

Reserve Market Overview and Reserve Market Settlements

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Market Analysis and Settlements

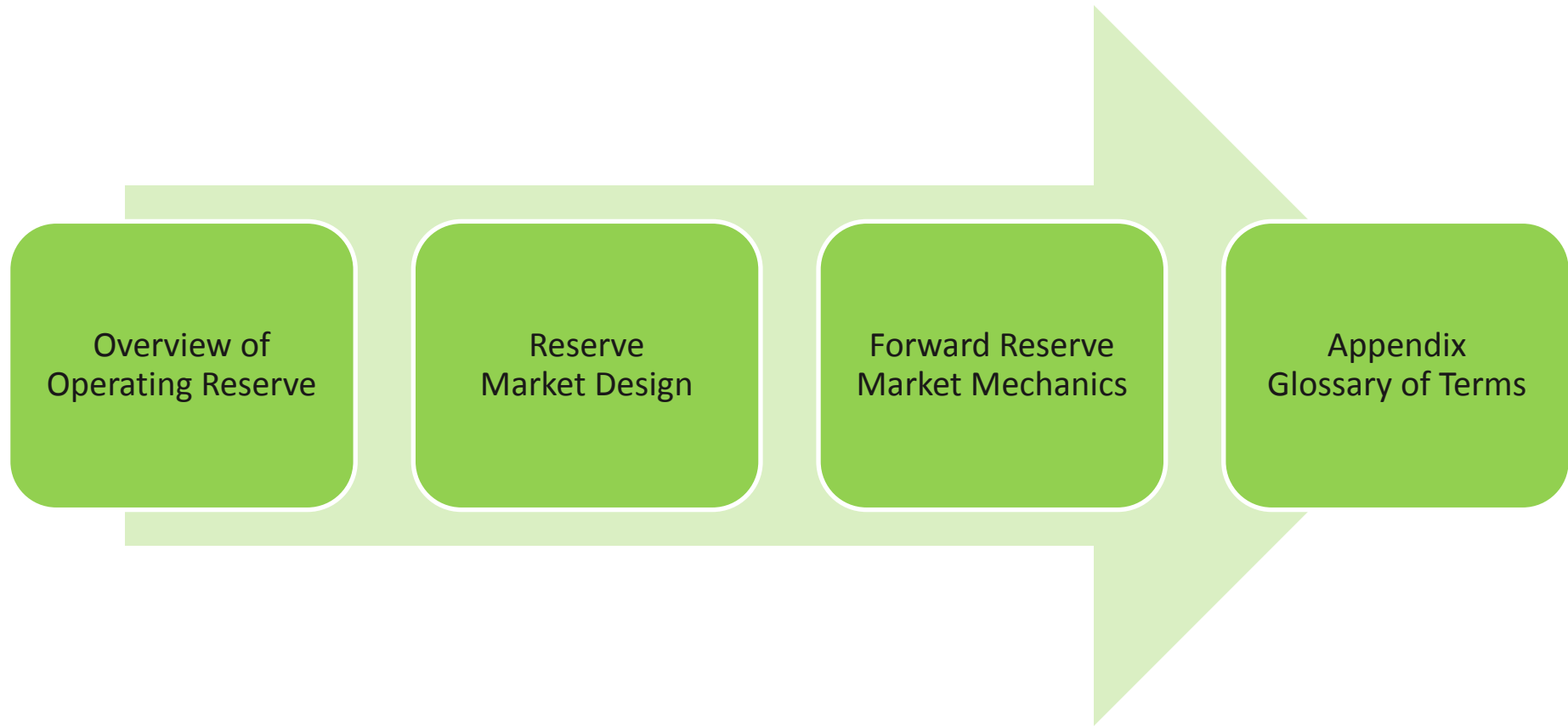
Reserve Market Overview

Learning Objectives

- To understand the concept of Operating Reserve
- To understand the New England Reserve Market concepts
 - Real-Time (RT) Reserve
 - Forward Reserve
- Forward Reserve Market (FRM) Mechanics
 - Process Overview



Topics Covered in this Module





Overview of
Operating Reserve

Reserve
Market Design

Forward Reserve
Market Mechanics

Appendix
Glossary of Terms

What are Reserves?



- Reserve Capacity – Capacity over and above what is required to provide energy in the Control Area in order to ensure reliability; this capacity is available for dispatch during system contingencies
- Reserves allow the Control Area to withstand contingencies
 - Reserve capacity requirements are based on largest foreseeable loss of supply
 - Contingency examples: Large generator trips, line trips

Types of Reserve

TMSR: “Ten-Minute Spinning Reserve”

- Capability of on-line unit to provide increased energy within 10 minutes
- Partially loaded on-line generator
- Limited by ramp rate and Eco Max

TMNSR: “Ten-Minute Non-Spinning Reserve”

- Capability of off-line resources to provide energy within 10 minutes
- Off-line generation turbine, diesel or hydro generators
- Load interruption – Dispatchable Asset Related Demand (DARD)

TMOR: “Thirty-Minute Operating Reserve”

- Capability of resources to provide energy within 30 minutes
- Can be either on-line or off-line resource
- Generally the larger generation turbines
- Load Interruption – DARD can also qualify

New England Operating Reserve

System Requirements

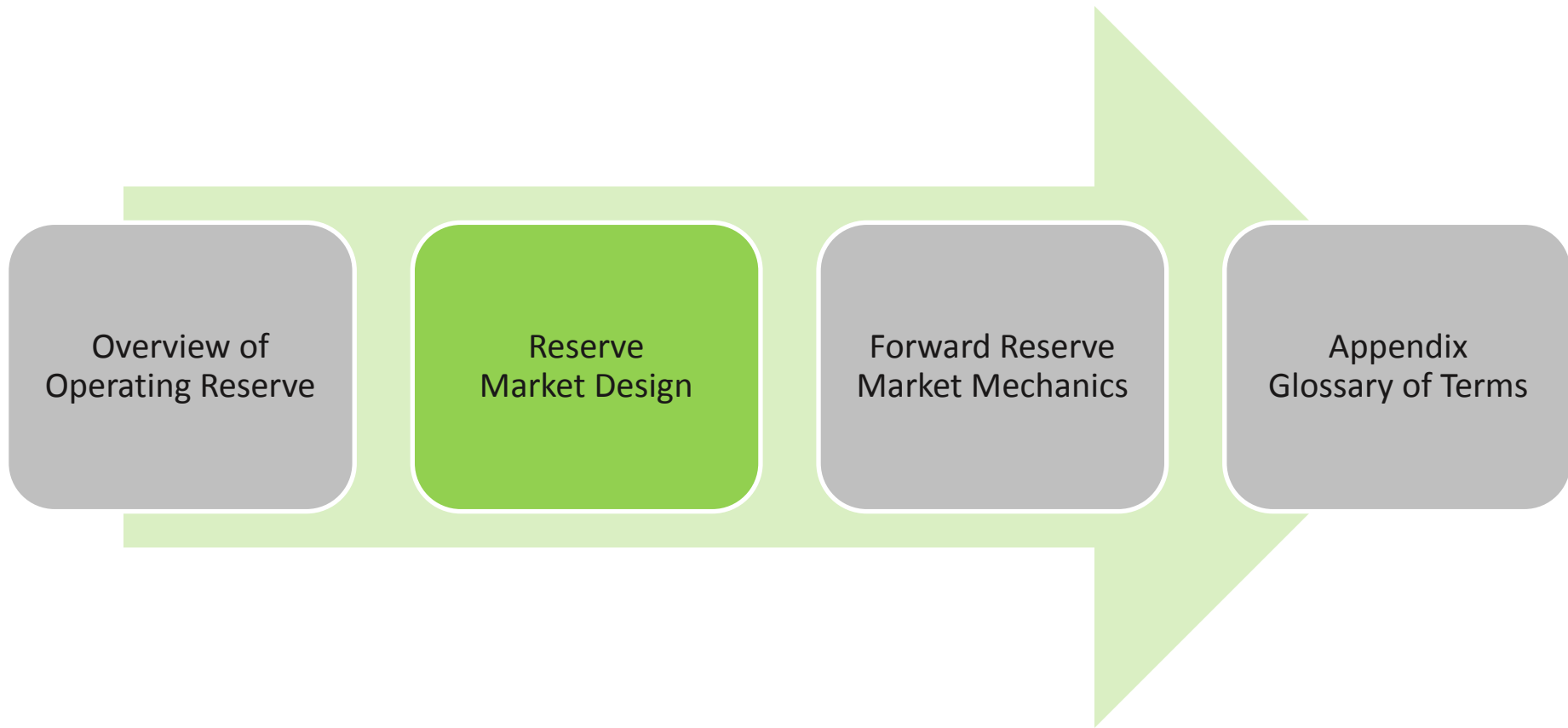
- Current Operating Reserve Requirements
 - 100% of 1st Contingency MW in 10-Minute Reserve
 - 50% in TMSR
 - 50% in TMNSR
 - 50% of 2nd Contingency MW in 30-Minute Reserve
- Summer 2011
 - Requirement is 1600 MW in 10-Minute Reserve
 - 800 MW TMSR
 - 800 MW TMNSR
 - Requirement is 750 MW in 30-Minute Reserve

New England Operating Reserve

Locational Requirements

- Locational requirements for the Forward Reserve Market are established per Market Rule 1, Section III.9.2.3 and are a function of historical operating requirements.
 - Summer 2011
 - CT: 723 MW TMOR





Reserve Market Design

- ISO-NE Reserve Market
 - Two Components
 1. Real-Time Reserve Market
 2. Forward Reserve Market



Reserve Market Design

Real-Time Reserve Market

- Real-Time Energy and Reserves Co-optimization
 - The market clearing prices for Energy and reserves (TMSR, TMNSR, TMOR) are determined simultaneously
- Least cost method for meeting energy demand while maintaining system reliability
 - Dispatch point for each generator is optimal point for revenue from the Energy and Real-Time Reserve Markets
- Real-Time Reserve is designated by the Control Room to provide reserves every five minutes during the operating day
 - The capacity will not be dispatched for Energy unless there is a contingency event that results in reserve activation

Real-Time Reserve Pricing



- Each Real-Time dispatch execution dispatches and prices resources to simultaneously meet all active energy, reserve and transmission constraints.
 - Suppliers do not submit offers for real-time reserves; the hourly Reserve Market Clearing Prices (RMCP) are determined using energy offers
 - TMSR RMCP, TMNSR RMCP, TMOR RMCP
- Real-Time prices for reserve are set by either:
 - Re-dispatch cost, which represents the additional cost, above the optimal dispatch, necessary to meet the reserve requirements, or
 - Reserve Constraint Penalty Factor is an administrative price designed to reflect the value of reserve scarcity when a reserve requirement cannot be satisfied.

Real-Time Reserve Designation

- All units in New England that are capable of providing Operating Reserve will be evaluated for Real-Time Reserve.
- Reserve quantities are designated by resource on the basis of reserve capability and the dispatch/re-dispatch cost of reserve.
- Real-Time Reserves are compensated only during hours where the Reserve Market Clearing Price is non-zero.



Remember, there are no Real-Time Reserve Offers.

- In most hours, RMCPs are zero. Non-zero RMCP values in about 10 % of the hours since inception of market

Reserve Market Design

Forward Reserve Market (FRM)

- Market Mechanism to procure capacity in resources to provide the off-line reserves that are incorporated in the optimal dispatch of Energy and Real-Time reserve
- FRM was designed to provide appropriate economic incentives to resources that provide these valuable Real-Time operating reserve supplies during peak periods

Forward Reserve Market

- A Participant who takes on FRM obligation will be paid to designate resources to be available to meet Off-line (TMNSR, TMOR) Real-Time Reserve Requirements. This designation is made in advance of the Operating Day.
 - “Forward” Reserve
- In general, FRM capacity will be available for dispatch, but will not normally be in economic merit
 - Capacity is held in reserve, in the event of a contingency on the system
 - Note: FRM provides revenue to peaking resources that operate infrequently

Forward Reserve Market (cont.)

- Participants take on obligations in the FRM through Auctions that are held twice a year. The Auctions set the prices and procure the reserve capacity to meet system-wide TMNSR and TMOR requirements and local TMOR requirements.
 - Summer 2010 Clearing prices ranged from ~\$6-\$14/kW-month
 - Summer 2011 Clearing price for all products is \$4.50/kW-month
 - Forward Capacity Auction Clearing Price is subtracted from the FRM Clearing price
- Summer 2011 Pricing
 - $\$4.50/\text{kW-month} - \$3.60/\text{kW-month} = \$0.90/\text{kW-month}$



Forward Reserve Market (cont.)

- Suppliers can offer to supply the FRM in Reserve Zones or in the Rest of System (RoS) in the Auction
- Participants whose bids clear in an Auction will have an obligation for the entire seasonal period
 - Obligations are for hours ending 8-23 weekdays, excluding NERC holidays
 - Winter season is October through May
 - Summer season is June through September
- Clearing Prices for TMNSR and TMOR in Zones and RoS may vary
 - Not the case in Summer 2011; all prices same

Forward Reserve Market (cont.)

- A resource paid in the FRM will have its Real-Time Reserve payment adjusted to prevent double payment for same MW.

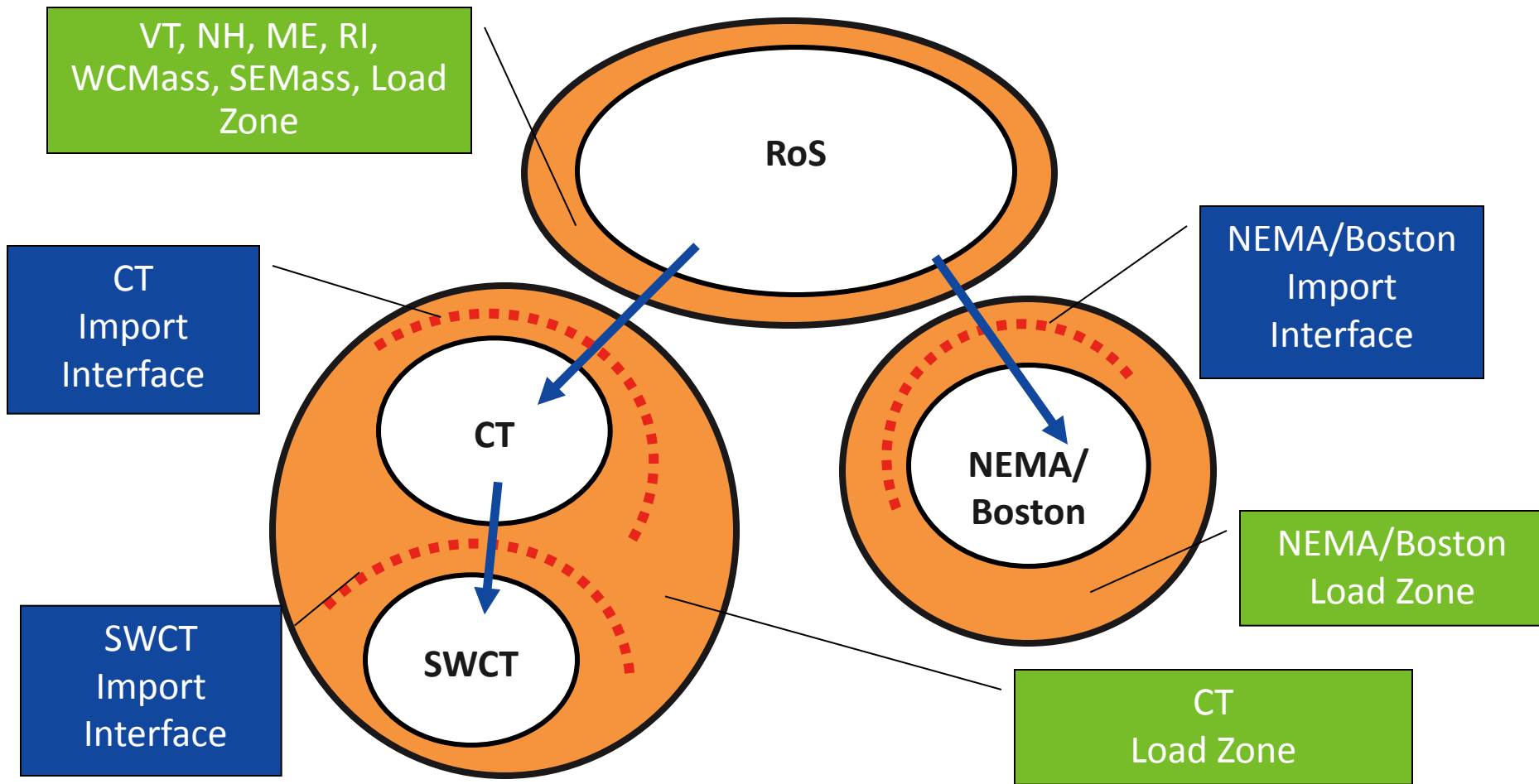


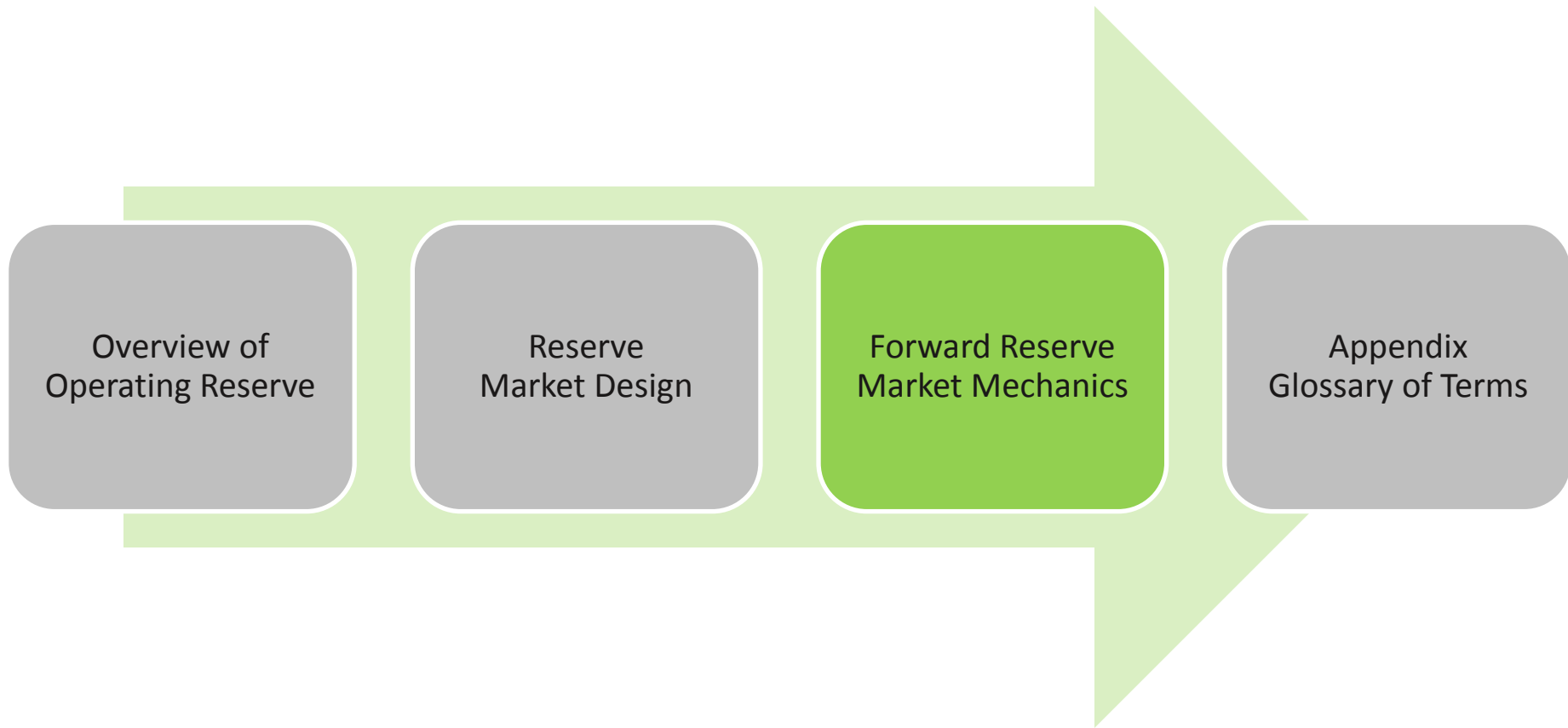
Note: A unit does not have to be offered in the FRM to provide Real-Time Reserve.

Forward Reserve Market (cont.)

