

FERC Order 764 Compliance

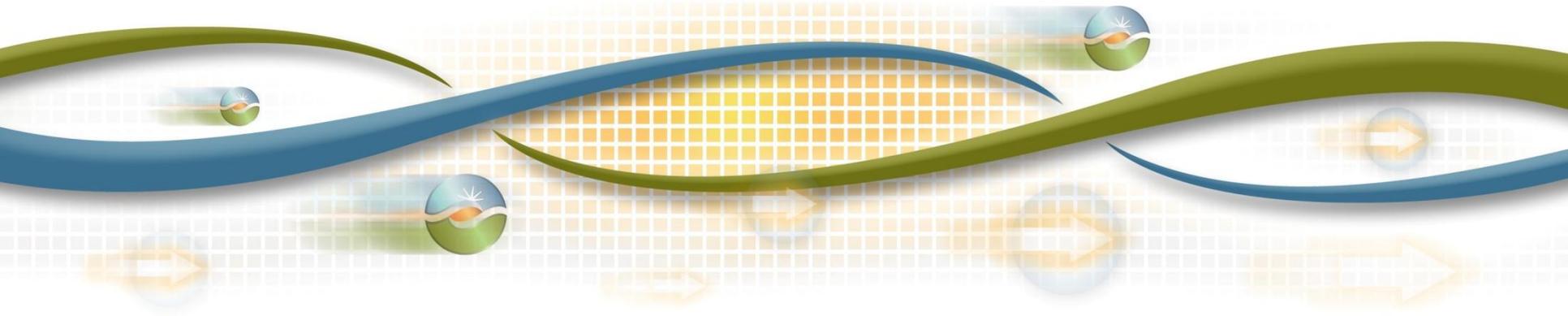
Implementation of 15 minute scheduling and settlement

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Market Surveillance Committee Meeting

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Changes from Revised Straw Proposal

- Provide tagging examples
- Clarify Hourly Process Declines Charge
 - Applies to hourly process advisory schedules including VERs
- Allow hourly block single schedule change per hour
 - Eliminate BCR for all hourly block schedules
- ISO updates tag based upon cleared energy schedules
 - Addresses 2.5 minute issue, but market participant can opt out
- Clarification of InterSC Trade Settlement
 - Simple average since it is an hourly trade
- Participating Intermittent Program
 - No netting of imbalances
- Convergence bidding position limits per intertie

FERC Order 764

- “To remove barriers to the integration of variable energy resources:
 1. Offer an option to schedule energy with 15-minute granularity; and,
 2. Require variable energy resources to provide meteorological and forced outage data for the purpose of power production forecasting.”

Summary of real-time market design changes

- Interties:
 - Dispatch and settlement in 15-minute intervals
 - Option for hourly schedules, but price takers in 15-minute market
- Internal and dynamically-scheduled resources:
 - Financially binding 15-minute schedules
 - Existing 5-minute dispatch and settlement remains
- Intertie and internal convergence bids
 - Both closed-out at same 15-minute LMP
 - Addresses uplift costs that led to convergence bid suspension
- Variable energy resources:
 - Reduced scheduling lead time
 - Scheduling granularity reduced from hourly to 5-min
 - Eliminates PIRP's need for netting imbalance energy monthly

Imbalance settlement with binding 15-minute market

- Interties, generation, demand response:
 - 15-minute LMP:
 - Imbalances between day-ahead and 15-minute schedule
 - 5-minute LMP
 - Generation and demand response:
 - Instructed imbalances between 15-minute schedule and 5-minute dispatch
 - Uninstructed imbalances from 5-minute dispatch
 - Interties:
 - Uninstructed imbalances from 15-minute dispatch
 - Metering and settlement interval changes from 10 min to 5 min

Imbalance settlement with binding 15-minute market (continued)

- Hourly metered load
 - Imbalances between day-ahead schedule and metered load settle at weighted average 15- and 5-minute LMPs by DLAP
 - Weighting of 15- and 5-minute LMPs determined by ISO real-time load forecast
 - Neutrality charge allocated to metered demand by DLAP

Hourly process for intertie hourly block schedules and to account for VERs forecast over interties

