution for State of Charge Considerations

- Interim Period SOC changes ([NPRR1186](#)), will still use the “Combo” battery model:
  - Introduces AS duration requirements in DAM.
  - Defines new COP fields for SOC minimum, maximum and planned target, to be used by RUC studies to determine ESR-GR capacity available to meet Load Forecast after satisfying ESR COP AS responsibilities. Also reflected in Real-Time HASL calculations.
  - Implements refinements to the ERCOT “SOC accounting-monitoring-expectations” approach. Provides clarity on how much SOC is required for each AS responsibility and how ERCOT will check to see if the SOC is adequate for the AS responsibilities.
- RTC+B SOC changes ([NPRR1204](#)), will use the new “Single” battery model:
  - **Day-Ahead Market (DAM)**
    - No SOC accounting.
    - Keeps Interim Period (NPRR1186) changes for tracking AS duration requirements in DAM.
  - **Reliability Unit Commitment (RUC)**
    - Include additional SOC accounting related constraints.
    - For every given hour, ensure there is sufficient Energy (SOC MWh) available in ESRs to sustain the MW dispatch for Energy and AS (for their respective durations), and validate this against COP minimum and maximum SOC values (introduced in NPRR1186).
    - The study/simulated dispatch for Energy and AS for a given hour are such that the resulting SOC accounting for the end of the hour will be equal to the planned hour-beginning SOC (COPs) for the next hour.
  - **Real-Time Market (RTM) – Security-Constrained Economic Dispatch (SCED) to:**
    - Perform Telemetry validations to make sure current SOC is within bounds of minimum and maximum SOC.
    - Incorporate SOC related constraints such that there is sufficient Energy to sustain the MW awards for Energy (base-points) and AS for their respective time duration, without violating telemetered minimum and maximum SOC bounds.



# NPRR1058 – Resource Offer Modernization

- **Objectives**

- Allow all Resources to update their offers in Real-Time to reflect their current costs.
  - For any Operating Hour, a QSE
    - may submit or change Energy Offer Curve for a Resource
    - may submit or change RTM Energy Bid
  - The QSE can provide a freeform reason (to address IMM’s comments included in its 12/21/2020 comments) if EOC submitted after the end of the Adjustment Period
  - For the percentages FIP and FOP within an EOC, submissions and updates must be received by ERCOT in the Adjustment Period
- Changes will be in
  - XSD
    - posted on the ERCOT [XSDs page](#), and
    - Posted on the Developer Portal at [https://github.com/ercot/api-specs/tree/ews\\_npr\\_1058\\_updates/ews](https://github.com/ercot/api-specs/tree/ews_npr_1058_updates/ews))
  - Market Manager UI
  - Backward compatible

- **Project is in Execution Phase**

- Testing in progress
- Go live – August 22, 2024

- **MOTE Testing Expectations**

- Changes will be available in MOTE for MPs testing – planned for 08/02/2024
- Perform submission of [Energy Offer Curve and RTM Energy Bid](#) up to Real Time
  - Market Manager UI
  - API

## Acronyms used in this slide deck

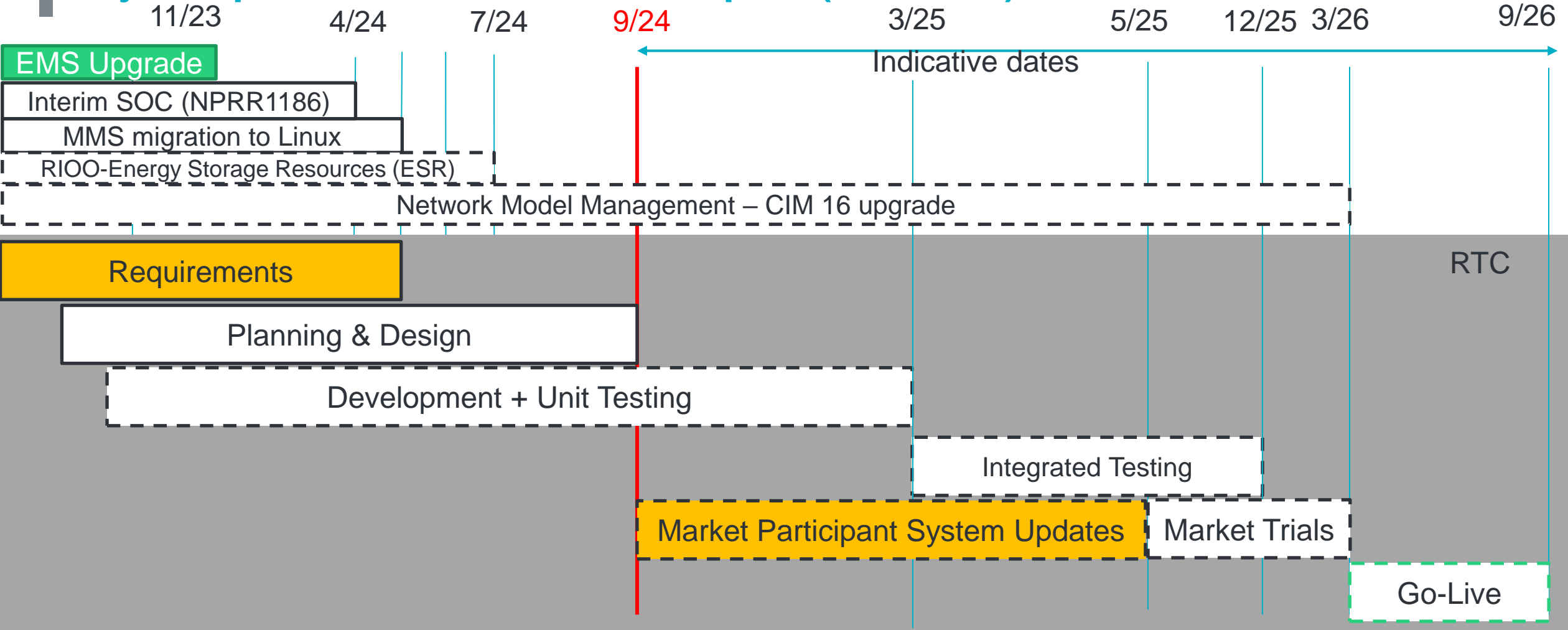
CIM	Common Information Modeling
CMM	Credit Monitoring & Management
DSA	Dynamic Stability Analysis
EMS	Energy Management System
GMS	Generation Management System
I&I	Integration and Information
ICCP	Inter control Center Protocol
LFC	Load Frequency Control
MMS	Market Management System
MP	Market Participant
NMMS	Network Model Maintenance System