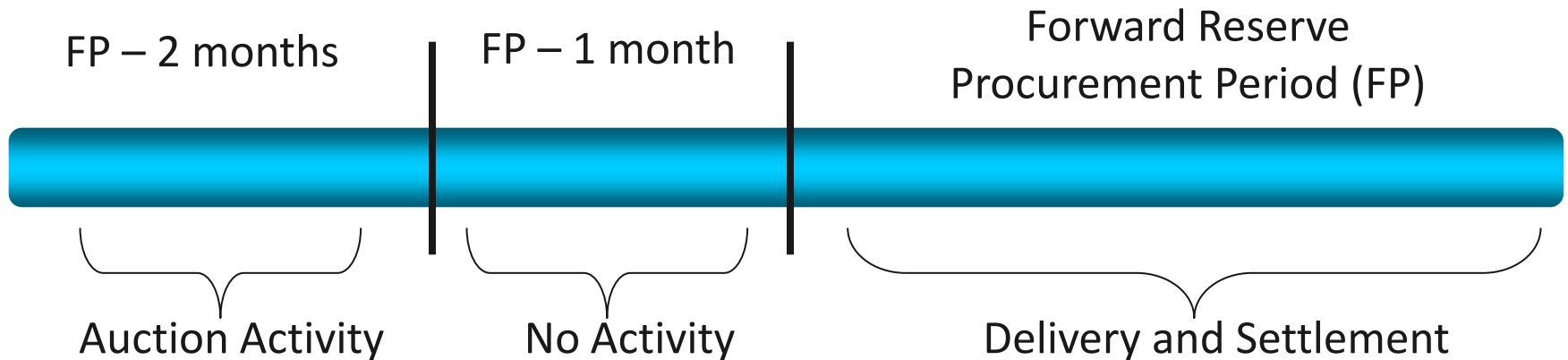
- Suppliers manage their Forward Reserve capable resources daily, on a portfolio basis, to meet their FRM Auction obligations
- Obligations can be traded bilaterally between suppliers
- Real-time performance monitoring of FRM designated resources
 - A Participant that does not meet its FRM obligation in any hour will not be paid for any unmet obligation
 - A Participant that does not meet its FRM obligation in any hour will also be penalized for every MW of unmet obligation

Reserve Zones and Load Zones





Auction Timeline Overview



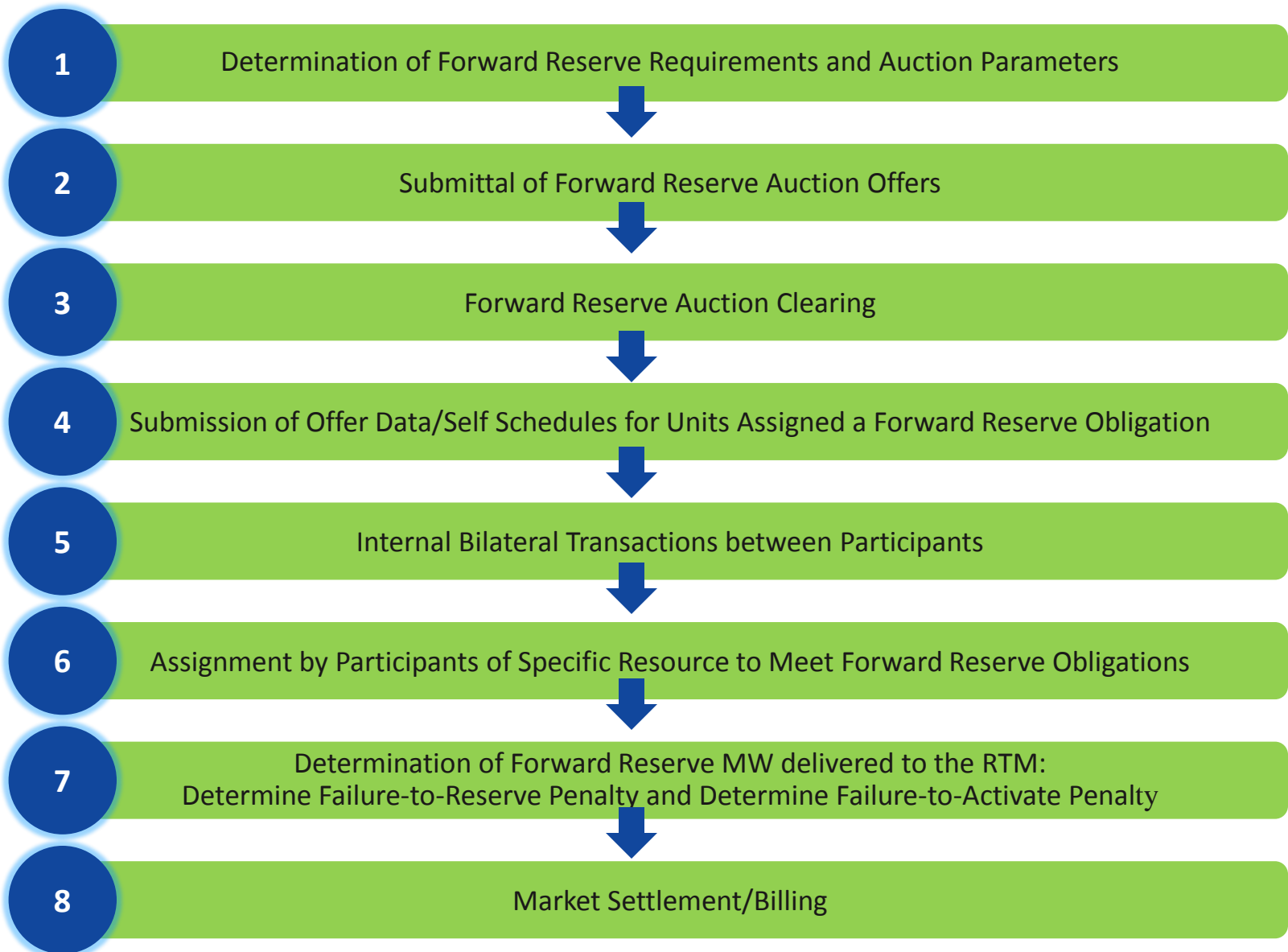
Forward Reserve Procurement Periods

- Summer Capability Period (June 1 - September 30)
- Winter Capability Period (October 1 - May 31)

Delivery hours

- On-Peak Hours (07:00 - 23:00)
- Weekdays, excluding NERC holidays

FRM Process Flow



Determination of Forward Reserve

Requirements and Auction Parameters

- FRM system requirements are established consistent with ISO-NE Operating Procedure No. 8 (OP8) and operational practice.
 - Summer 2011: 800 MW TMNSR; 750 MW TMOR
- FRM locational requirements are established per Market Rule 1, Section III.9.2.3 and are a function of historical operating requirements.
 - Summer 2011
 - CT: 723 MW TMOR



Determination of Forward Reserve

Requirements and Auction Parameters (cont.)

- Forward Reserve Threshold Price
 - Threshold Price is a parameter used each day by Participants with LFRM obligations for supply offer determination
 - Resources must be offered at or above the Threshold price in the Energy Market in order for these resources to qualify as meeting the participant's LFRM obligations
 - Threshold Price is the product of the following variables:
 - Forward Reserve Heat Rate Index – set at Auction time and for the whole entire Forward Reserve procurement period
 - Summer 2011: 15,236 Btu/kWh
 - Forward Reserve Fuel Index – set monthly, and when multiplied by the Heat Rate Index, produces the Forward Reserve Threshold Price.

Participant Forward Reserve Offers

- Forward Reserve Auction Offers are submitted on a portfolio basis by Participants
- Specific physical Resources are not offered into the auction
- Offer consists of MW, type, location, and price
- Offer price is capped at \$14/kW-month
 - Offer cap amount is based on the estimated carrying cost of an aero-derivative combustion turbine.
 - Offer cap reflects the sum of the components that a supplier would be expected to consider in developing its bid

ISO-NE Forward Reserve Auction Clearing

- ISO-NE clears the FRM auction based on offers and reserve requirements.
- No more than the Locational Reserve Requirement must be purchased from Resources within an import-constrained location.
- Auction obligations are met in real-time
 - No money changes hands when Auction results are published
 - Payment is contingent on meeting delivery performance obligations



Participant Submittal of Supply Offer

Data for Resources to be Assigned for Forward Reserve

- Supply Offers for the days during the Procurement Period
- MW of a resource assigned against a FRM obligation must be offered by the close of the re-offer period at a \$/MWh rate that is greater than or equal to the Forward Reserve Threshold Price.
- On-line resources assigned against an FRM obligation must be self-scheduled or have cleared the DAM.
 - Resources committed by the ISO to provide Local Second Contingency Protection or VAR will not be credited with any Qualifying MW for the hour.

Internal Bilateral Transactions

Between Participants

- Bilateral trading of obligations
 - Can trade previously acquired obligation (from Auction or other bilateral) to any other Participant.
 - Buyer and Seller must confirm.
 - Are communicated in similar Interface the same way that bilateral for Energy Market are submitted.
 - Must be submitted prior to midnight of the day prior to the Operating Day.
 - Buyer of Bilateral takes on assignment obligations.



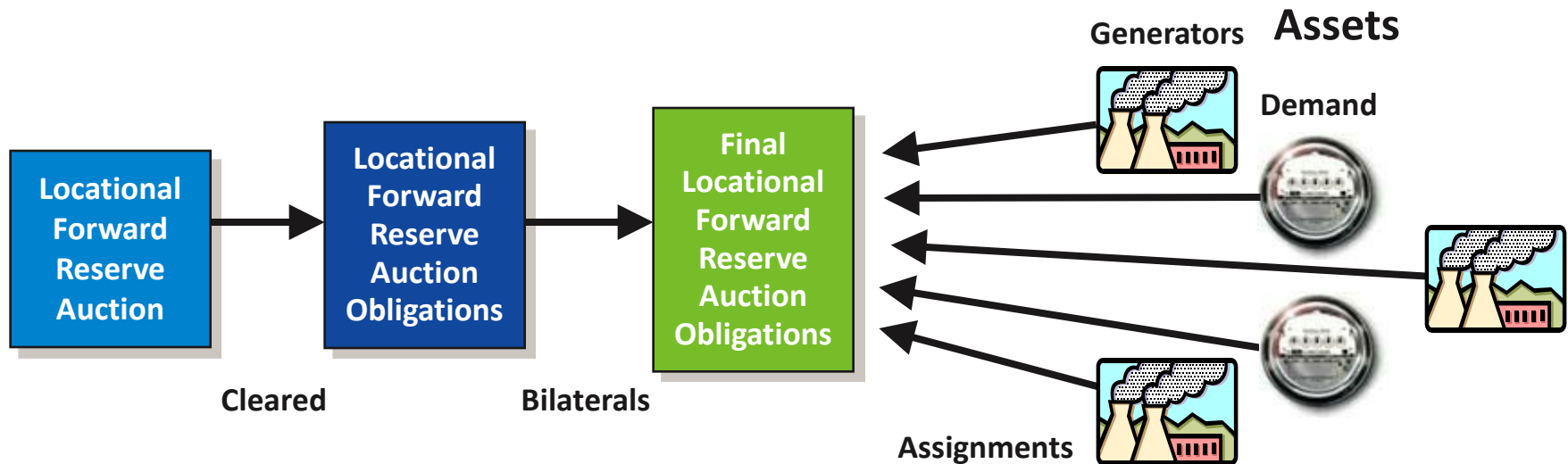
Assignment by Participants of

Specific Resources to Meet Forward Reserve Obligations

- Assignment of Resources
 - Assignment must be done by Lead Participant for the Asset
 - Hourly Assignment of the resource
 - Over Assignment ($>$ Obligation) is possible and allowed
 - Resource is assigned to meet product obligations (type and location)
 - All assignments must be made prior to close of re-offer period before the operating day
 - Assignments do not automatically “roll over”, assignments must be made specifically for each day
 - An assignment for a day may be performed in advance; assignments for all days in a Procurement Period can be made at once

Assignment by Participants of

Specific Resources to Meet Forward Reserve Obligations (cont.)



Assignment by Participants of

Specific Resources to Meet Forward Reserve Obligations (cont.)

- A resource that is being assigned against an FRM obligation must be able to receive and follow Dispatch Instructions
- Off-line resources must be available for dispatch in RT, and have a submitted and demonstrated “Claim10” or “Claim30” rating

Assignment by Participants of

Specific Resources to Meet Forward Reserve Obligations (cont.)

Remember:

- MW of a resource assigned against a FRM obligation must have been offered by the close of the re-offer period at a \$/MWh rate that is greater than or equal to the Forward Reserve Threshold Price.
- On-line resources assigned against an FRM obligation must be self-scheduled or cleared the DAM.
- Resources committed by the ISO to provide Local Second Contingency Protection or VAR will not be credited with any Qualifying MW for the hour.



Determination of Forward Reserve

MW Delivery

- Forward Reserve Delivered MW
 - Assigned in advance of operating day
 - Offered at or above the FRM Threshold price
 - Resource is available, and can physically provide operating reserves
- Delivery evaluation and payment is hourly
 - Hourly payment rate determined from Auction rate, less Forward Capacity Auction (FCA) rate

Determination of Forward Reserve

MW Delivered to the RTM (Penalties) – Failure to Reserve

- Failure to Reserve
 - A Participant that does not have enough Forward Reserve MW delivery in an hour to meet its obligation will have a Failure to Reserve in that hour.
 - Failure to Reserve MW are assessed a penalty charge
- 1.5 x the FRM Hourly Rate**
- Participant is also NOT PAID for any MW not reserved

Determination of Forward Reserve

MW Delivered to the RTM (Penalties) – Failure to Activate

- Failure to Activate
 - Participant's off-line Resource assigned for FRM fails to start when requested by the ISO; or
 - Participant's off-line Resource assigned for FRM fails to reach Claim 10 or Claim 30 amounts in the required 10 or 30 minute interval; or
 - Participant's on-line Resource assigned for FRM fails to follow dispatch instructions

Determination of Forward Reserve

MW Delivered to the RTM (Penalties) – Failure to Activate (cont.)

- Failure to Activate MW are assessed a penalty charge

(FRM rate + Max[2.25 x FRM rate, RT LMP at generator node])

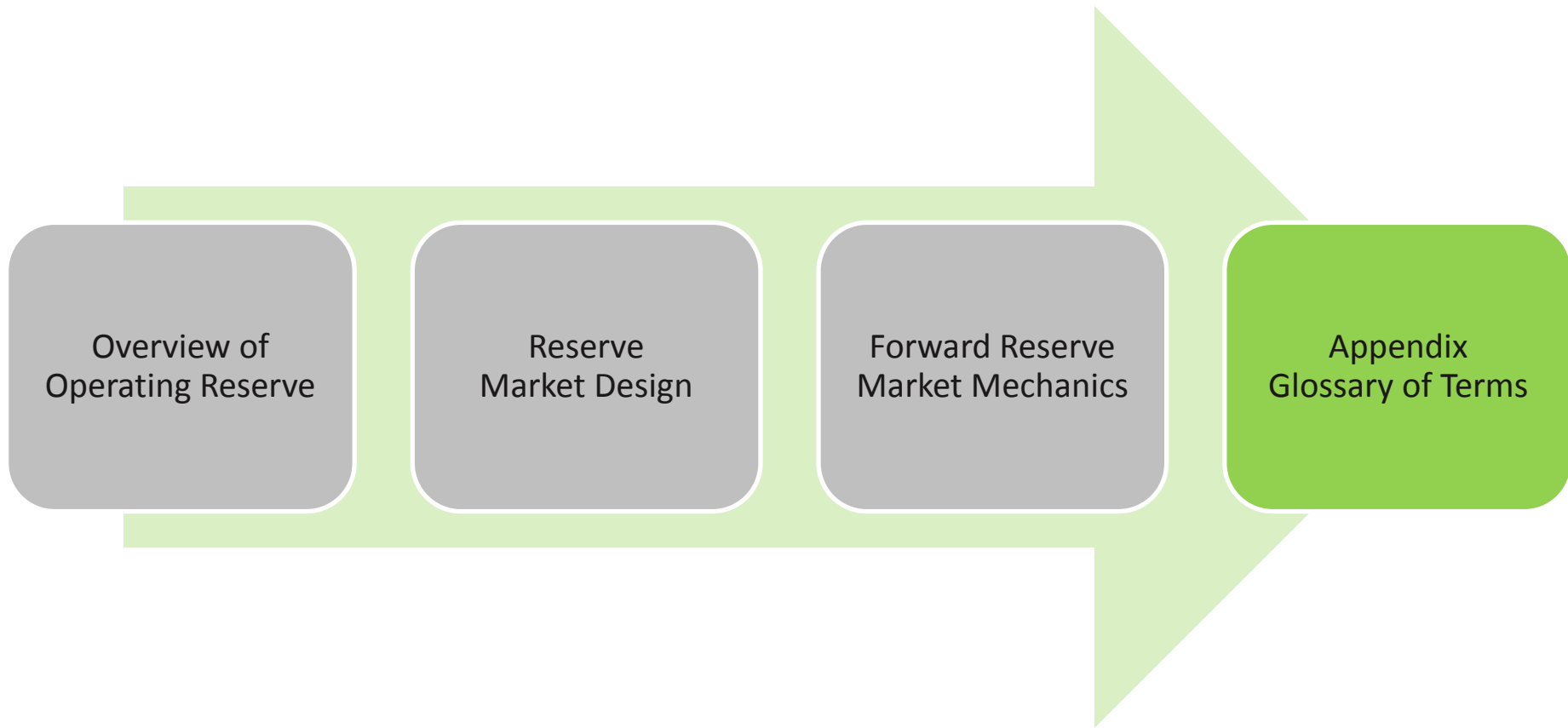
- Participant is paid for delivered MW up to its Forward Reserve Obligation MW

Market Settlement and Billing

- Payments (and penalties, as applicable) are calculated for Participants with Forward Reserve Obligations
- Charges for Participants with Real-Time Load Obligations are calculated
- Settlement reports are issued, generally 4 business days after the operating day.
 - Real-Time Reserve Market settlement is also included in these reports
- Once the settlement report is issued, the Reserve Market will be billed in the next service bill.
 - Service bills are issued twice a week; on Mondays and Wednesdays (or next business day, if Monday or Wednesday is a holiday)



Contact: Market Support Services at (413) 540-4220,
Fax: (413) 535-4156, or E-mail: custserv@iso-ne.com



Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions

- Claim 10 (or Claimed 10-Minute Off-Line Reserve)
 - The generation output level, expressed in MW, which can be reached by a Generator (from an off-line state) within ten minutes after receiving a Dispatch Instruction from the ISO or the amount of reduced consumption, expressed in MW, which can be reached by a Dispatchable Asset Related Demand within 10 minutes after receiving a Dispatch Instruction from the ISO.
- Claim 30 (or Claimed 30-Minute Off-Line Reserve)
 - The generation output level, expressed in MW, which can be reached by a Generator (from an off-line state) within thirty minutes after receiving a Dispatch Instruction from the ISO or the amount of reduced consumption, expressed in MW, which can be reached by a Dispatchable Asset Related Demand within thirty minutes after receiving a Dispatch Instruction from the ISO.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Fast Start Generator
 - A generating unit that the ISO may dispatch within the hour through electronic dispatch and that meets the following criteria:
 - i. minimum run time does not exceed one hour;
 - ii. minimum down time does not exceed one hour;
 - iii. time to start does not exceed 30 minutes;
 - iv. available for dispatch and manned or has automatic remote dispatch capability;
 - v. capable of receiving and acknowledging a start-up or shut-down dispatch instruction electronically; and
 - vi. has satisfied its minimum down time.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Forward Reserve – TMNSR and TMOR purchased by the ISO on a forward basis on behalf of Market Participants.
- Forward Reserve Assigned Megawatts – The amount of Forward Reserve, in MWs, that a Market Participant assigns to eligible Forward Reserve Resources to meet its Forward Reserve Obligation.
- Forward Reserve Auction – The periodic auction conducted by the ISO to procure Forward Reserve.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Forward Reserve Auction Offer – An offer to provide Forward Reserve to meet system and Reserve Zone requirements as submitted by a Market Participant.
- Forward Reserve Clearing Price – The clearing price for TMNSR or TMOR, as applicable, for the system and each Reserve Zone resulting from the Forward Reserve Auction.
- Forward Reserve Obligation – A Market Participant's amount, in MW, of Forward Reserve that cleared in the Forward Reserve Auction adjusted, as applicable, to account for bilateral transactions that transfer Forward Reserve Obligations.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Forward Reserve Threshold Price – The minimum price at which a Forward Reserve Resource is required to be offered into the Real-Time Energy Market
- Manual Response Rate – The rate, in MW/minute, at which a Market Participant is willing to have a generating unit change its output when the unit is not under automatic control. This is also often referred to as the unit’s “ramp rate.”

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Ten-Minute Non-Spinning Reserve (TMNSR) – The reserve capability of a generating unit that can be converted fully into energy within ten minutes from the request of the ISO dispatcher, and is provided by generating units that are either electrically synchronized or not electrically synchronized to the New England Transmission System or the reserve capability of a Dispatchable Asset Related Demand that can be fully utilized within ten minutes from the request of the ISO dispatcher to reduce consumption.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Ten-Minute Spinning Reserve (TMSR) – The reserve capability of a generating unit that can be converted fully into energy within ten minutes from the request of the ISO or a Dispatchable Asset Related Demand pump that can reduce energy consumption within ten minutes from the request of the ISO, and is provided by generating units and Dispatchable Asset Related Demand pumps electrically synchronized to the New England Transmission System.