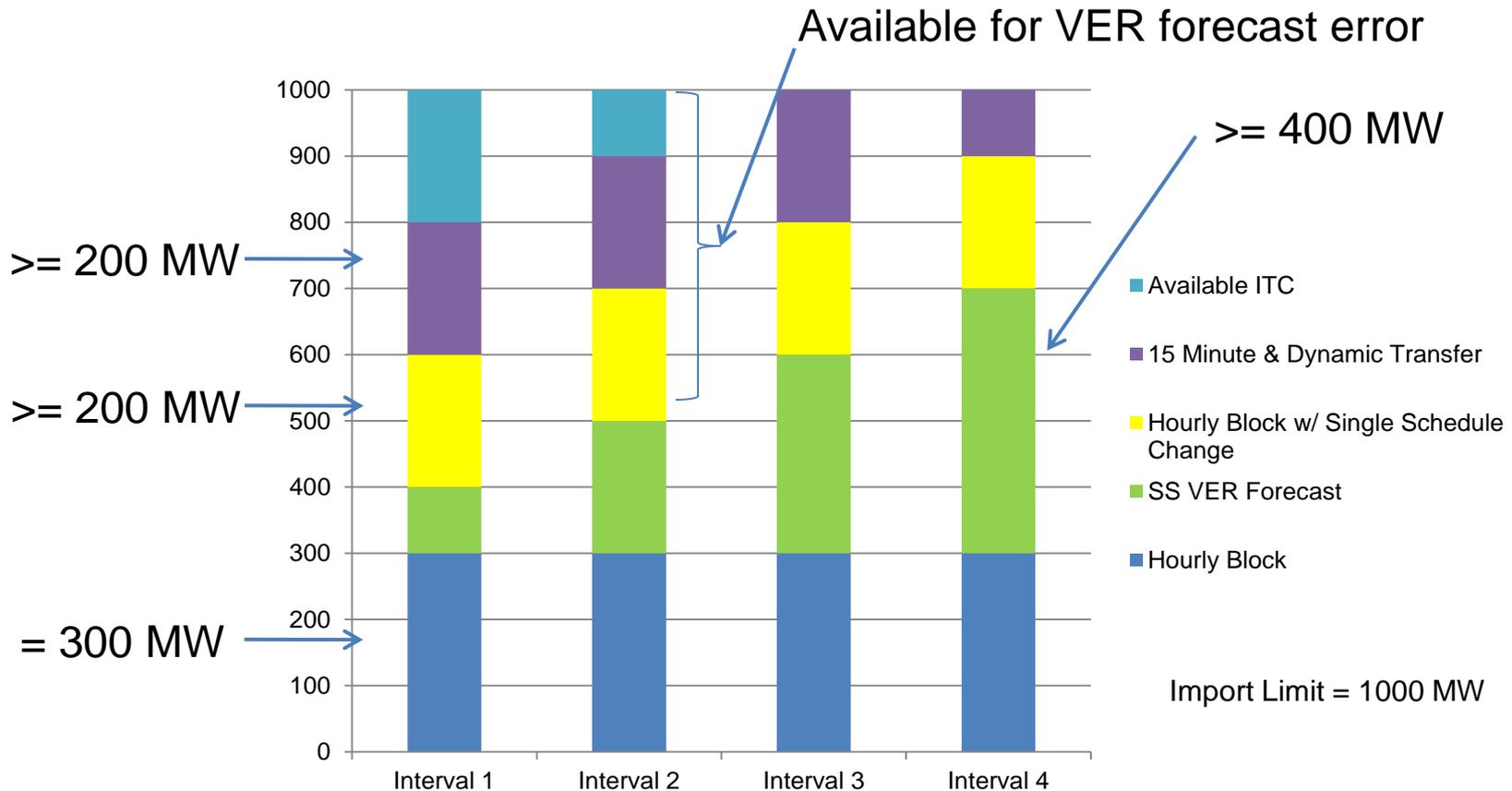
- Hourly market optimization
 - Hourly blocks
 - Enforce constraint that $T = T+15 = T+30 = T+45$
 - 15 minute and dynamic schedules
 - 15 minute intervals can have different MW level
 - VER forecast over intertie
 - Use hourly forecast in 15 minute intervals
- Publish results on hourly block schedules accepted at T-45
- Hourly block-schedules are price takers in 15-min market
 - Even if an economic bid submitted for purposes of determining if hourly block schedule is accepted
- Hour ahead schedules decline charge
- Transmission reservation process from Dynamic Transfers initiative is eliminated (yet to be implemented)

Based on bid information provided, the following intertie options are available

1. Self-scheduled hourly block
2. Self-scheduled variable energy resource forecast
3. Economic bid hourly block
4. Economic bid hourly block with single intra-hour economic schedule change
5. Economic bid with participation in 15-minute market
6. Dynamic transfer

Only option 5 & 6 eligible for bid cost recovery

What transmission profile on tag would be approved from hourly block acceptance process?