## Acronyms used in this slide deck

OS	Outage Scheduler
OTS	Operator Training Simulator
RIOO	Resource Integration and Ongoing Operations
RLC	Resource Limit Calculator
RTC	Real-Time Co-Optimization
RTCA	Real-Time Contingency Analysis
S&B	Settlements & Billing
SCADA	Supervisory Control and Data Acquisition
SE	State Estimator
SOC	State of Charge
VSA	Voltage Stability Analysis

# Slides from Previous Updates

# Major Dependencies in our critical path (Dec 2023)



**Key Takeaway:** RTC project plan firmed up by completing planning and design by 9/24



## RTC+B KR: Requirements complete

- Requirements Complete
  - Target Goal is 5/31
  - **Stretch Goal 4/30 – Achieved 4/17**
- Key components included:\*

\* Business Requirements for RUC Capacity-Short changes to accommodate State of Charge are in flight as whitepaper and draft NPRR and will be complete in time for development. White-paper draft published and discussed in RTCBTF meetings. Internal requirement updates for GMS Interfaces and S&B are complete, design is in-progress.

# Review - Major Short-term milestones for Apr '24 T&S Committee Meeting

Task	Due by	Status
PR447-03 MMS – CMM Integration Requirements	Feb 16, 2024	Complete
PR447-01 EMS Core Applications Requirements (ICCP,SCADA,LFC,RLC,SE,RTCA,TCM,DSA,VSA, etc.)	Feb 29, 2024	Complete
PR447-03 Establish Remaining Planning Milestones for I&I	Mar 6, 2024	Wave 2 started. Dates for Wave 3 identified (next slide)
PR447-01 MMS Ancillary Service Manager Requirements	Mar 15, 2024	Complete, additional NPRR being evaluated for cleanup
PR447-01 EMS – MMS Integration Requirements	Mar 21, 2024	Complete
PR447-00 Start Internal DEV Systems Build-out	Apr 5, 2024	Complete
PR447-01 Outage Scheduler Requirements	Apr 12, 2024	Complete
PR447-01 PI Requirements (first deliverables)	Apr 12, 2024	At Risk
PR447-02 Registration (Siebel) Requirements	Apr 30, 2024	On-Track
PR447-01 EMS Operator Training Simulator Requirements	Apr 30, 2024	Complete

**Key Takeaway:** RTC project plan on track to completing planning and design by 9/24

# Review - Major Short-term milestones for Jun '24 T&S Committee Meeting

Task	Due by	Status
PR447-01 PI Requirements (first deliverables)	Apr 12, 2024	Identified as no system changes required, configuration changes will be documented "as-built".
PR447-01 MMS Market-facing Reports Requirements	May 1, 2024	Initial requirements complete, detailed requirements in-progress (tracked under PR447-03 I&I)
PR447-01 MMS Vendor CIM & DAM Preliminary Release	May 17, 2024	Complete
PR447-03 I&I Wave 3 Planning Begin	May 29, 2024	Complete, Wave 3 planning in-progress
PR447-00 RTC+B Requirements (Goal)	May 31, 2024	Complete (4/30 stretch goal)
PR447-01 EMS, MMS Core Design Complete	May 31, 2024	EMS Complete, MMS - Vendor design, Ancillary Service Manager Complete. Submissions design document will be "as-built", implementation work is in-progress.
PR447-03 I&I Wave 2 Planning Complete	Jun 17, 2024	Complete
PR447-01 Operator Training Simulator (OTS) Design	Jun 28, 2024	In-Progress

**Key Takeaway:** RTC project plan on track to completing planning and design by 9/24