Market Rule 1 Terminology

Per ISO-NE Manual 35 – Definitions (cont.)

- Thirty-Minute Operating Reserve (TMOR) – The reserve capability of a generating unit that can be converted fully into energy within thirty minutes from the request of the ISO, and is provided by generating units that are either not electrically synchronized or electrically synchronized to the New England Transmission System or the reserve capability of a Dispatchable Asset Related Demand that can be fully utilized within thirty minutes from the request of the ISO to reduce consumption.

Reserve Market Settlements

Objectives

- Explain settlement processes of the Real-Time (RT) Reserve and Forward Reserve markets.
- Settlement concepts will be presented using a “high level” view.

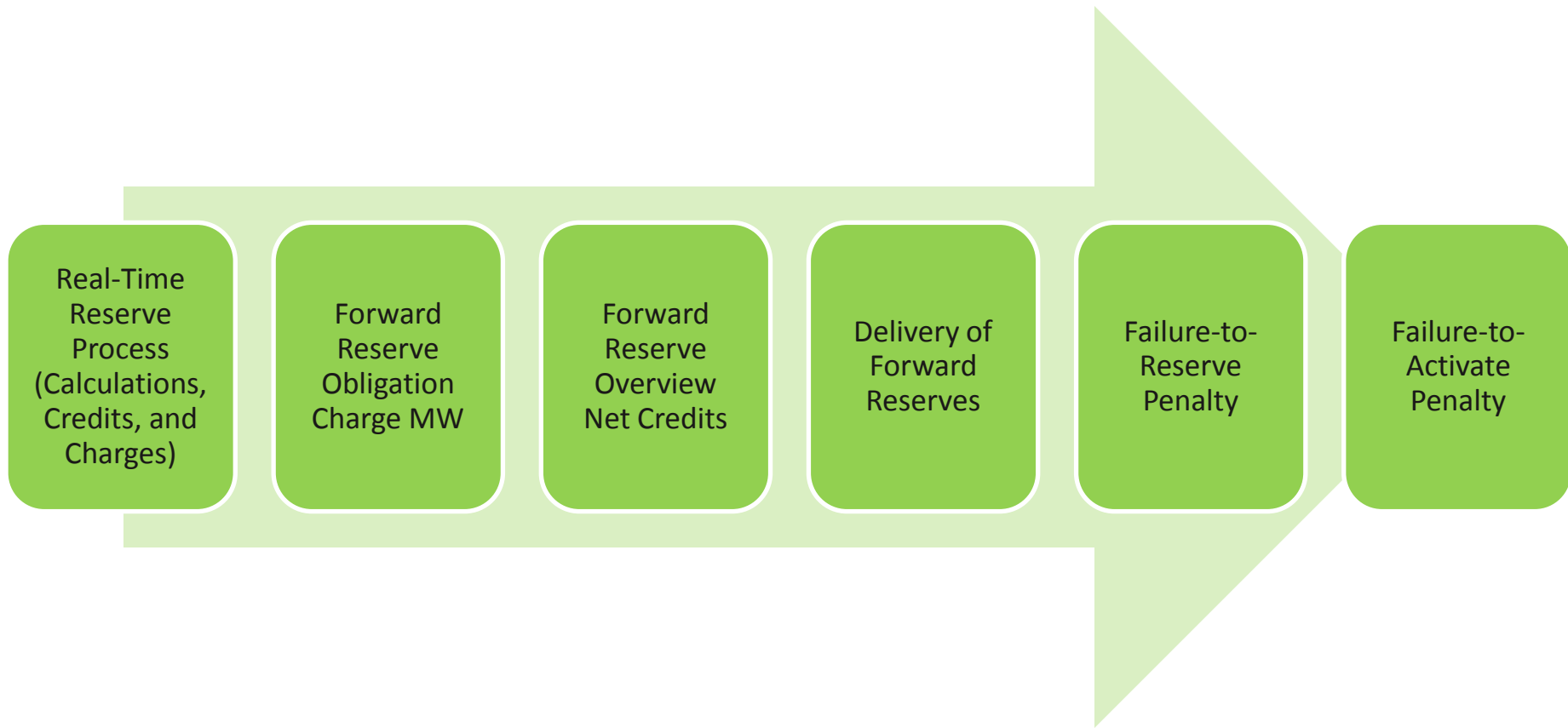


Reserve Market – Governing Documents

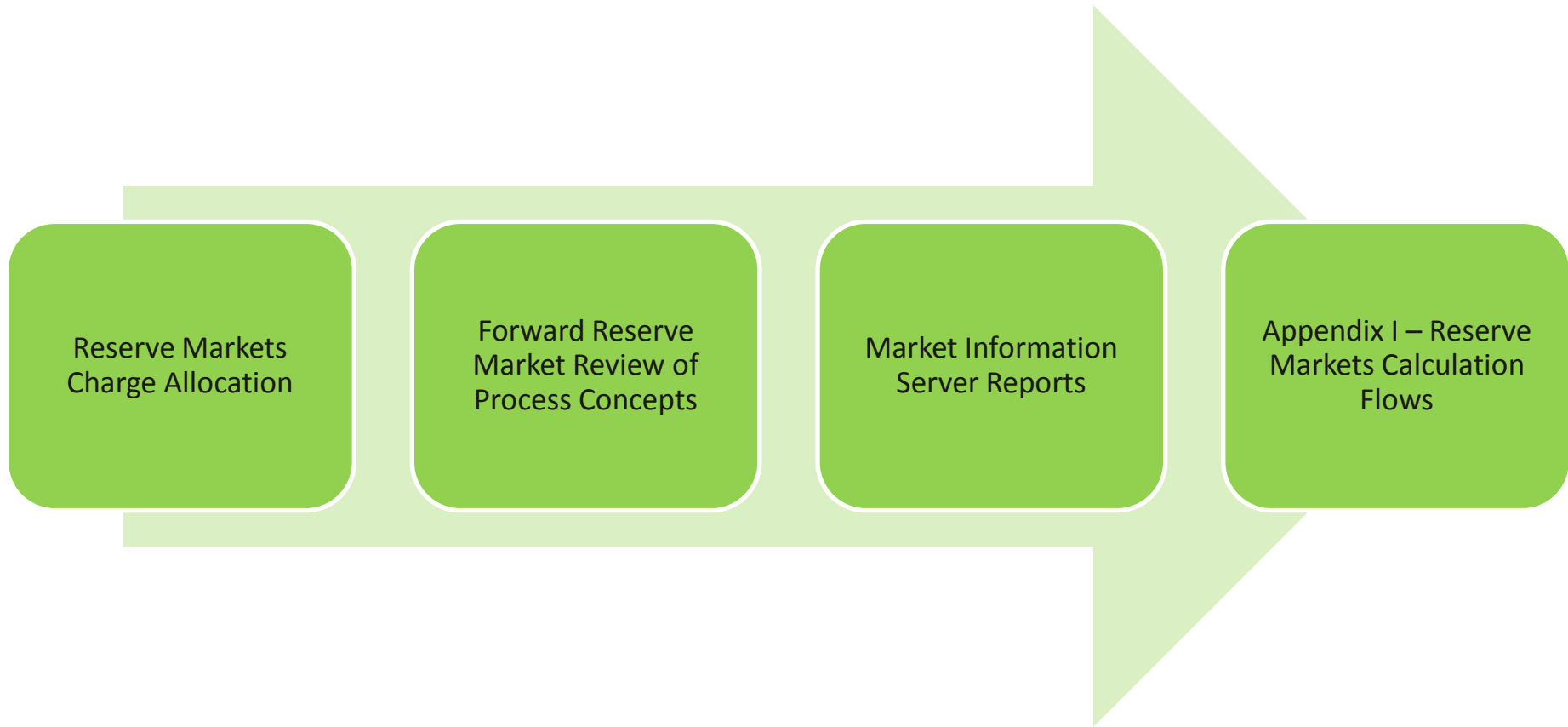


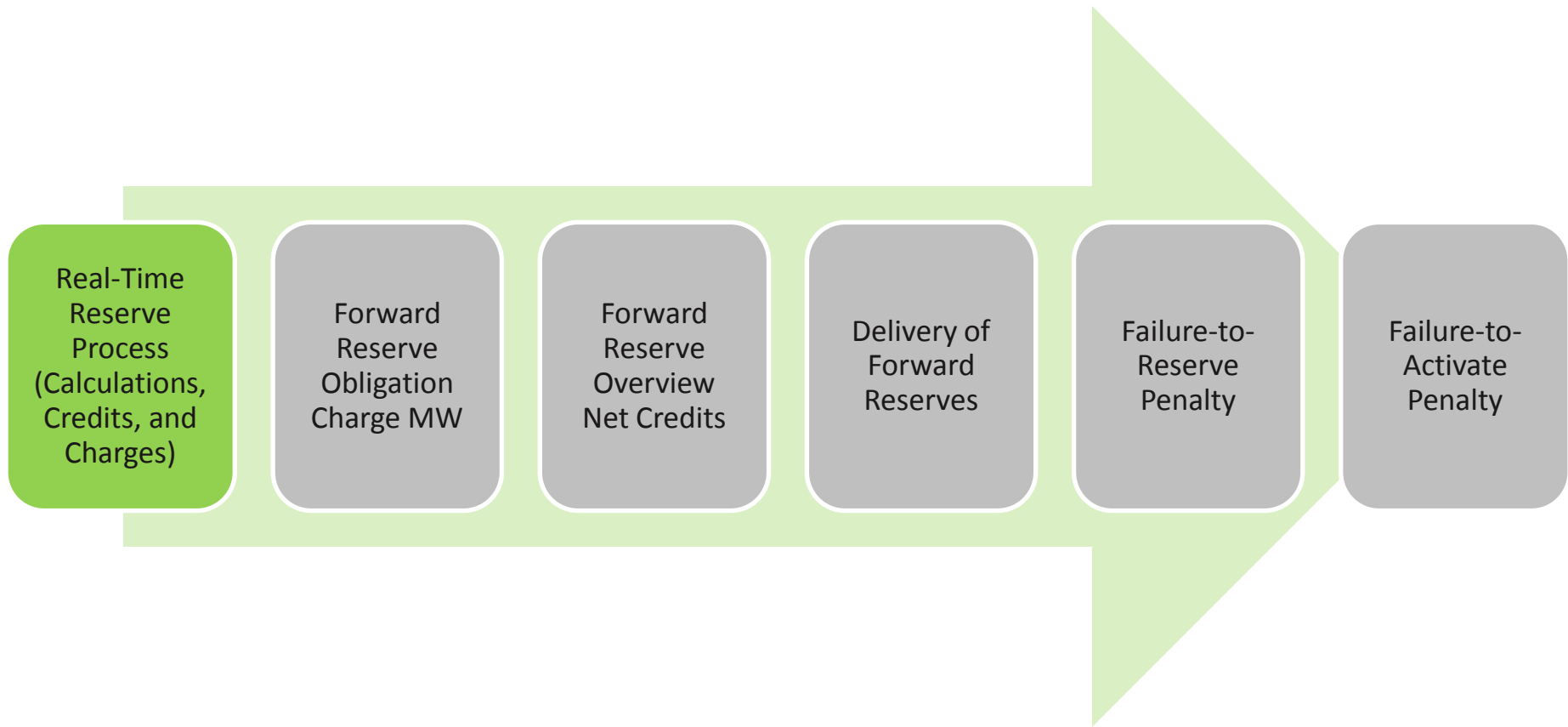
- Market Rule 1, Section 9
- Market Rule 1, Section 10
- Manual 28, Section 2
- Manual 36

Topics Covered in this Module



Topics Covered in this Module (cont.)





Real-Time Reserve Process

1 Operating Day

- Resource is dispatched based upon RT submitted Offers
- MW not dispatched for energy may be designated for Real-Time Reserves based on:
 - Ramp Rate for On-line Resources
 - Claim 10/Claim 30 Active values for Off-line resources

2 Approximately four to five business days after the Operating Day:

- Preliminary Settlement Statement
- Real-Time Reserves are calculated for all hours

Real-Time Reserve Capacity

- Operations Real-Time Reserve Designation is the amount of reserves designated in Real-Time every hour for each available asset in the New England Control Area
 - Ten-Minute Spinning Reserve (TMSR)
 - Ten-Minute Non-Spinning Reserve (TMNSR)
 - Thirty-Minute Operating Reserve (TMOR)
- Real-Time Reserve Credits are calculated based upon the Real-Time Designation and the Real-Time Reserve Market Clearing Price (RMCP).

Real-Time Reserve Credit Calculation

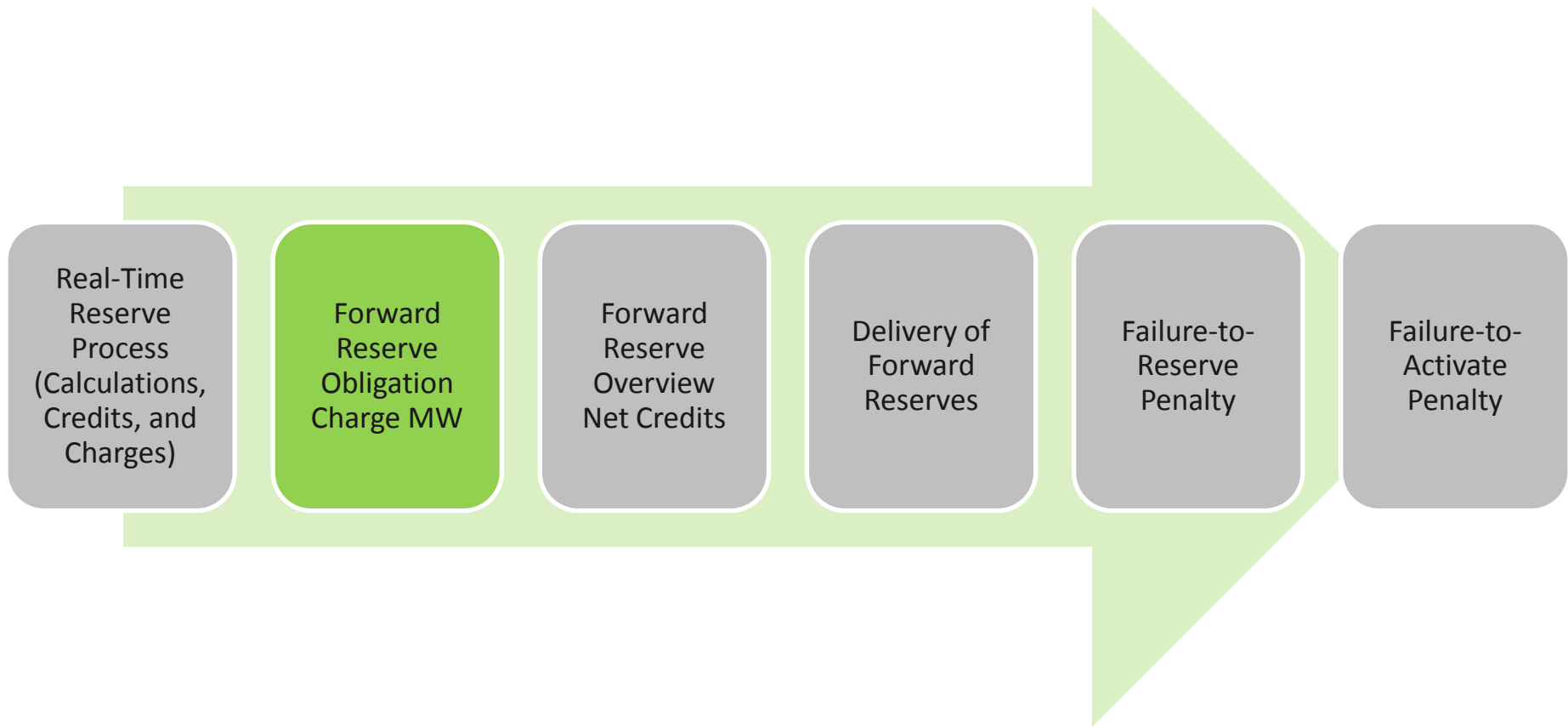
- In hours when the Reserve Market Clearing Price (RMCP) is not zero, resources are credited for the Reserve MW multiplied by the RMCP:
 - $\text{Min}(\text{Designated Reserves}, \text{Reserves based on Metering}) \times \text{RMCP}$
 - Note that final meter readings may yield different Reserve MW quantity calculation; meter readings used for the settlement
 - Payment is adjusted if resource paid in LFRM, avoid paying twice for same MW



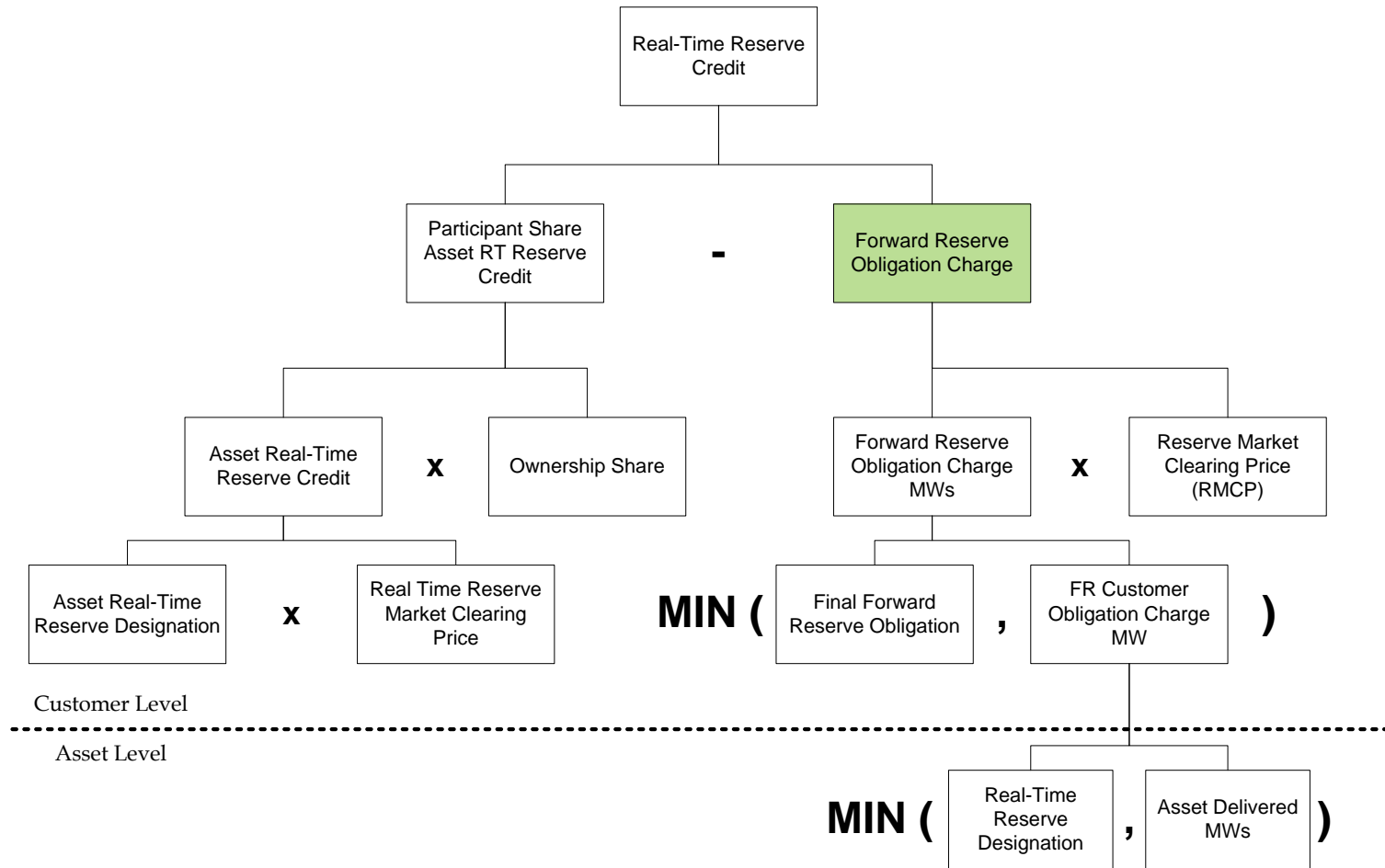
Real-Time Reserve Charges

- Total of the credits paid to resources for Real-Time Reserve are charged to Participants with Real-Time Load Obligation (RTLO)





Real-Time Reserve Credit

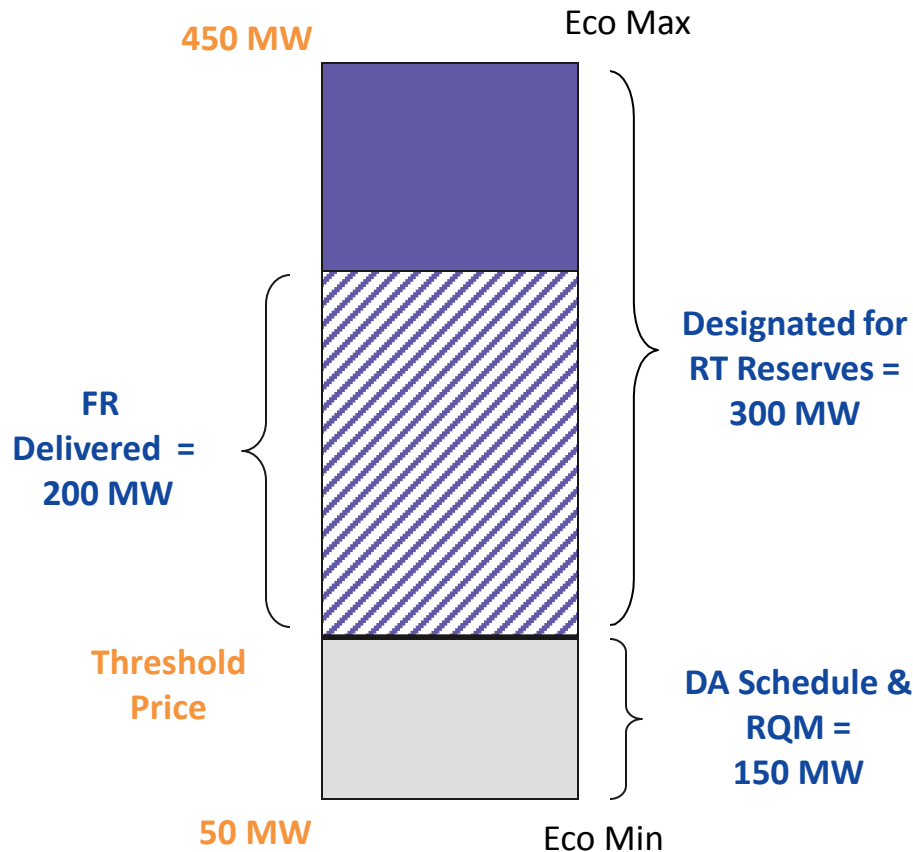


Forward Reserve Obligation Charge MW

- It is probable that resources paid for Forward Reserve will also be designated for Real-Time Reserves.
- Mechanism to adjust Real-Time Reserve payment so that MW are not compensated for both Forward Reserve and Real-Time Reserve

Forward Reserve Obligation Charge MW (cont.)