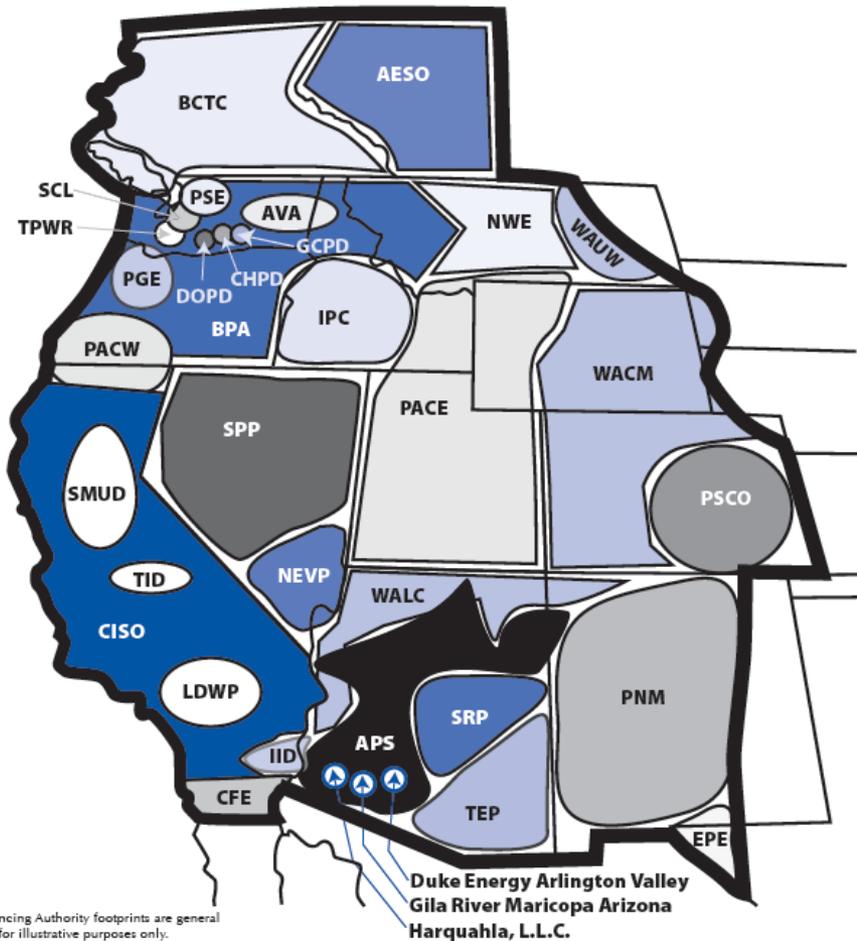


- ISO will approve tags with transmission profiles \geq scheduling limit
- Energy schedules in 15-minute market \leq scheduling limit
- ISO will update energy schedule on tag. MP can opt out, 2.5 min to update tag

Hour ahead schedules decline charge addresses with advisory energy schedules that do not deliver

- Incremental imports exports in hour-ahead process have not financial exposure if not delivered
- Equivalent to existing HASP schedules decline charge
 - Incremental imports/exports operational adjustment charged the HASP price
 - Will use same monthly threshold and penalty
- VERs using their own forecast also subject to decline charge
 - Overstate forecast to crowd out other hourly block schedules
 - If monthly net of forecast deviations exceeds threshold then subject to penalty

ISO working with neighbors on 15-minute scheduling



BAID	Balancing Authority	FERC Jurisdictional
AESO	Alberta Electric System Operator	RECIP
AZPS	Arizona Public Service Company	YES
AVA	Avista Corp.	YES
BANC	Balancing Authority of Northern California	NO
BPA	Bonneville Power Administration	NO
BCH	British Columbia Transmission Corporation	NO
CISO	California Independent System Operator	YES
GWA	Constellation Energy Control and Dispatch (CECD), LLC	NO
GRIF	Constellation Energy Control and Dispatch (CECD), LLC	NO
CFE	Comision Federal de Electricidad	NO
DEAA	Duke Energy Control Area, LLC - Arlington Valley	NO
EPE	El Paso Electric Company	YES
GRMA	Gila River Maricopa Arizona	YES
HGMA	Harquahala L.L.C.	NO
IPC	Idaho Power Company	YES
IID	Imperial Irrigation District	NO
LDWP	Los Angeles Department of Water and Power	NO
WWA	NaturEner Wind Watch Balancing Authority	YES
NEVP	Nevada Power Company	YES
NWMT	NorthWestern Energy	YES
PACE	PacifiCorp-East	YES
PACW	PacifiCorp-West	YES
PGE	Portland General Electric Company	YES
PSCO	Public Service Company of Colorado	YES
PNM	Public Service Company of New Mexico	YES
CHPD	PUD No. 1 of Chelan County	NO
DOPD	PUD No. 1 of Douglas County	NO
GCPD	PUD No. 2 of Grant County	NO
PSEI	Puget Sound Energy	YES
SRP	Salt River Project	NO
SCL	Seattle Department of Lighting	NO
SPPC	Sierra Pacific Power Company	YES
TPWR	Tacoma Power	NO
TEPC	Tucson Electric Power Company	NO
TID	Turlock Irrigation District	NO
WACM	Western Area Power Administration - Colorado-Missouri	NO
WALC	Western Area Power Administration - Lower Colorado	NO
WAUW	Western Area Power Administration - Upper Great Plains West	NO