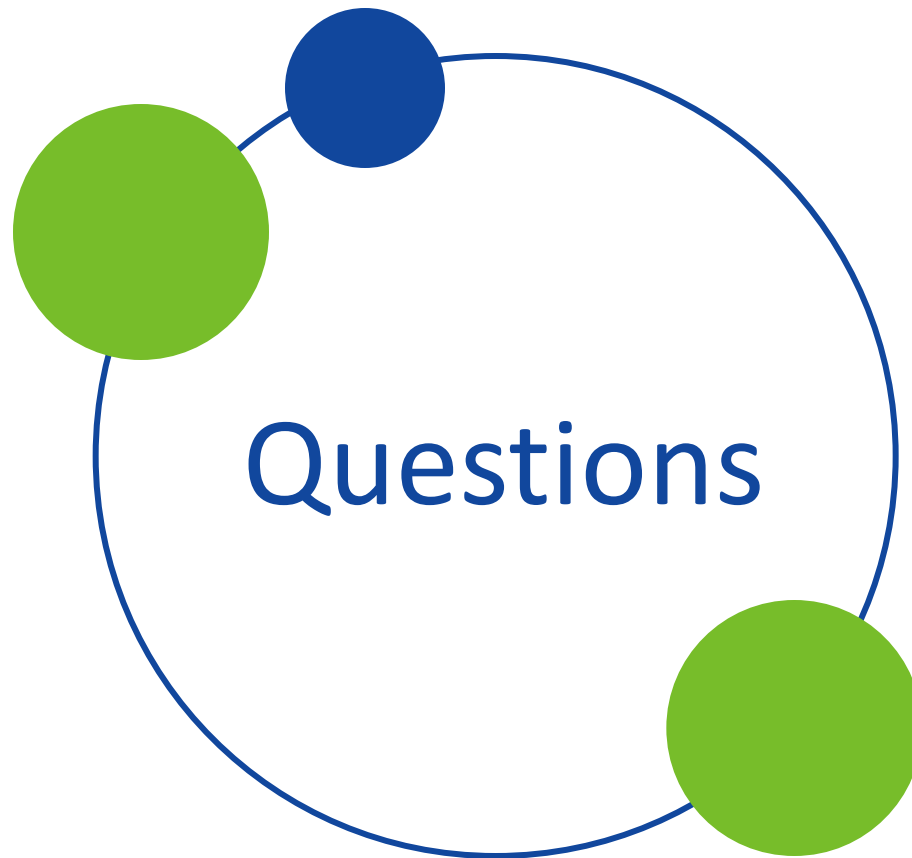
Forward Reserve Resource – Generating Asset



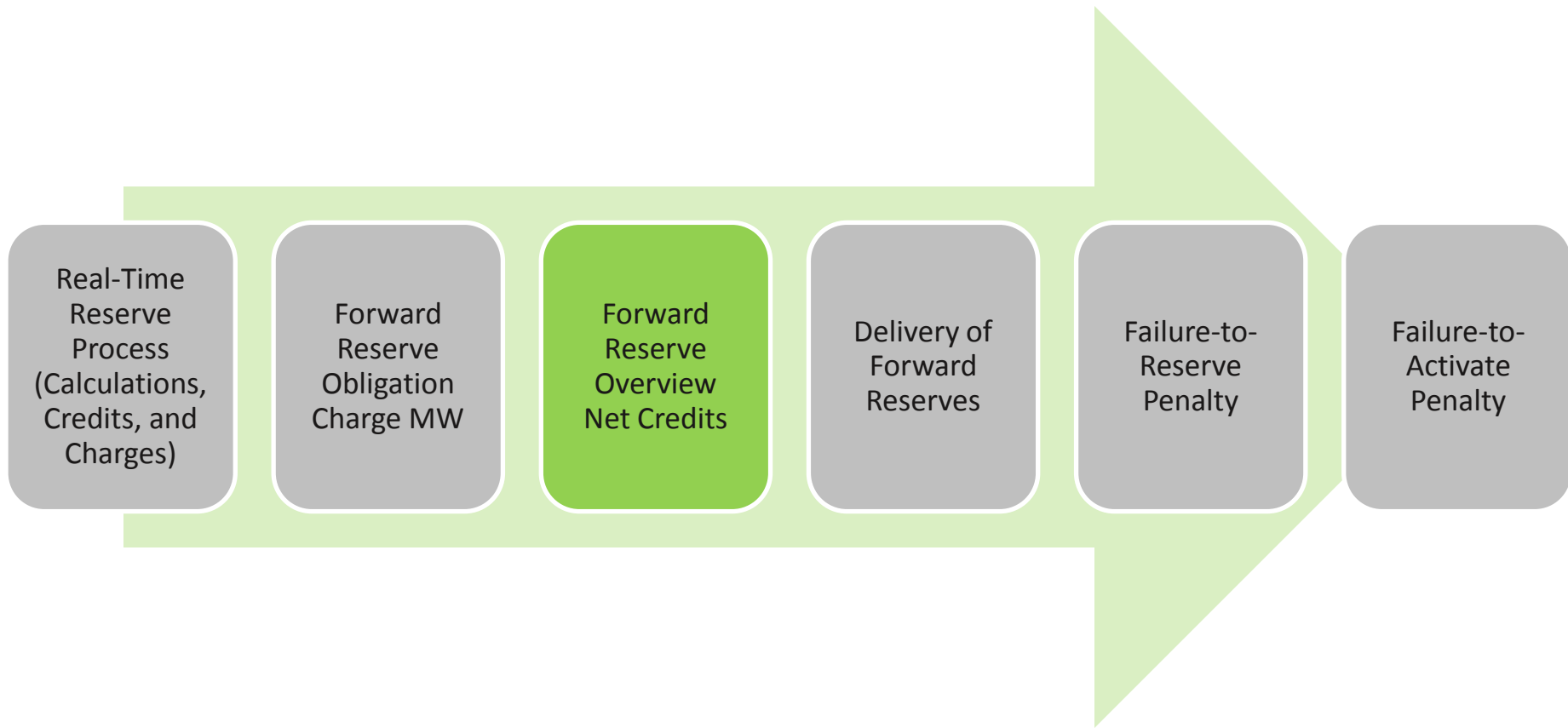
Real-Time Reserve Payment =
RT Reserve Designation
(300 MW) x RMCP

Forward Reserve Credit =
Forward Reserve Delivered
(200 MW) x FRM Hourly Rate

Forward Reserve Obligation
Charge = 200 MW x RMCP x -1



Questions



Overview:

Forward Reserve Credits and Charges

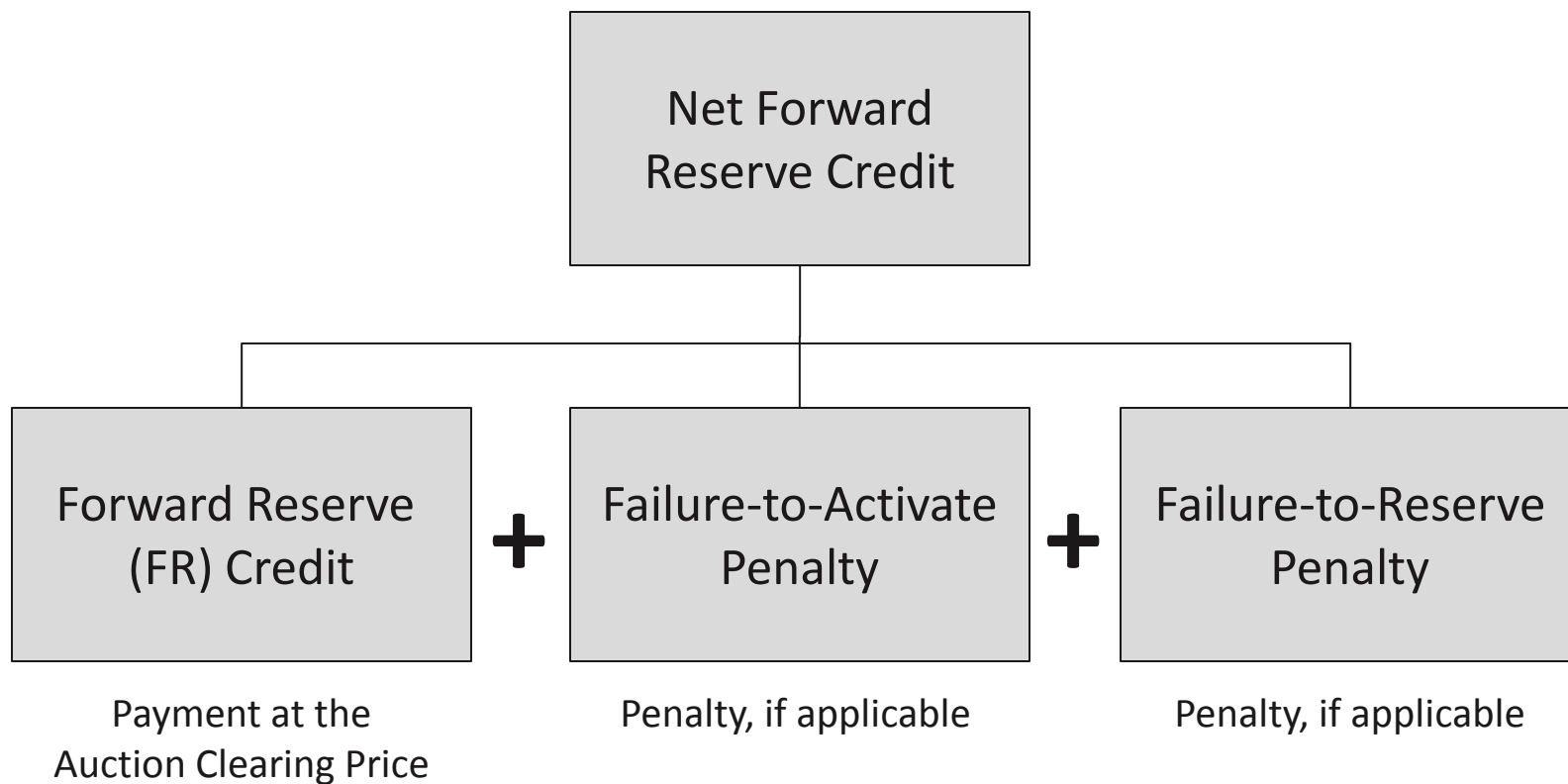
- Participants are credited when they satisfy their Forward Reserve Obligation

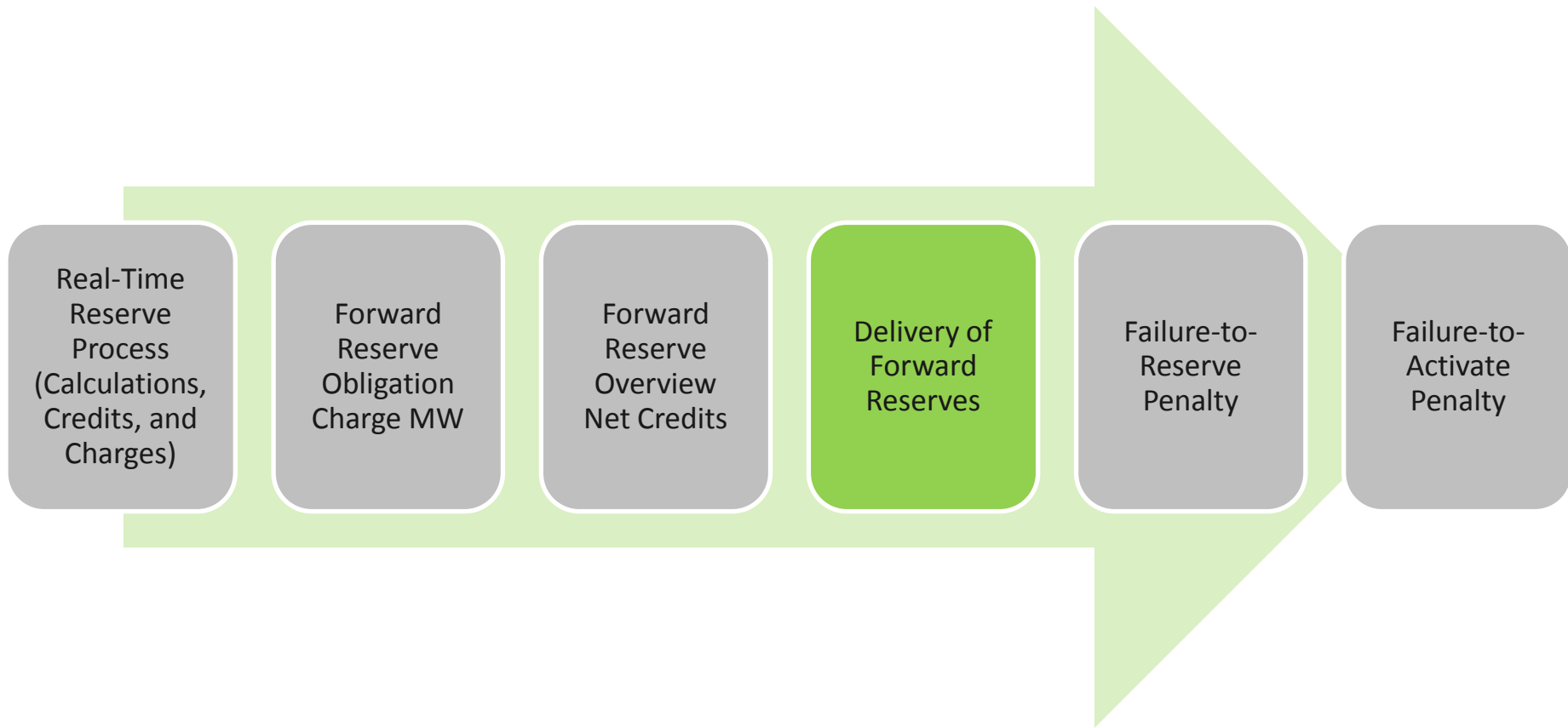


Remember that the Obligation is only incurred through participation in the Auction, or through bilateral contracts

- Net Forward Reserve Credit is composed of three components, and is calculated for each hour in the period of 8:00 – 23:00 weekdays

Net Forward Reserve Credit





Asset Qualifying MW and Available MW

Qualifying MW

Those available based upon the resource's location, supply offer above the Threshold Price, and capability within 10 or 30 minutes.

- On-line resources are based on ramping capability
- Off-line resources are based on Claim 10 or Claim 30 values

Available MW

Qualifying MW which can meet Forward Reserve

- (Qualifying MW less any MW assigned for other Forward Reserve Category)

Assigned MW and Delivered MW

Assigned MW

MW in Resources assigned by Participant owner to meet Forward Reserve Obligation

Delivered MW

Minimum amount of Asset Available and Asset Assigned MW.

- Participants **MUST** assign assets prior to the Operating Day to meet Forward Reserve Obligations!
- Deadline for the assignment is the close of the re-offer period - Typically @ hour end 1800

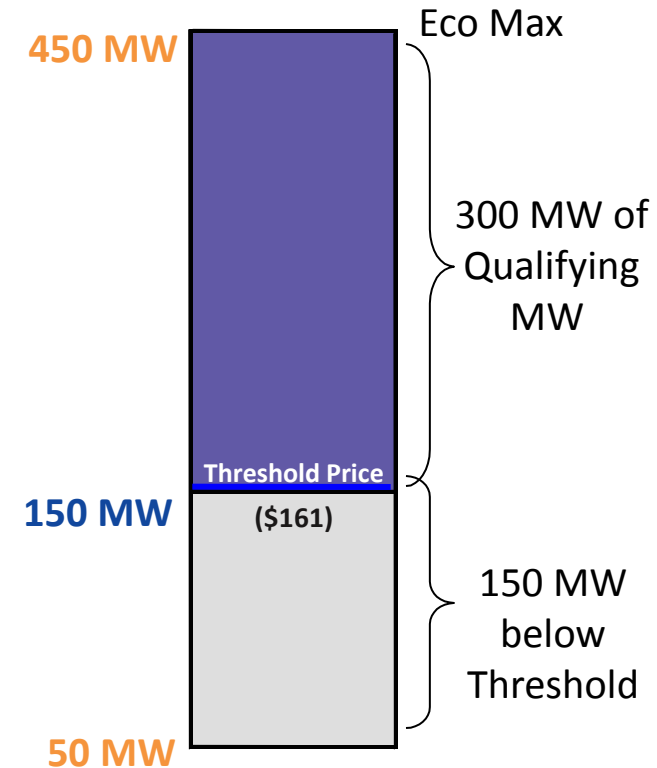
Asset Qualifying MW

- MW offered in at, or above, the FR Threshold Price which could potentially provide reserves
- Calculated hourly, for each asset, based on real time unit parameters and operating status.
- Generators
 - EcoMax - MAX [MW offered below the FR Threshold Price, Implicit Self Scheduled Regulation MW]
 - Not calculated if on-line generator did not clear DA and is flagged for VAR or RMR.
- Asset Related Demand
 - MIN (DA Bid Max Consumption, MW bid below the FR Threshold Price)
- DA Bid Min Consumption

Example:

Qualifying MW

- EcoMin = 50 MW
- EcoMax = 450 MW
- Threshold Price = \$161/MWh
- Energy Offers:
 - 300 MW > than Threshold Price
 - Initial 50 MW offer @ \$25/MWh (EcoMin)
 - Next 100 MW offer @ \$150/MWh
 - Remaining 300 MW offer @ \$165/MWh
- Qualifying MW (Threshold) = 300 MW



Example:

Asset Qualifying, Available and Assigned MW

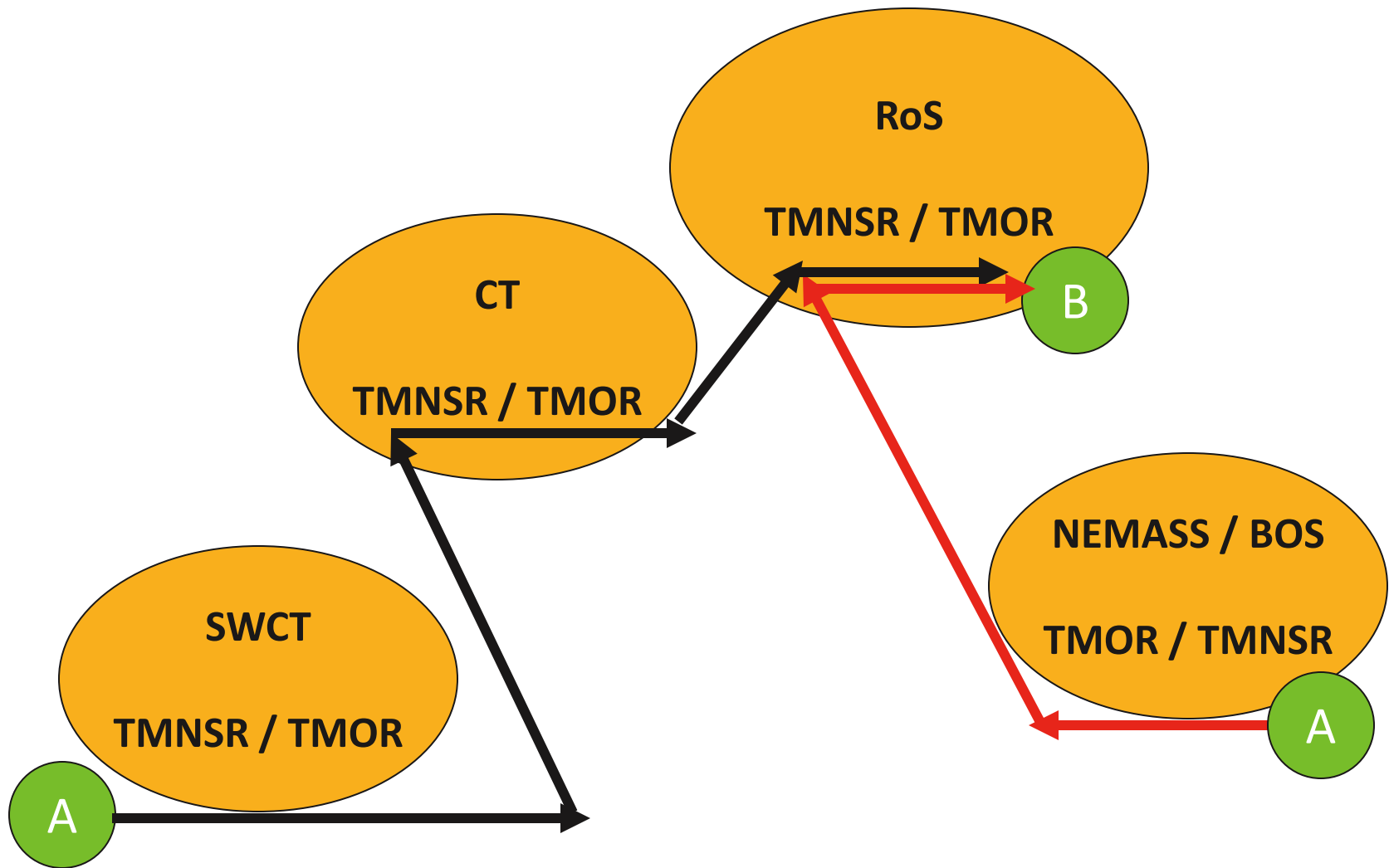
- Resource is on-line, with ramp rate = 10 MW/minute
 - Ramping capability in 10 minutes = 100 MW
 - Ramping capability in 30 minutes = 300 MW
- This unit can qualify for a total of 300 MW of reserve
 - Offer above threshold satisfied; ramp capability of 10 MW/min
- Maximum designation for this unit for Forward Reserves
 - 100 MW of TMNSR
 - 200 MW of TMOR



Cascading of Asset Available & Delivered MW

- If an asset's Available MW are not all “delivered” in one category, the MW can cascade to lower quality categories. The cascading follows “Settlement Precedence Order.”
- Any excess (when Delivered MW > Obligation) can cascade to a lesser value product or less constrained Reserve Zone.
 - TMNSR delivered MW can cascade to TMOR in the same reserve zone, or TMNSR or TMOR in a less constrained reserve zone.
 - TMOR delivered MW can only cascade to TMOR in a less constrained reserve zone.

Settlement Precedence Order



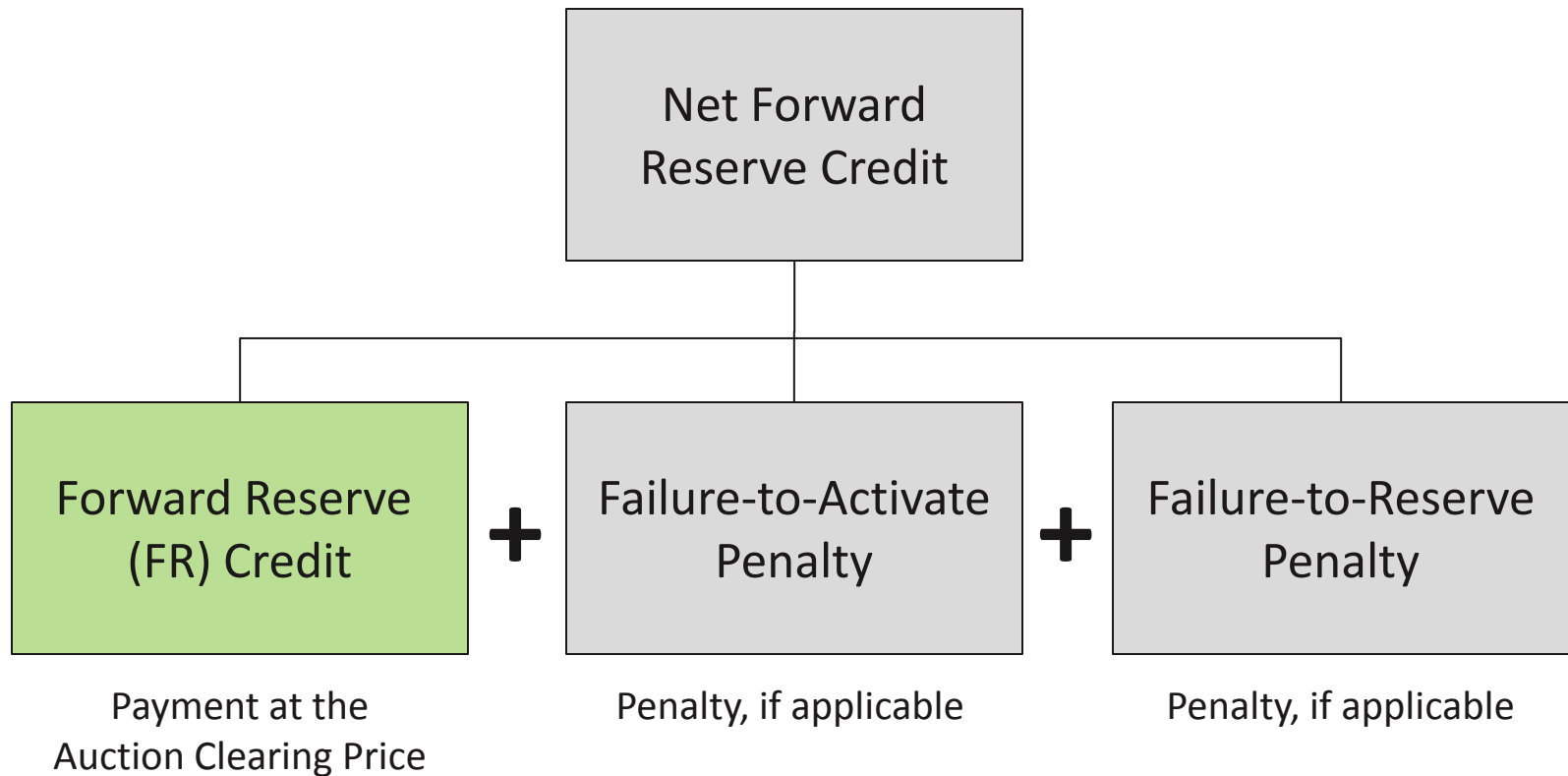
Cascading of Asset Available & Delivered MW

- Example:
 - Participant has 100 MW TMNSR obligation, 100 MW TMOR obligation in Rest of System
 - Participant has asset located in Rest of System area that can provide 200 MW TMNSR
 - Participant can assign 100 MW of the asset to its TMNSR obligation and 100 MW of the asset to its TMOR obligation
- OR
- Participant can choose to assign the 200 MW of the asset to TMNSR obligation.
 - 100 MW left to “cascade” to TMOR Obligation

Final Forward Reserve Obligation

- Participant Delivered MW are summed for each product and Reserve Zone, and compared to the Participant Forward Reserve Obligation from the Auction for each product and Reserve Zone.
- Final Forward Reserve Obligation is the lesser of the Participant's Delivered MW or Forward Reserve Obligation.
 - Final Forward Reserve Obligation MW are multiplied by the FRM payment rate to determine the Forward Reserve Credit for the Participant

Forward Reserve Credit



Example:

Forward Reserve Credit – \$

- Forward Reserve Credit is the component where the Auction Clearing price is paid to the Participant.



Example:

Forward Reserve Credit – \$ (cont.)

Example: CT Reserve Zone

Summer 2010 TMOR Clearing Price: \$13,900/MW - Month

Subtract Forward Capacity Auction Clearing Price \$4,500/MW-Month

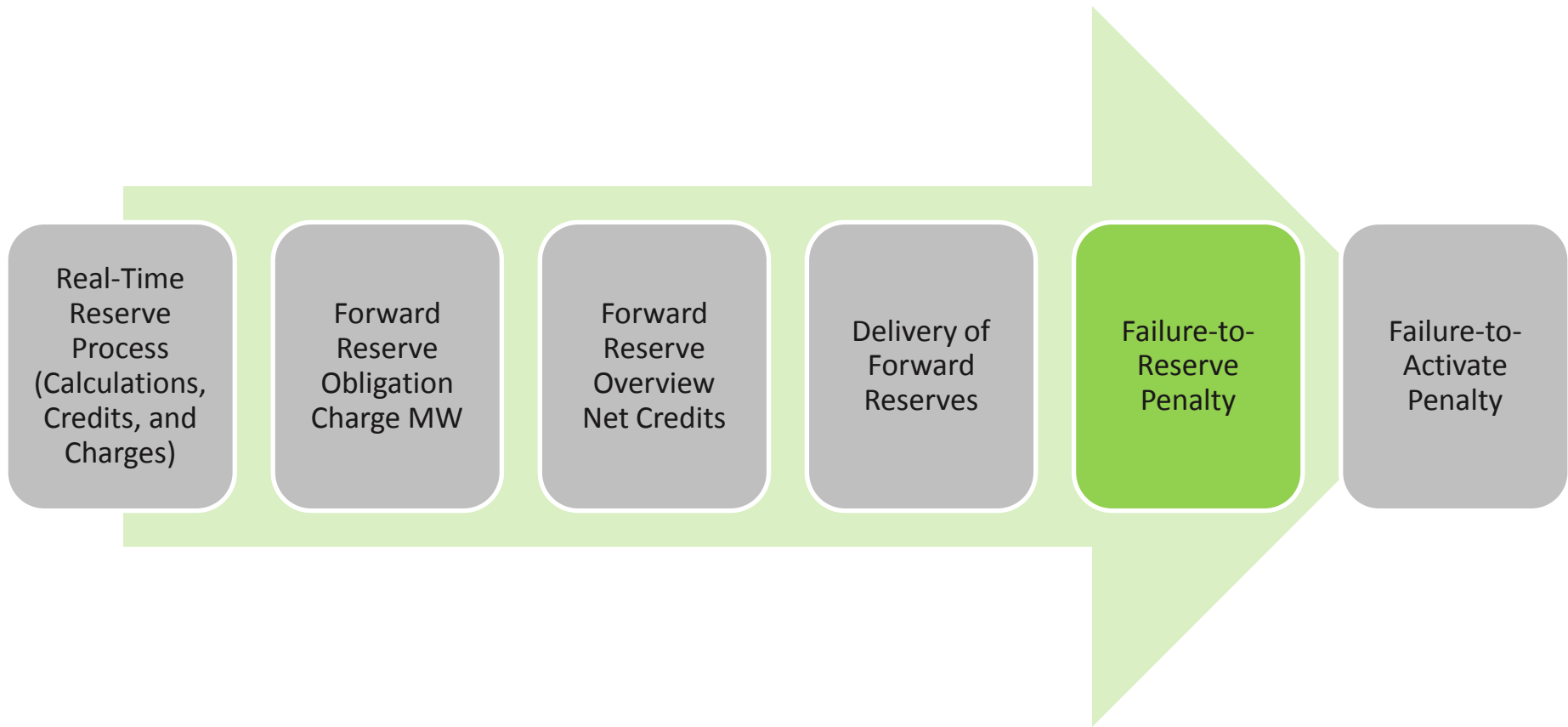
→ \$9,400/MW-Month

June 2010: 22 weekdays; 352 on-peak hours

CT TMOR FRM Hourly Rate: $\$9,400/352 = \$26.70/\text{MWh}$

Participant with 100 MW Final Forward Reserve Obligation for CT TMOR:
 $100 \text{ MW} \times \$26.70/\text{MWh} = \$2,670/\text{hour}$

If Participant delivers 100 MW in all 352 hours: \$0.9 Million for month



Failure-to-Reserve Penalty MW

- If a Participant fails to deliver enough MW to cover the Obligation, there is a “Failure-to-Reserve” Penalty.
 - Failure MW x 1.5 x FRM Hourly Rate
- Calculated per Product and Reserve Zone.
- In addition to the Penalty, the Participant is not paid the Forward Reserve Credit for any Fail-to-Reserve MW



Example:

Failure-to-Reserve \$ Impact

- Back to our example in the CT Reserve Zone, remember the Participant with 100 MW Final Forward Reserve Obligation for CT TMOR:

100 MW x \$26.70/MWh = \$2,670/hour

Failure to Reserve Situation

- No Assignment? No MW above Threshold? Units out of service?

Impact for one hour:

No Payment of \$2,670

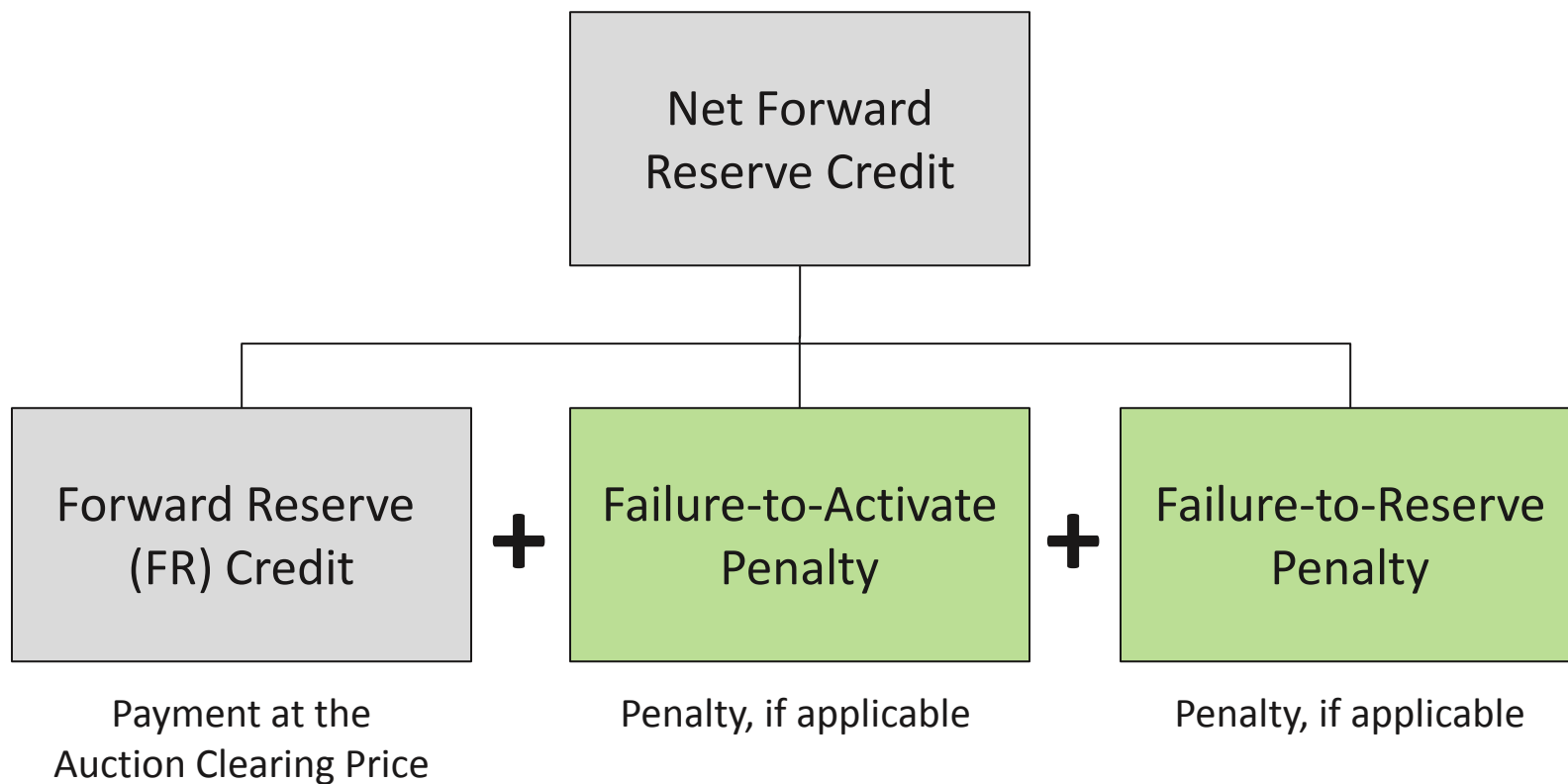
Failure to Reserve Penalty Rate: $1.5 \times \$26.70 = \40.05

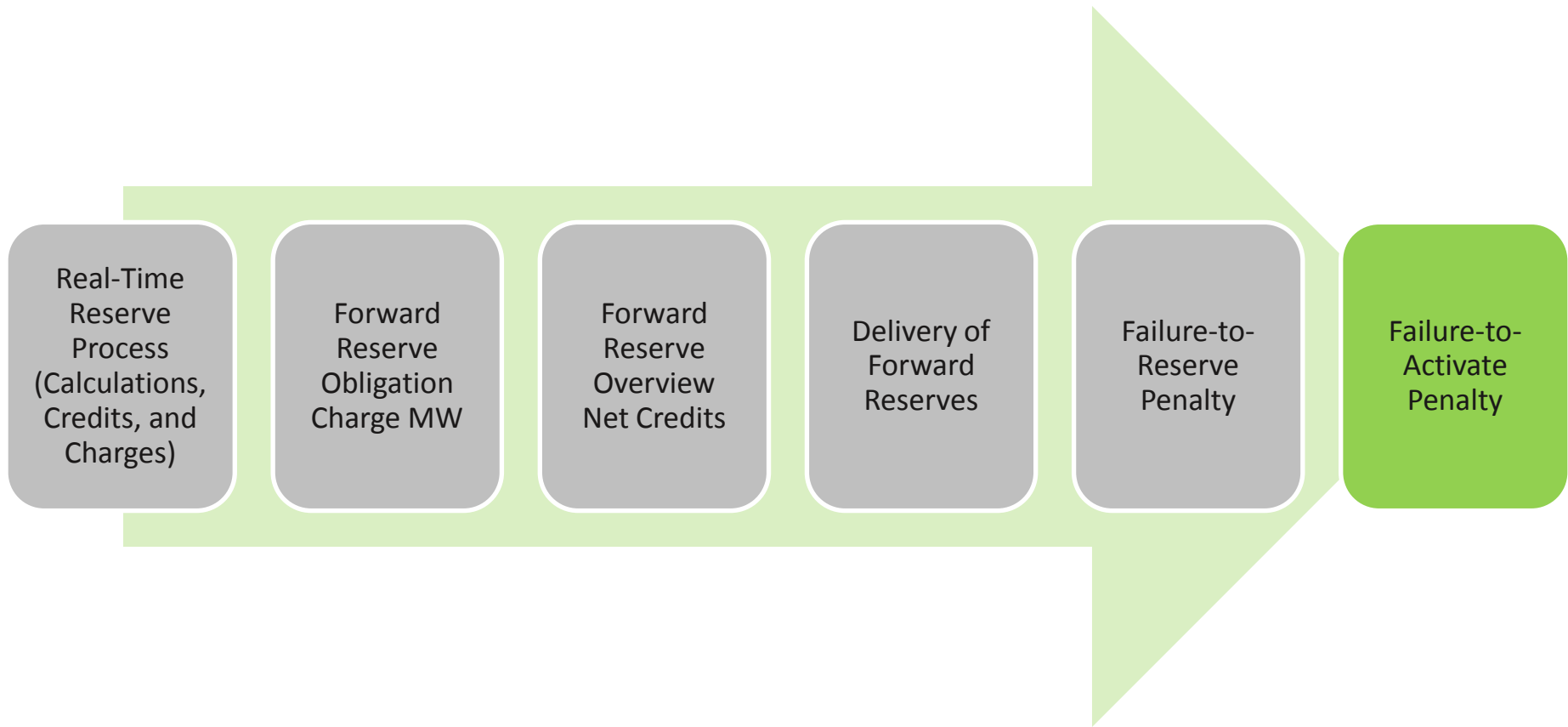
Penalty: $100 \text{ MW} \times \$40.05/\text{MWh} = \$4,005$

Total revenue impact: Loss of \$6,675

If failed to reserve for the entire month: \$2.3 Million loss

Penalties





Failure-to-Activate Penalty MW

- If a resource assigned to provide Forward Reserves is asked to activate reserves in Real-Time and the resource fails to meet the 90% of target MW, a Failure-to-Activate penalty is assessed.
 - Penalty Rate is calculated as:
Max (2.25 x FRM Hourly Rate, RT LMP)
 - Failure-to-Activate Penalty is:
 - (FRM Hourly Rate + Failure-to Activate Penalty Rate)
x Failure to Activate MW



Failure-to-Activate Penalty MW (cont.)