Enhanced PIRP

- Use ISO 2-hour rolling forecast with 5-minute granularity
 - Establish 15-minute energy self-schedule at T-37.5
 - RTD instructed energy at T-7.5
 - Instructed energy between 15- and 5-minute schedules
 - Uninstructed energy now between meter and forecast at T-7.5
 - Previously between hourly forecast at T-90
- No monthly netting of UIE
- Allow decremental bid from self-schedule in both 15-minute market and RTD
- Internal and external resources eligible
 - External resources avoid hour ahead schedules decline charge
- PIRP is not eliminated to minimize renegotiation of contracts

Real-time congestion offset and internal convergence bidding

- Balanced virtual supply and demand at two node creates a real-time CRR
- Changes in modeling between day-ahead market and real-time market can lead to uplifts
- Moving virtual bid real-time settlement from RTD to 15-minute market which can commit units should reduce uplifts
- Reinstating convergence bidding on the interties will increase the number of potential source-sink pairs

Convergence Bidding

- All convergence bids are liquidated in 15-minute market optimization
 - Intertie convergence bidding was suspended because interties and internal nodes were priced in different market optimizations
 - Less volatile 15-minute LMPs should reduce real-time congestion offset costs
- No convergence bidding between 15-min market & RTD
- Reinstated on intertie scheduling points
 - Dual-constraint issue addressed by DA tagging limit
 - Use same position limit per intertie and timeline from original CB implementation, i.e. 5% per SC for first 8 months.

Stakeholder concerns

- Will intertie liquidity decrease until WECC moves to 15-minute transmission and energy sales?
- No bid cost recovery for hourly block intertie transactions will result in risk shifted to imports/exports
- Is there sufficient coordination between the ISO and other BAs?
- What is PIRP under the Order 764 design changes?
- Are additional measures needed to ensure resources follow dispatch?
- Should convergence bidding on the interties be reinstated with Order 764 design changes?

Appendix

1. Self-scheduled hourly block

- Hour ahead process enforces constraint that energy schedule must be equal in each 15-minute interval
- T-20 Tag
 - Transmission profile = hour ahead process schedule
 - Energy profile = hour ahead process schedule
- No changes to tag made from 15-minute market
- Energy profile can be updated intra-hour due to reliability curtailments

2. Self-scheduled variable energy resource forecast

- At T-75, use 15-minute granular forecast for hour ahead process
- At T-37.5, updated forecast used for self-schedule in first 15-minute market
- T-20 tag,
 - Transmission profile = maximum 15-minute interval from hour ahead process
 - Energy profile = 15-minute market schedule
- Energy profile updated every 15 minutes

3. Economic bid hourly block

- Hour ahead process enforces constraint that energy schedule must be equal in each 15-minute interval
- T-20 Tag
 - Transmission profile = hour ahead process schedule
 - Energy profile = hour ahead process schedule unless curtailed in first 15-minute market
- No economic changes to tag made from 15-minute market
- Energy profile can be updated intra-hour due to reliability curtailments

4. Economic bid hourly block with single intra-hour economic schedule change

- Hour ahead process enforces constraint that energy schedule must be equal in each 15-minute interval
- T-20 Tag
 - Transmission profile \geq hour ahead process energy schedule
 - Energy profile = hour ahead process schedule unless updated in first 15-minute market
- 15-minute market can increment energy profile up to transmission profile tagged by T-20
- 15-minute market can decrement
- Energy profile updated once within the hour 20 minutes prior to flow and remains unchanged for balance of hour

5. Economic bid with participation in 15-minute market

- Hour ahead process can result in advisory energy schedule to differ in each 15-minute interval
- Until 15-minute transmission available, this option requires the transmission capacity \geq maximum bid in MW for 15-minute market
- T-20 Tag
 - Transmission profile \geq maximum MW bid submitted
 - Energy profile = 15-minute market schedule
- Energy profile is updated every 15 minutes based upon 15-minute market results