- Reserves are activated when the ISO approves a contingency dispatch case and an Emergency message appears on the asset's RTU.
 - In such cases, the asset's response to the Emergency request will be analyzed
 - Off-line Generator start-up requests
 - On-line Generator asked to ramp-up
 - On-line Dispatchable ARD for a reduction in consumption



Example:

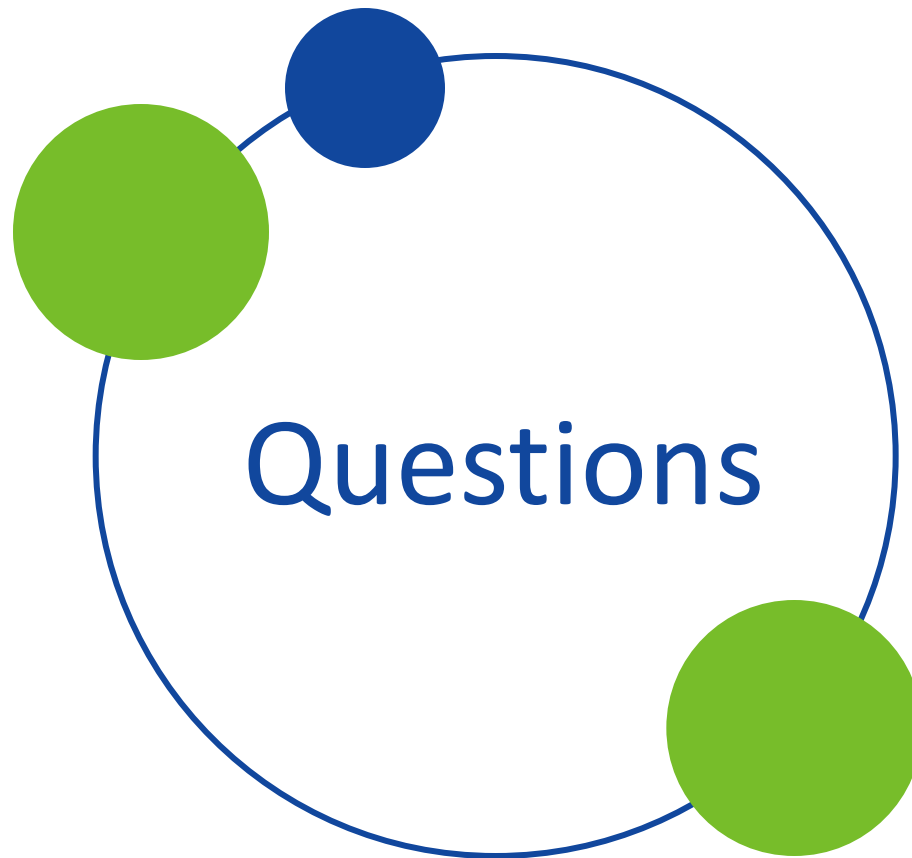
Failure-to-Activate \$ Impact

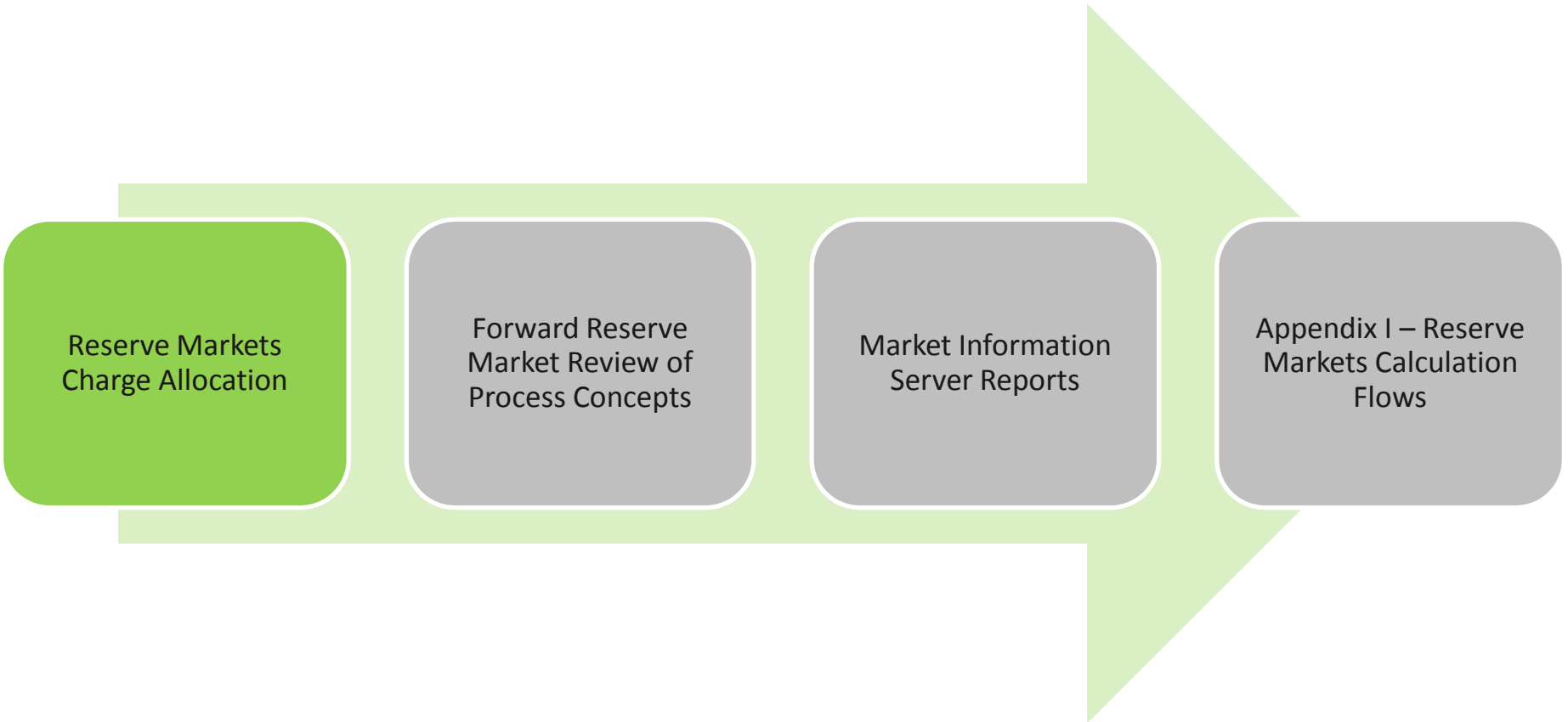
- Back to our example in the CT Reserve Zone; the Participant's 100 MW Resource Fails to Activate during a contingency...
Resource metered output is 0 MW for the hour
 - RT LMP at the Resource node: \$50
 - FRM Rate: \$26.70
 - Failure to Activate Penalty Rate:
$$\text{Max} [(2.25 \times \$26.70, \$50)$$
$$= \$60.08$$
 - Penalty Calculation: $100 \text{ MW} \times (\$26.70 + \$60.08)$
 - Impact for the hour: $100 \text{ MW} \times \$86.78 = \$8,678 \text{ loss}$

Example:

Failure-to-Activate \$ Impact (cont.)

- Also note that the resource will start to incur Failure to Reserve penalties in each subsequent hour until it is available again for dispatch.
- What if LMP had been \$300 instead of \$50?
 - Penalty Rate: $\text{Max} [(2.25 \times \$26.70), \$300]$
= \$300
 - Penalty Calculation: $100 \text{ Mw} \times (\$26.70 + \$300)$
 - Impact for the hour: $100 \text{ MW} \times \$326.70 = \$32,670 \text{ loss}$



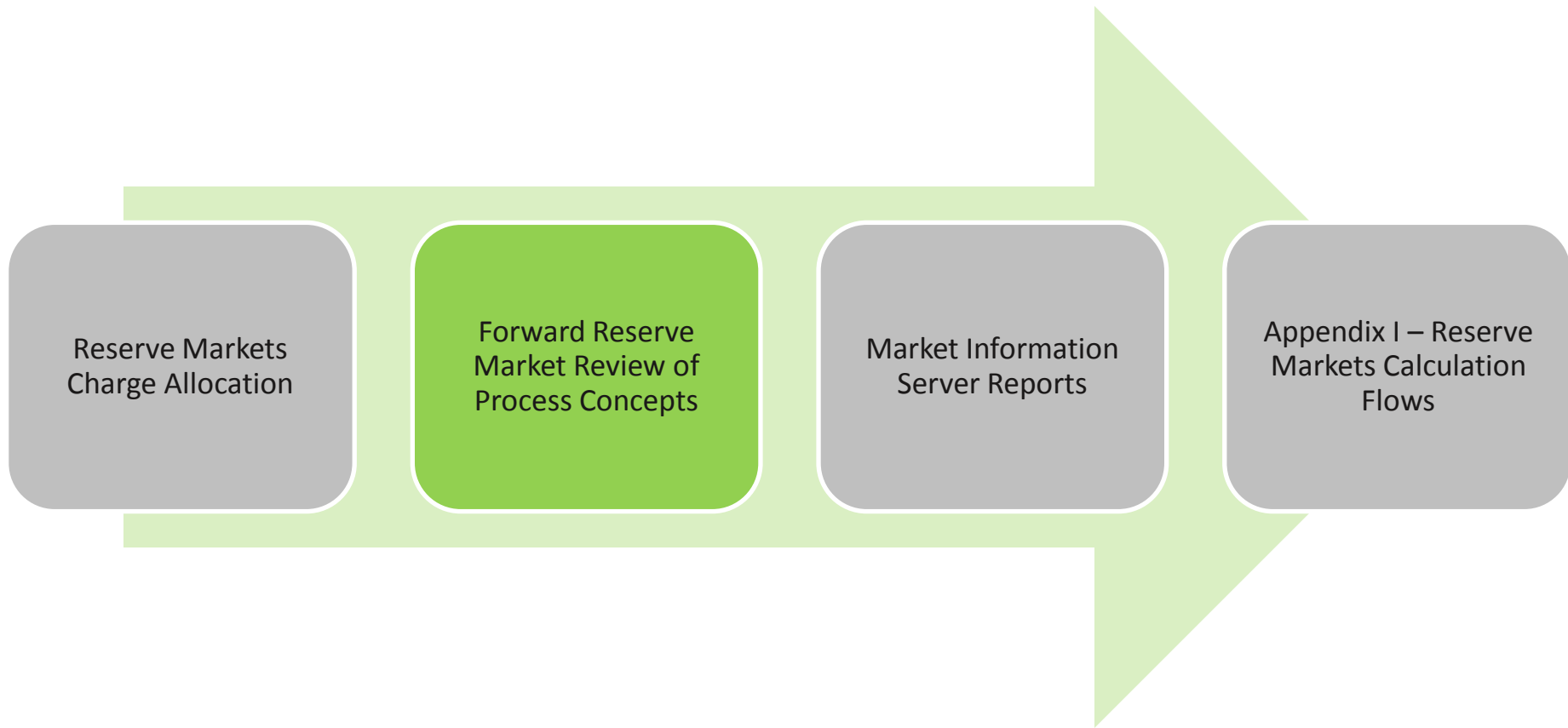


Forward Reserve Charge Allocation

- Total of the Net Credits paid to Participants with Forward Reserve Obligations each hour is allocated to Participants based on Real-Time Load Obligation (RTLO)
- Cost of Forward Reserves to meet the New England system wide requirement is allocated to all Load Zones
- Any incremental cost above the cost to meet the system wide reserve requirement is allocated locally to Load Zones with local reserve requirements

Real-Time Reserve Charge Allocation

- Pool total of Real-Time Reserve Credits is allocated based on Real-Time Load Obligation
 - TMSR, TMNSR, TMOR
- Reserves in the most constrained zones also satisfy reserve requirements in less constrained zones.
 - A unit providing reserves in SWCT may also be meeting reserve requirements for Rest of System.
- A weighted “Charge Rate” is calculated and used to allocate charges across all load zones.



Forward Reserve Market Process

1 Forward Reserve Auction – Prior to the Seasonal Period

– Obligation MWs

- Ten-Minute Non-Spinning Reserve (TMNSR)
- Thirty-Minute Operating Reserve (TMOR)
- Locational

Forward Reserve Market Process

2

Asset Offer Requirements: Day Prior to Operating Day



- MW from the resource offered into the Energy Market above the Threshold Price
 - If Start-up and No-Load values are to be included in Supply Offer, then the “Start-up/No-Load” option must be selected
- For On-Line Resources
 - Day Ahead offer that ensures unit commitment, or
 - Real-Time Self-Schedule (See Step 5 for more info)

Forward Reserve Market Process

2

Asset Offer Requirements: Day Prior to Operating Day (cont.)



- For Fast Start Resources, Claim10 or Claim30 MW must also be described in the supply offer in e-mkt
 - Resource parameters must conform to Fast Start Requirements; total Start-up and Notification times must be ≤ 10 Minutes (.16 hour) or ≤ 30 Minutes (.50 hour), as applicable
 - Claim10 or Claim30 performance demonstration to the ISO must be complete in order for asset to deliver off-line Forward Reserve.
 - If Claim10 or Claim30 MW increases through a performance audit, the Participant must change the offer in e-mkt to reflect the new MW value. If no update is made, then the assigned MW will be capped at the Claim10 or Claim30 value as offered in e-mkt.

Forward Reserve Market Process (cont.)

3

Assign Obligation to specific resource(s)



- Daily, no later than the end of the re-offer period prior to the Operating Day
- A Participant can use a selection of resources from its portfolio to meet its obligation; assignment must be made explicitly through the Asset Assignment User Interface
 - An asset can only be used to supply Forward Reserve if it has been assigned to meet a Forward Reserve obligation.
- Assign specific products (TMNSR/TMOR) & Reserve Zone

Forward Reserve Market Process (cont.)

3 Assign Obligation to specific resource(s) (cont.)

- A Participant can only satisfy a Forward Reserve obligation through ownership of an asset delivering Forward Reserve MWs
 - Participant with authority to offer/assign the asset must also OWN the asset in order to use it to satisfy a Forward Reserve Obligation
- Assignments do not carry forward daily, but can be performed in advance
 - For example, all days in for the procurement period can be assigned at one time
- Web-based training on the ISO Web site:
[Assignment Interface Training for the Forward Reserve Market](#)

Forward Reserve Market Process (cont.)

4 Enter Forward Reserve Internal Bilateral contracts



- No later than 2359 prior to the Operating Day
- Contracts must be confirmed by both Parties prior to the Operating Day
- These IBTs transfer the Forward Reserve Obligation
 - A Participant with Forward Reserve Obligation and insufficient ownership of assets to meet that obligation can transfer the obligation through this IBT mechanism
 - Participant that takes on Forward Reserve Obligation must own assets that deliver Forward Reserve MW in order to meet obligation

Forward Reserve Market Process (cont.)

5

Operating Day

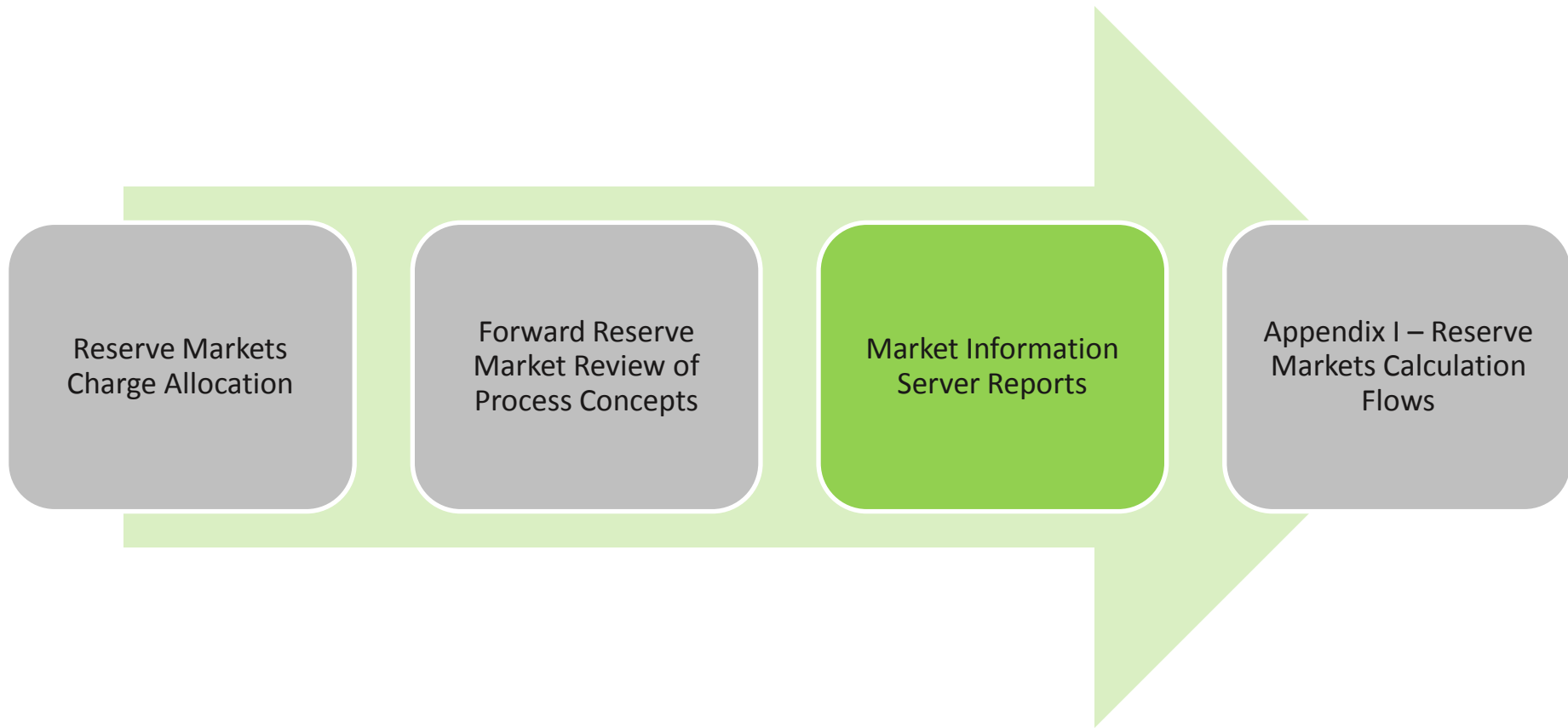


- Forward Reserves are provided based upon unit capability
- Note that On-line resources that do not have Day-Ahead schedule must be scheduled in Real-Time
 - As a practical matter, Participant should self-schedule
 - Almost all ISO Real-Time commitments are flagged for VAR or LSCPR (RMR)
 - Resources flagged for VAR or LSCPR do not qualify for Forward Reserve

Forward Reserve Market Process (cont.)