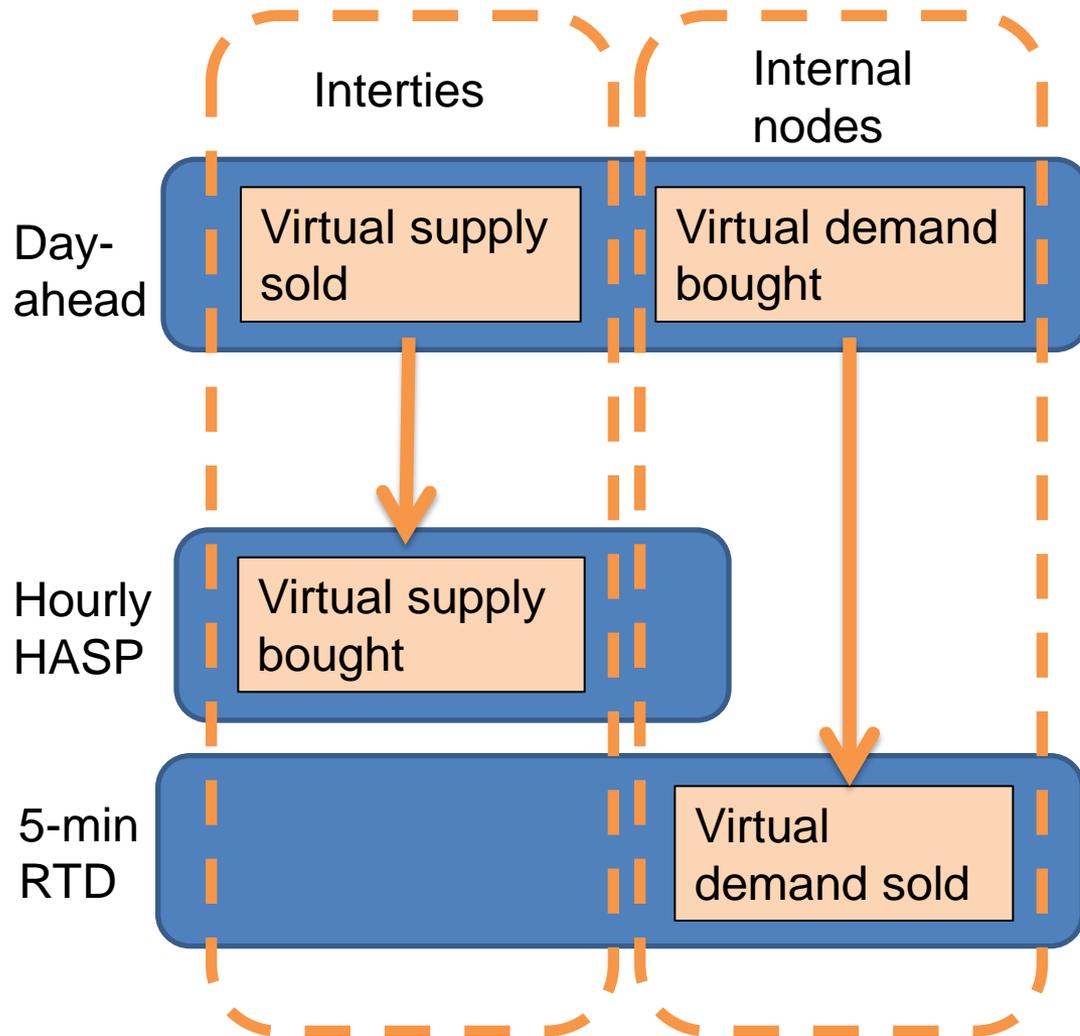
6. Economic bid with participation in 15-minute market only if cleared in hourly process for block schedules

- If no hourly advisory energy schedule, then no need to tag
- If hourly advisory energy schedule, then tagging is the same as option 5

7. Dynamic Transfer

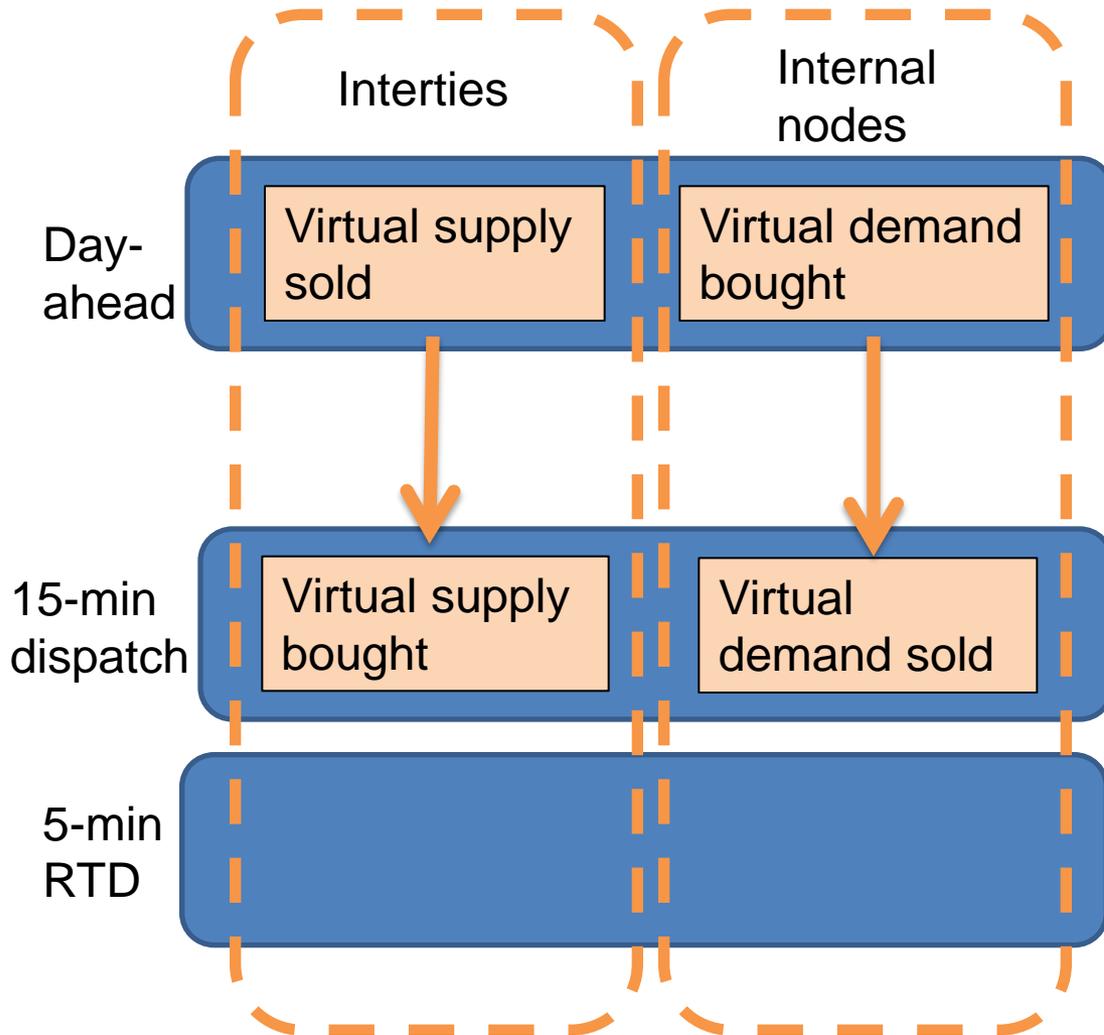
- Hour ahead process can result in advisory energy to differ in each 15-minute interval
- T-20 Tag
 - Transmission profile \geq maximum MW bid submitted
- Final energy profile in dynamic tag will be updated in the hour after schedule hour

Existing market design: intertie virtual bidding



- $RTD\ Price > IFM\ Price > HASP\ price$
- No change to day-ahead physical commitment
- Cost to market = virtual demand sold at RTD price – virtual supply bought at HASP price
- Convergence bid cost paid by uplift charge to load
- Uplift charge to load also produced by HASP/RTD dispatch and price differences

Order 764 market design: intertie virtual bidding



- Intertie and internal virtual bids liquidated at same price
- Virtual bids would not result in uplift charge to load
- Increased consistency between 15-min and 5-min schedules/prices will reduce other uplift charges to load