- 6 Approximately four to five business days after the Operating Day
 - Preliminary Settlement Statement
 - Forward Reserves are calculated for all On-Peak hours





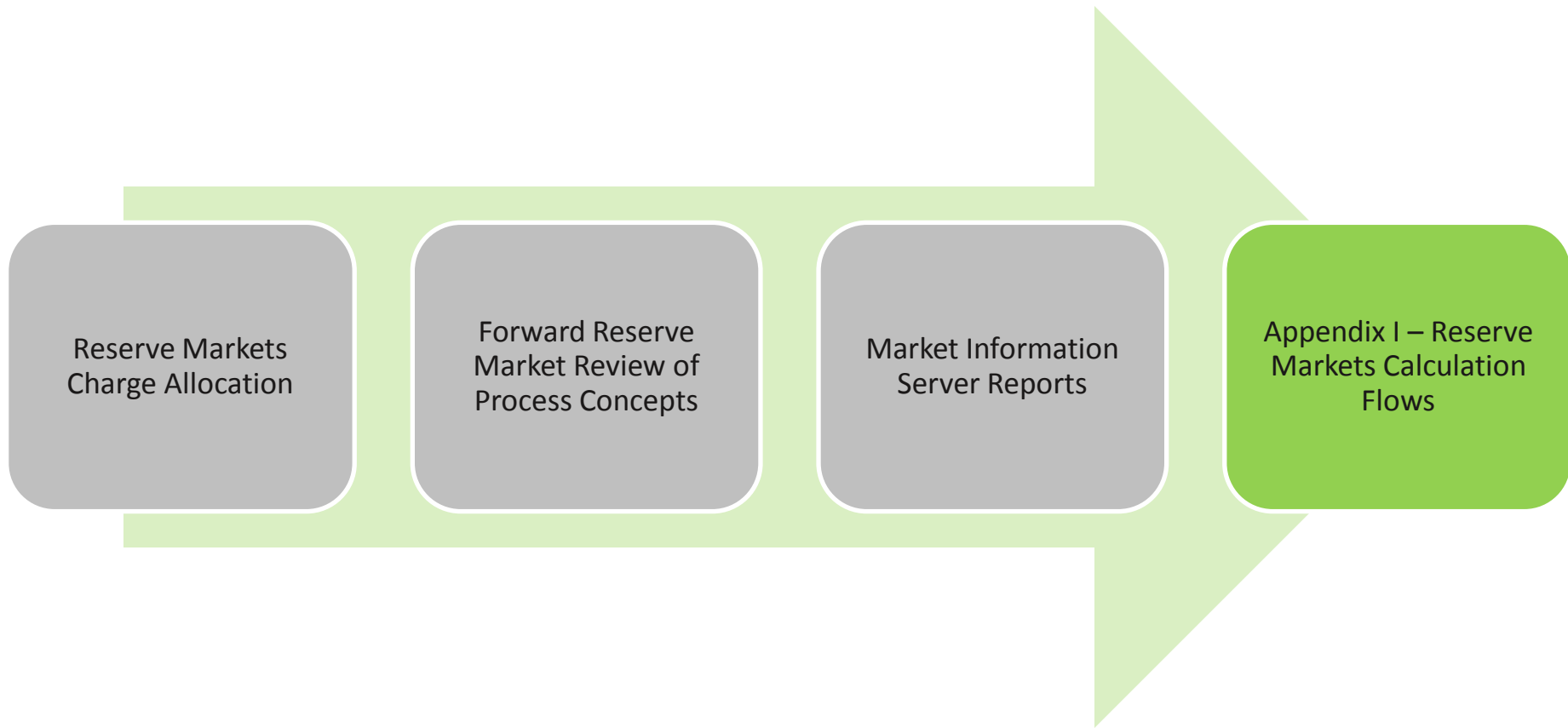
MIS Reports for Reserve Market

Summary Reports

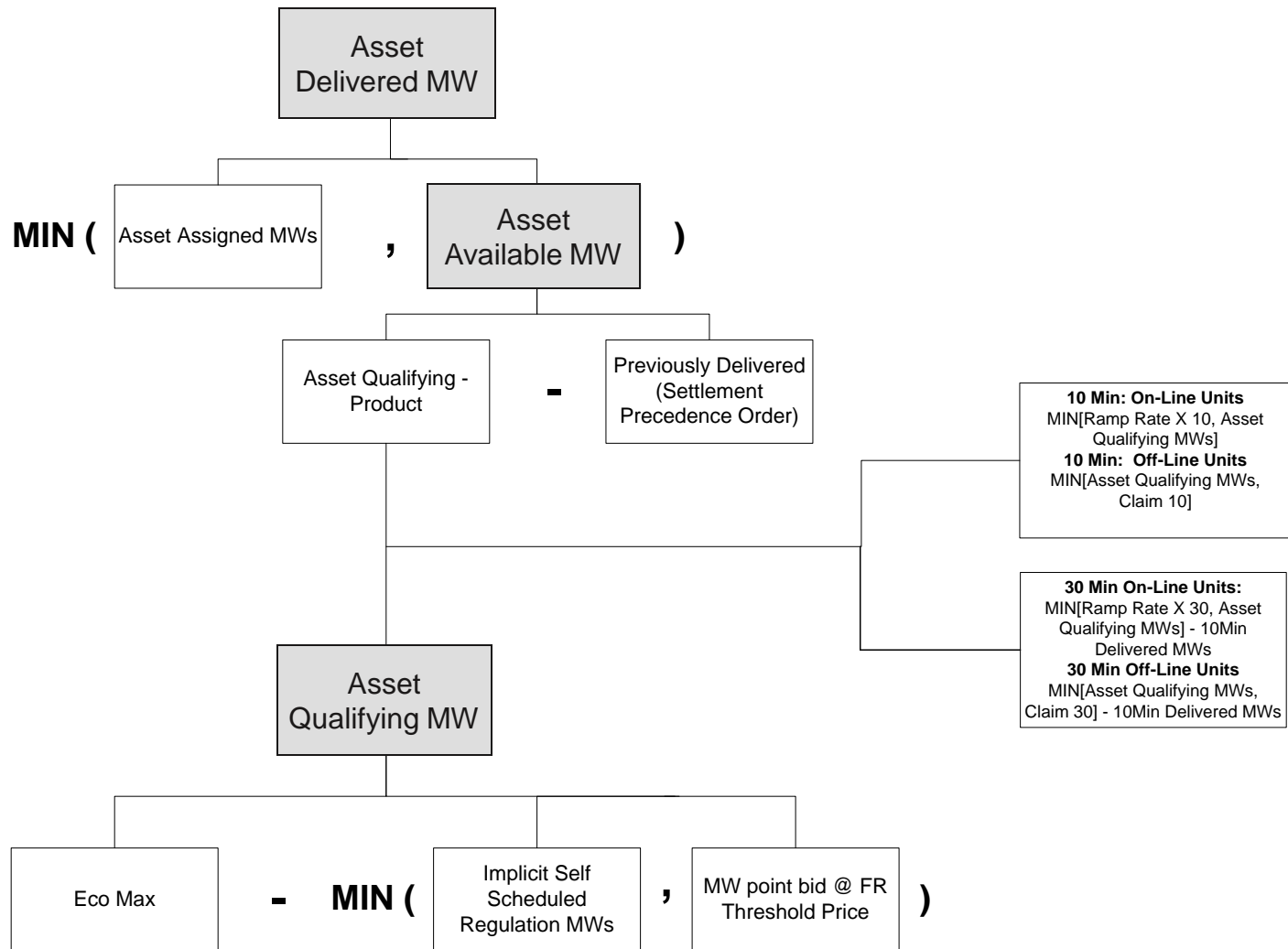
- SR_RSVCHG
 - Reserve Market Customer Charges
- SR_RSVSTL
 - Reserve Market Settlement
- SR_RSVZONESUM
 - Reserve Market Zonal Summary

Detail Reports

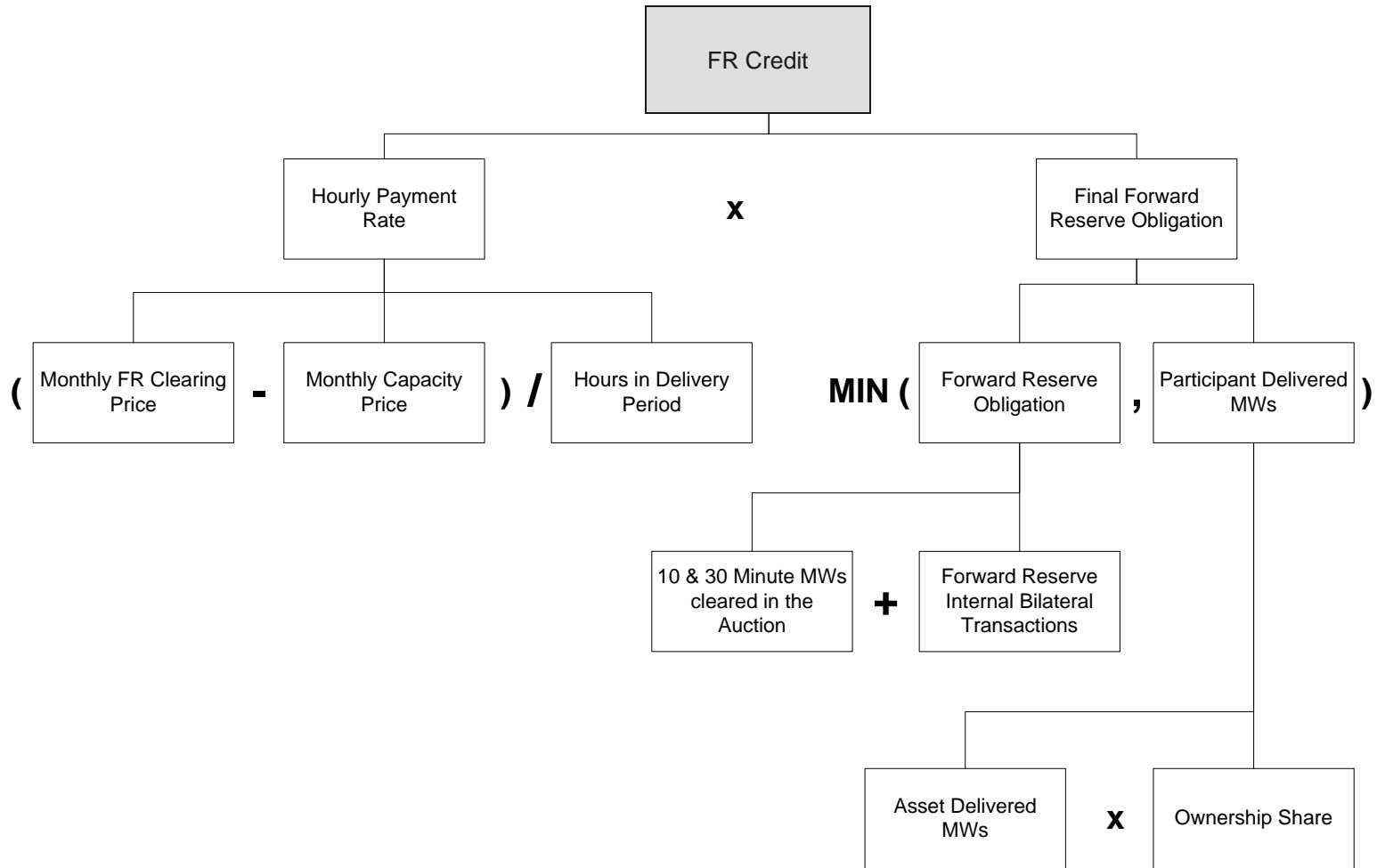
- SD_RSVASTDTL
 - Reserve Asset Detail
- SD_RSVTRANSACT
 - Forward Reserve Transaction Activity