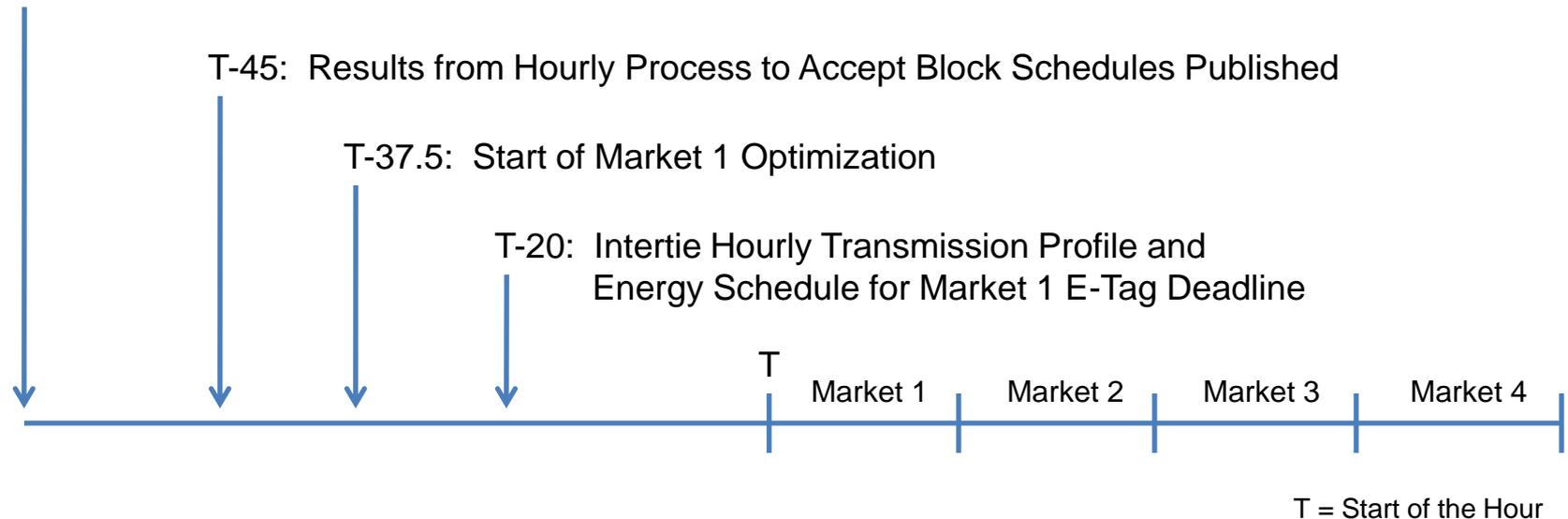
Hourly process for real-time market

T-75: Real-Time Bid Submission Deadline

T-45: Results from Hourly Process to Accept Block Schedules Published

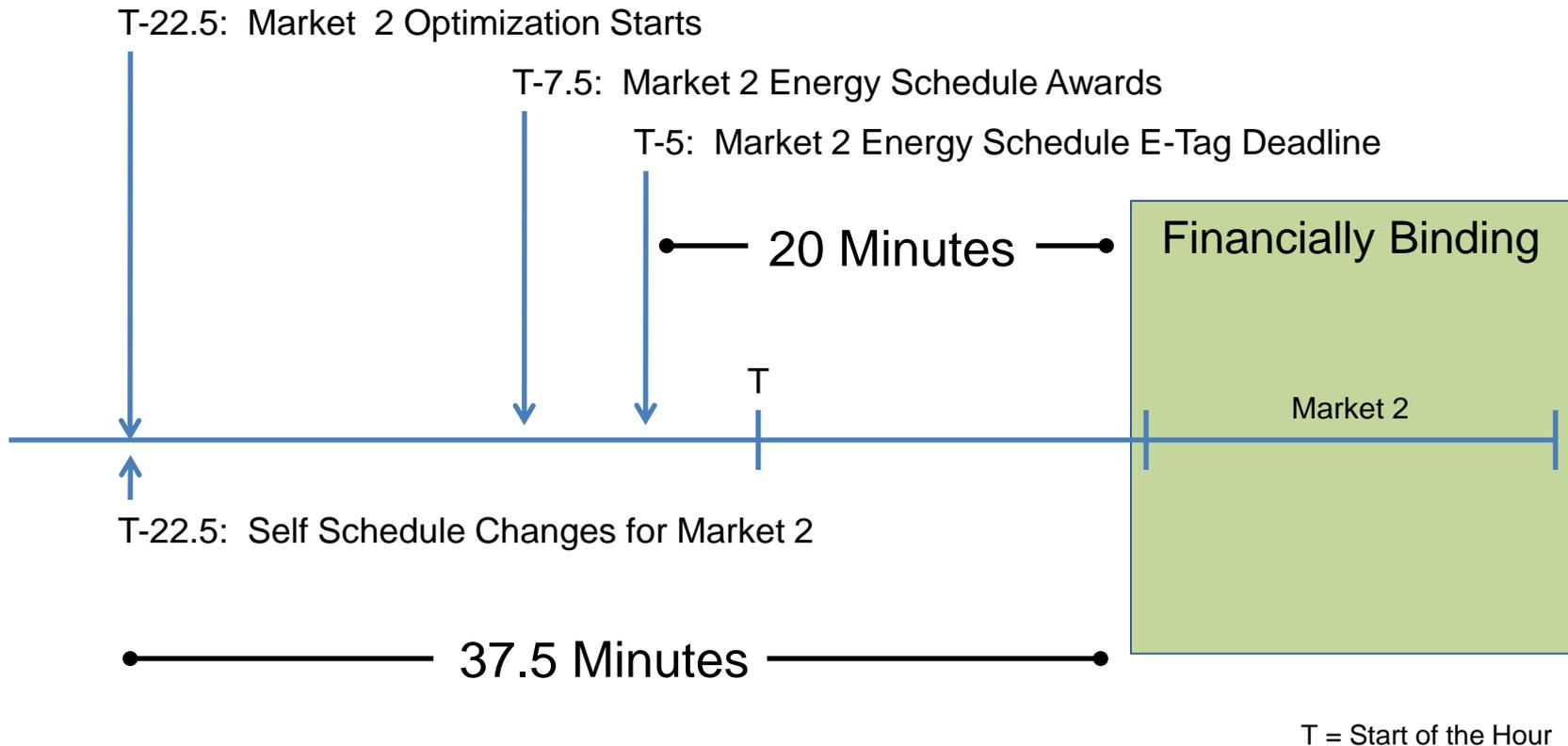
T-37.5: Start of Market 1 Optimization

T-20: Intertie Hourly Transmission Profile and Energy Schedule for Market 1 E-Tag Deadline



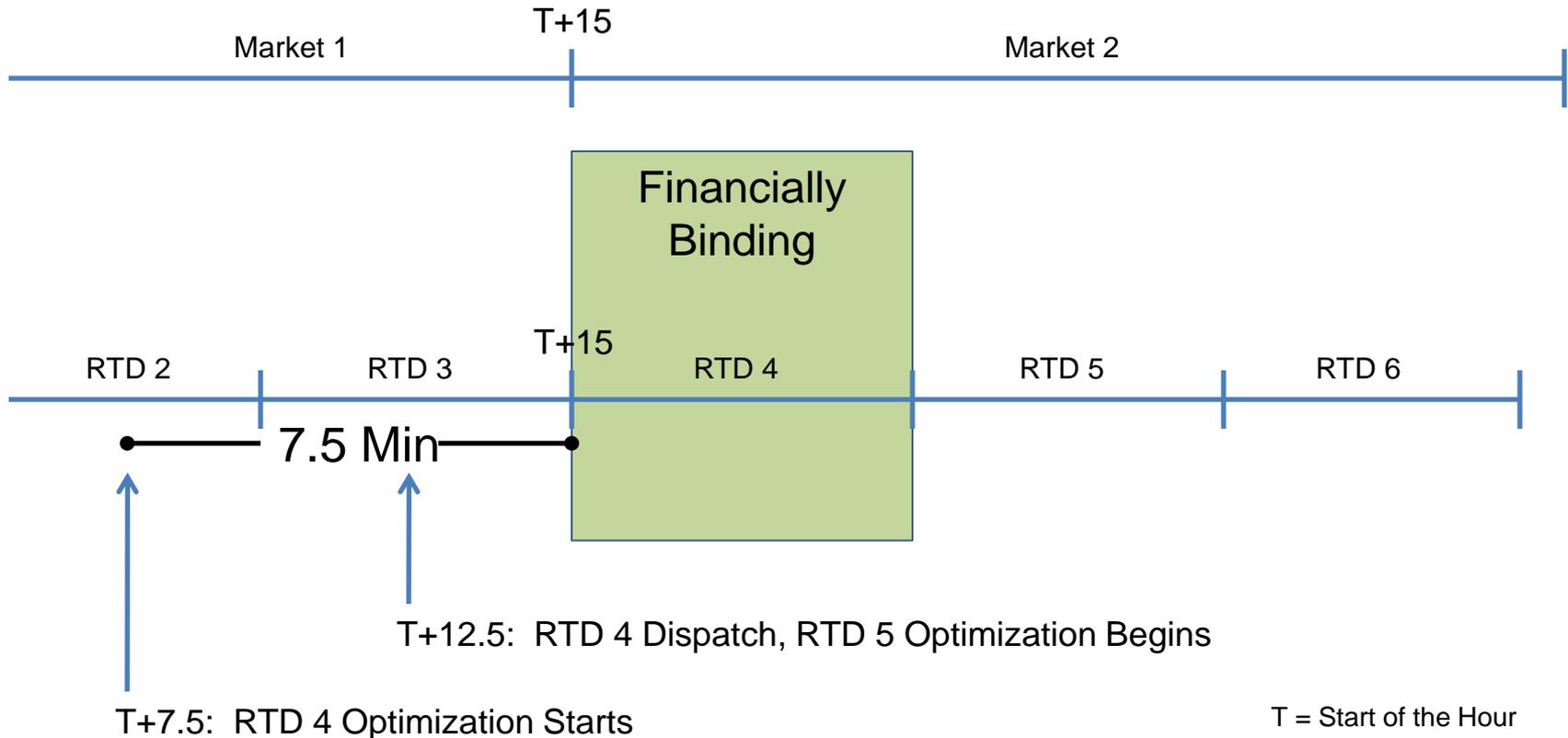
No hourly financially binding schedules

15-Minute Market Timeline



- Second interval of RTUC optimization used to avoid seams issues
- RTPD 2 becomes the first interval in new 15 minute market

RTD Market Timeline



- No changes to RTD 5-minute dispatch
- RTD provides operational instruction to all generation and demand response resources