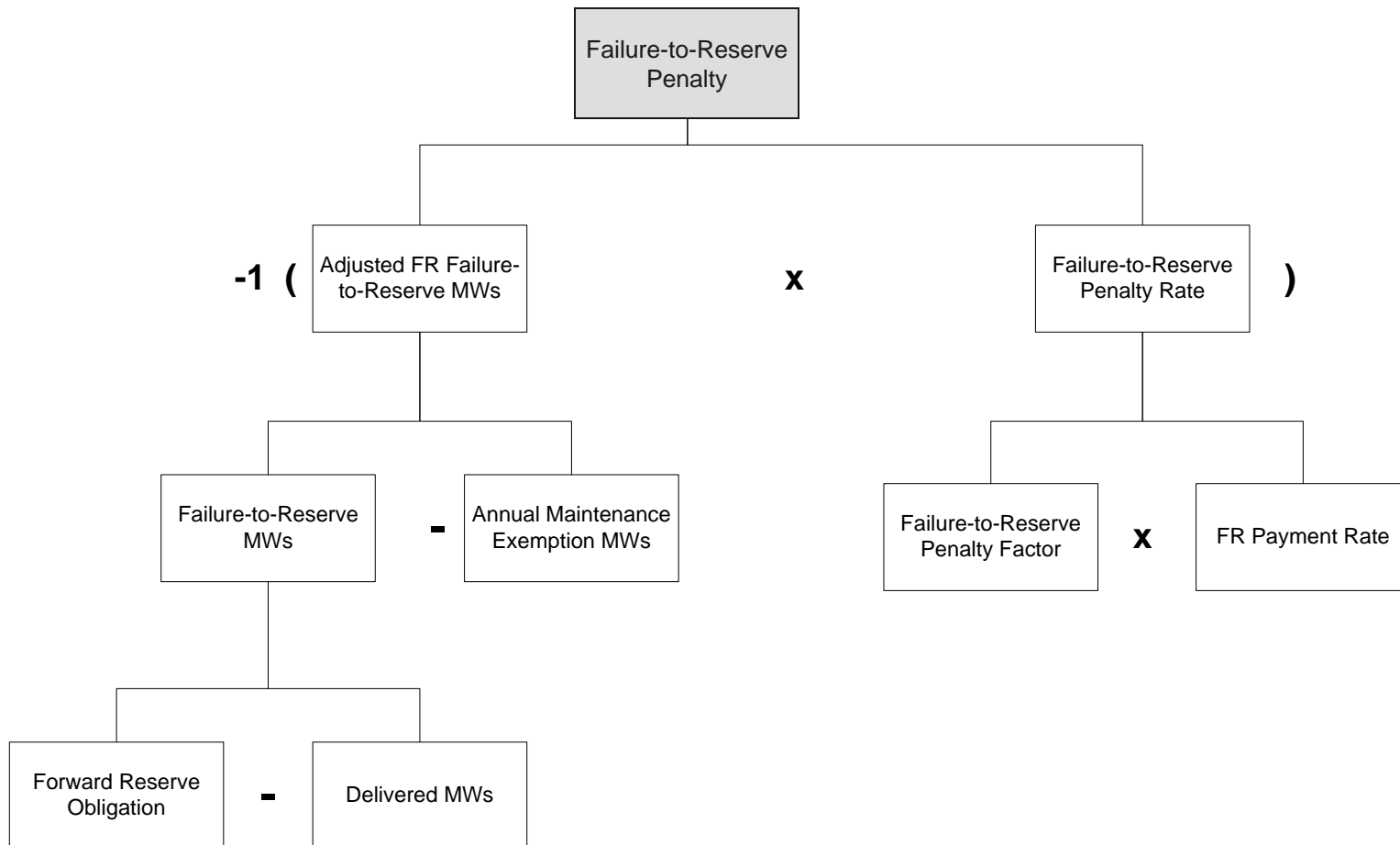
Asset Delivered MWs



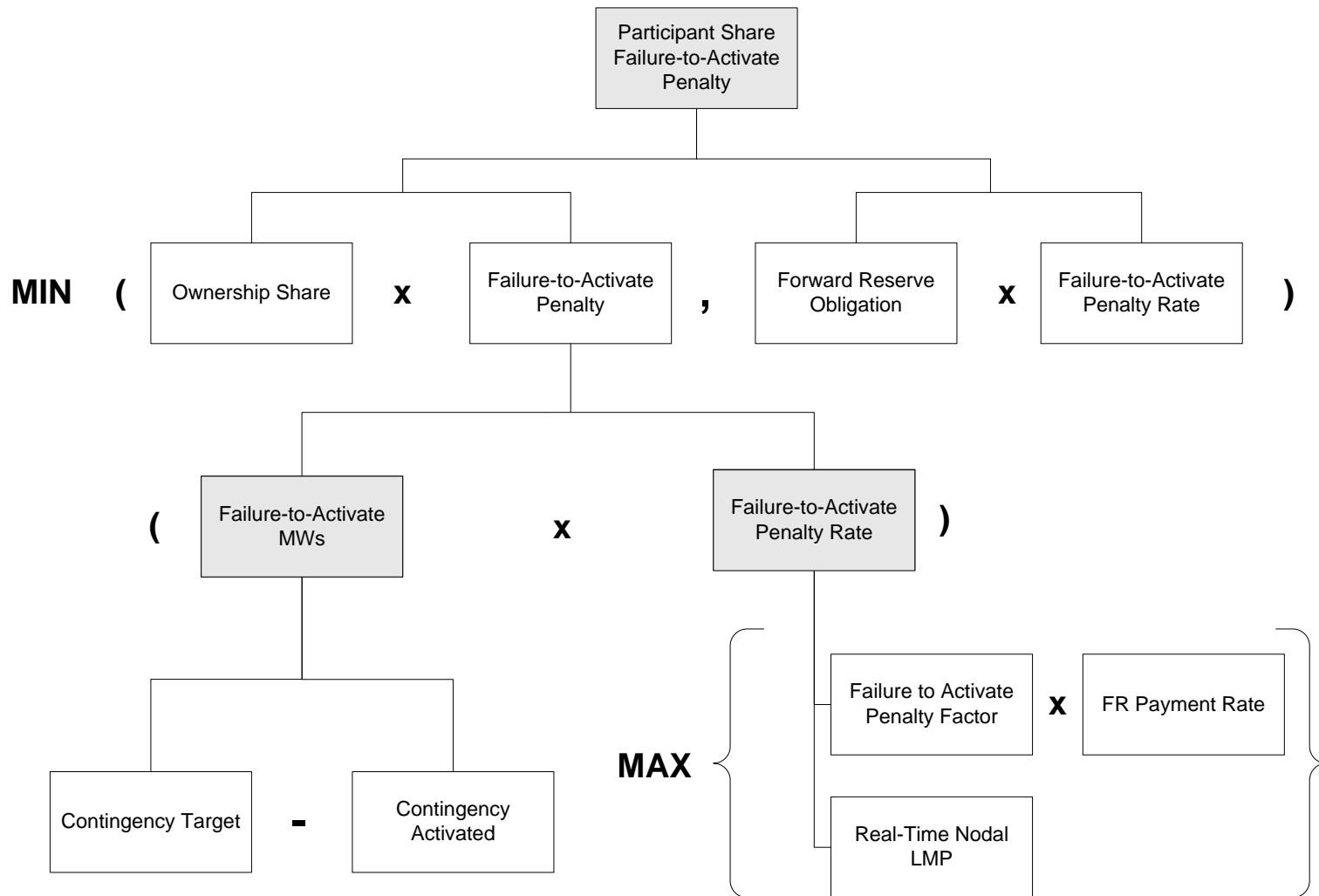
Forward Reserve Credit



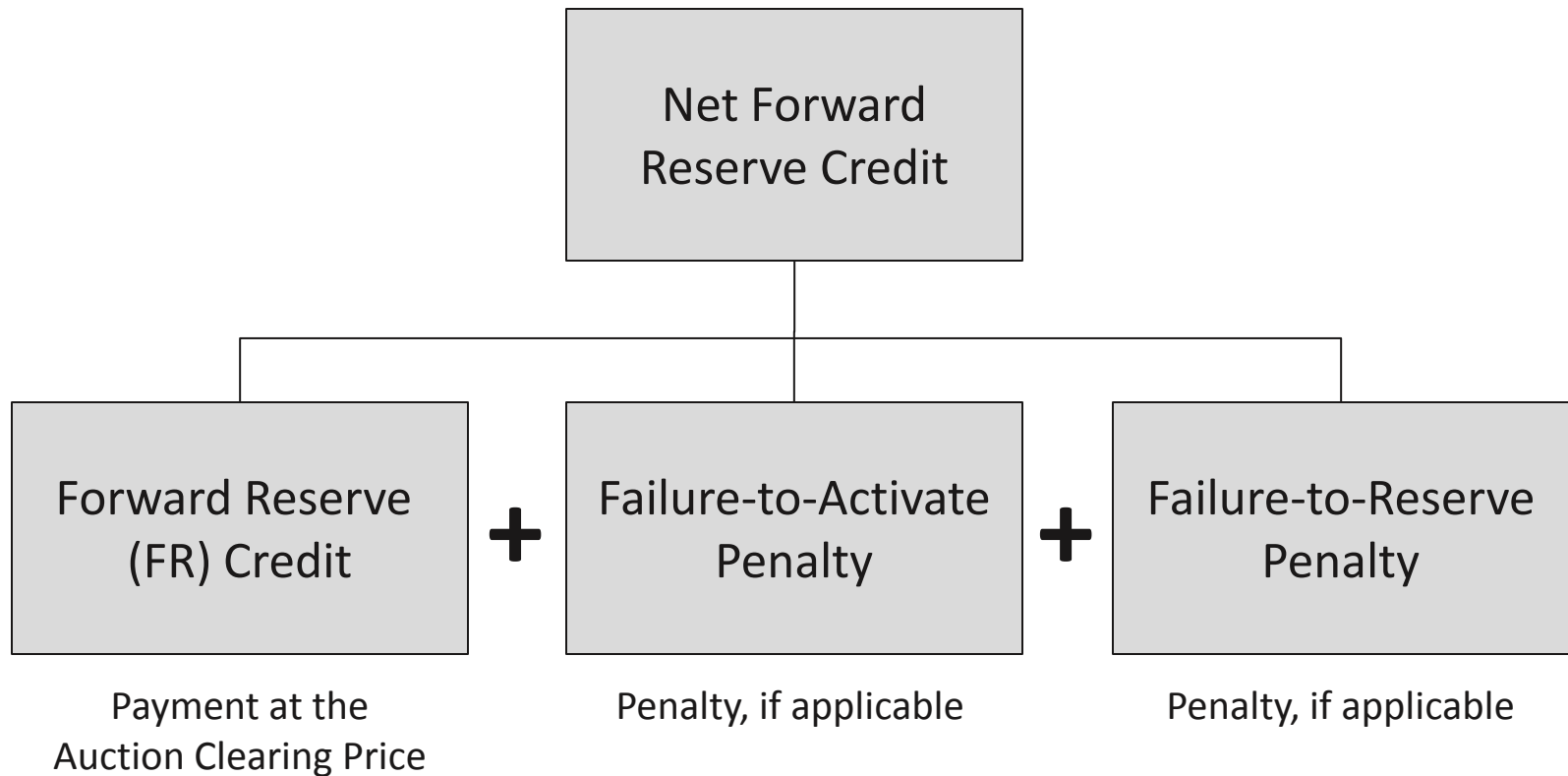
Failure-to-Reserve Penalty



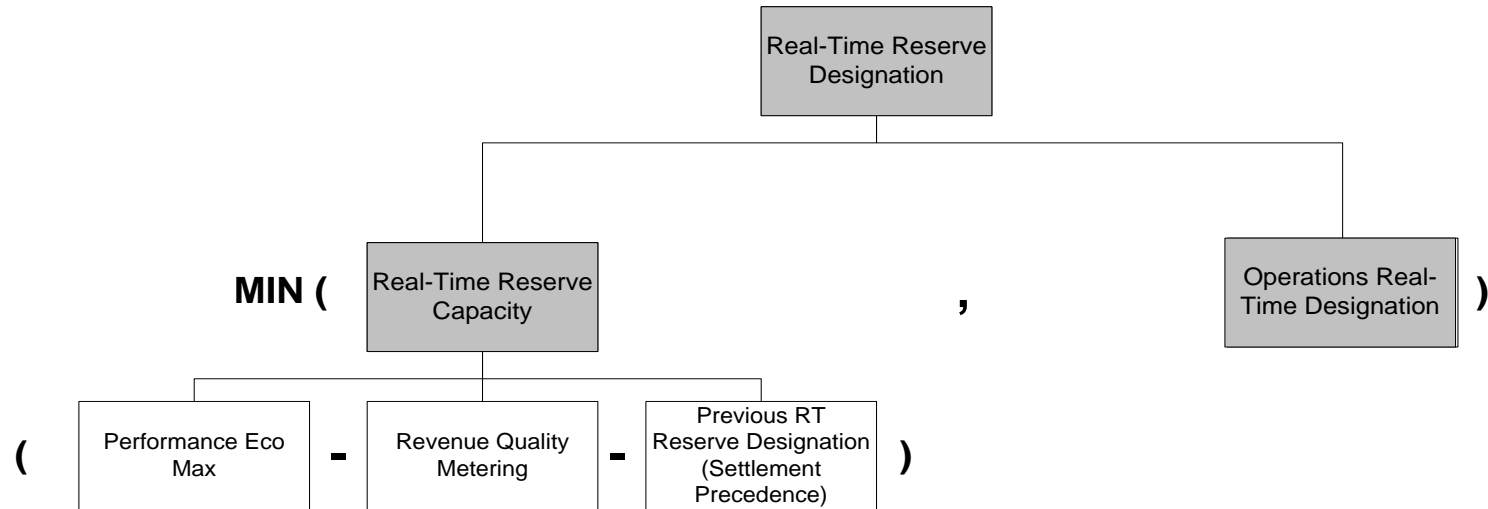
Failure-to-Activate Penalty



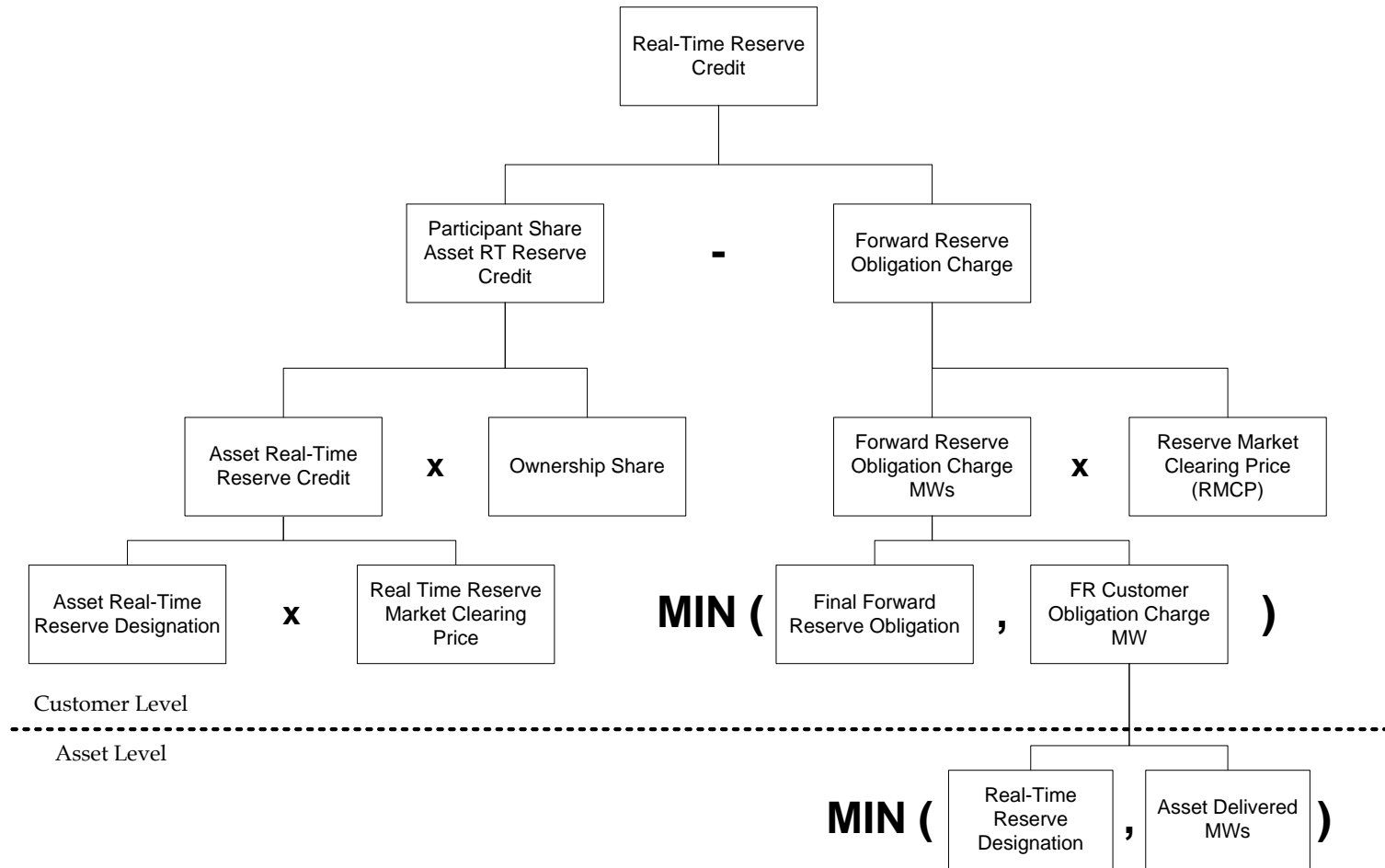
Net Forward Reserve Credit



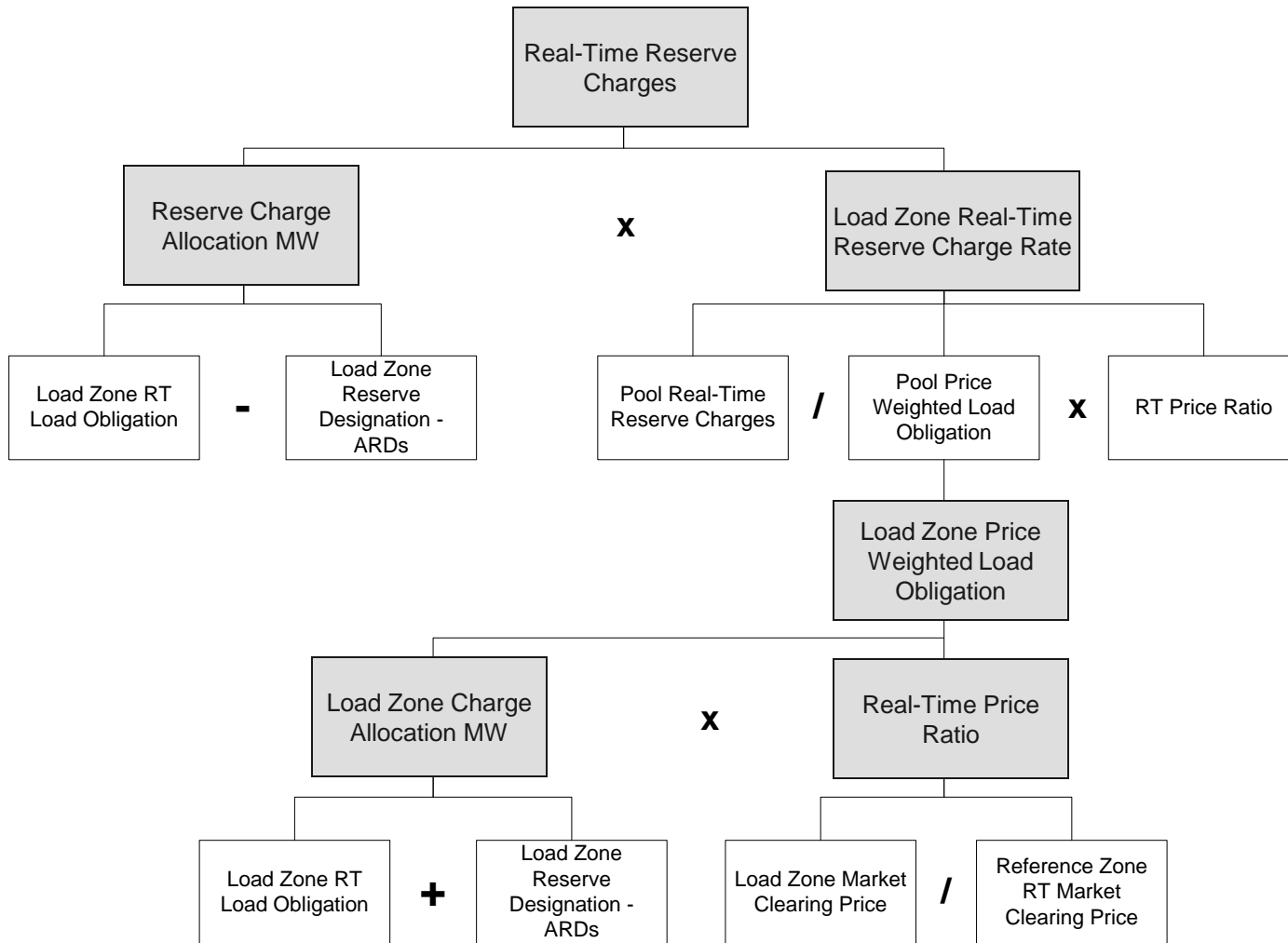
Real-Time Reserve Designation



Real-Time Reserve Credit

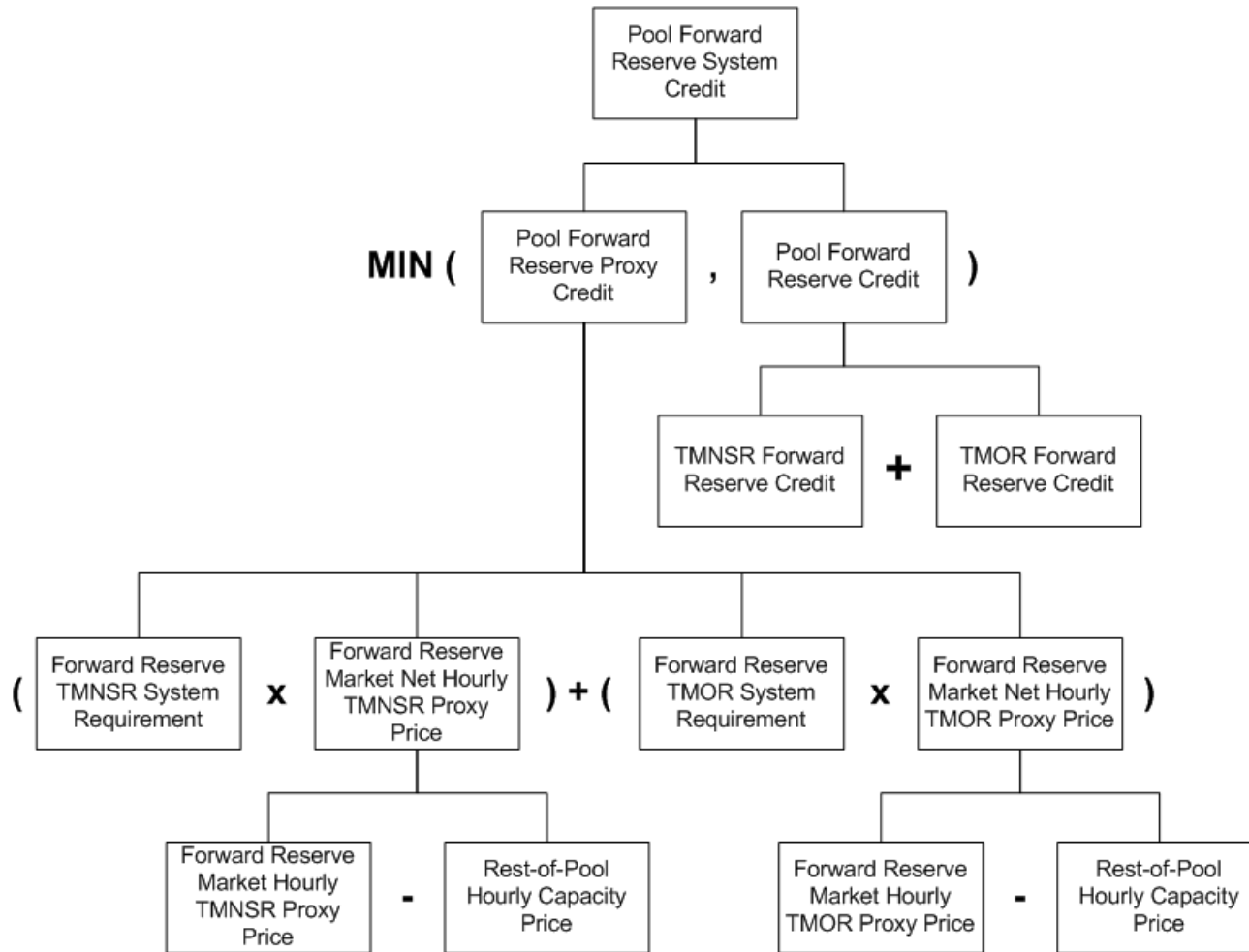


Real-Time Reserve Charge



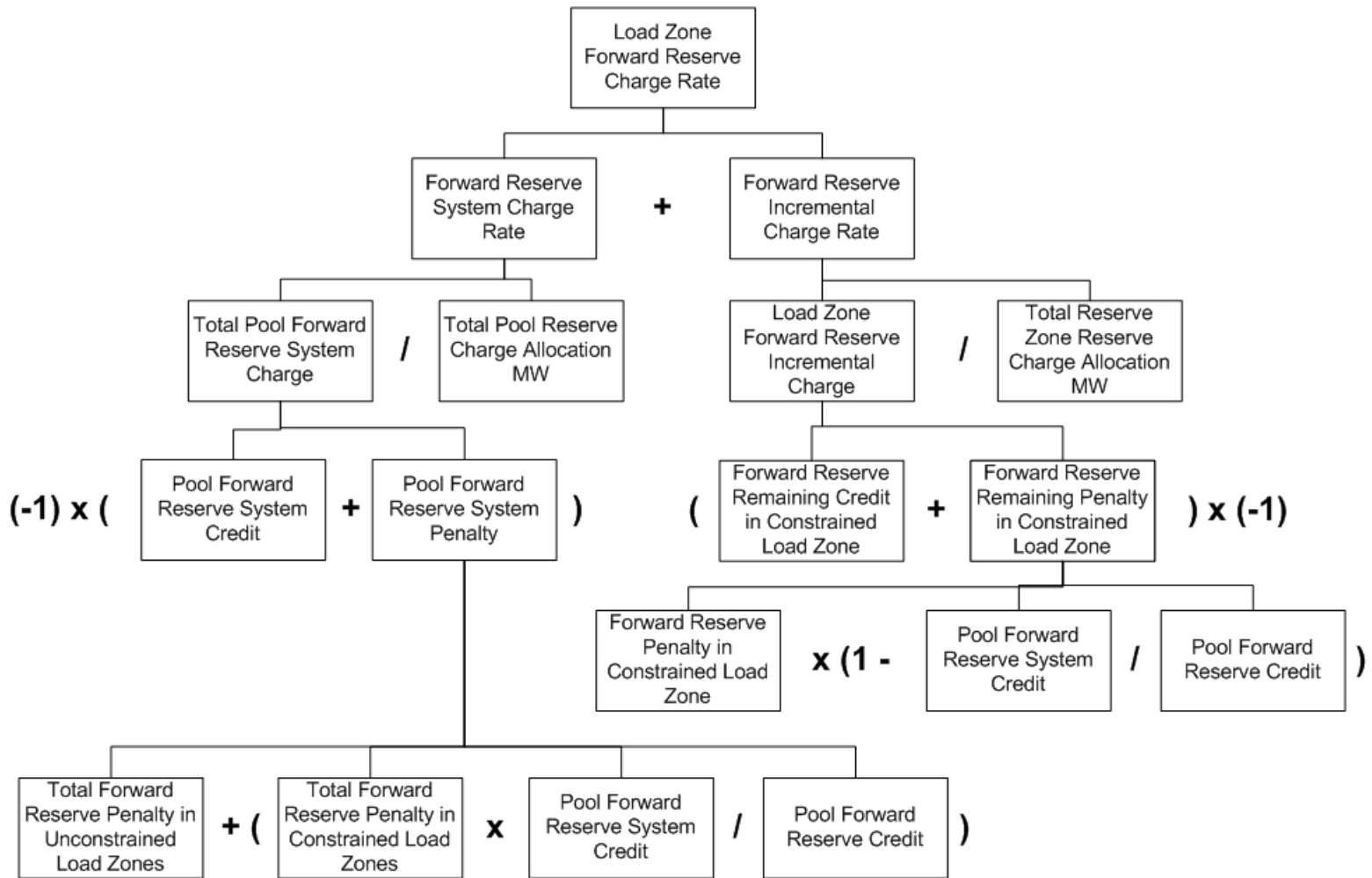
Forward Reserve System Credit

(For Forward Reserve Charge Allocation)

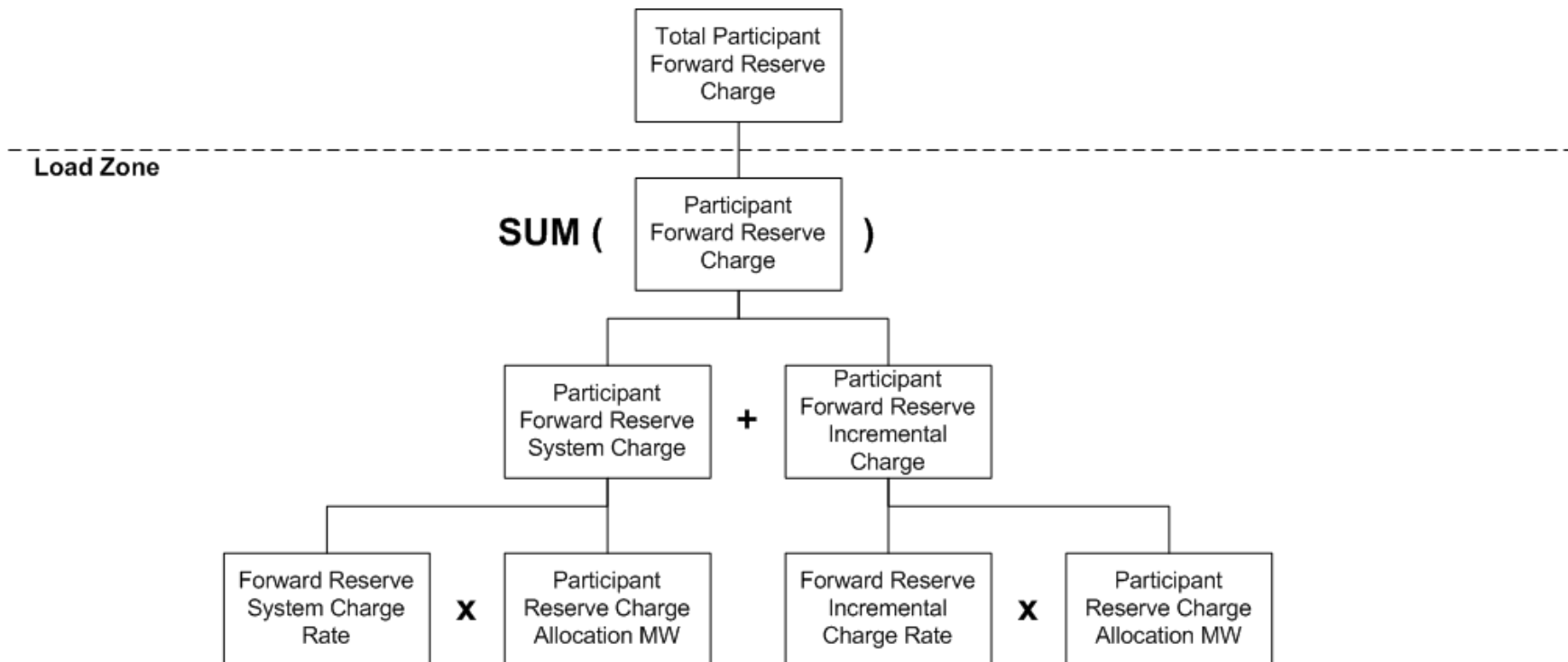


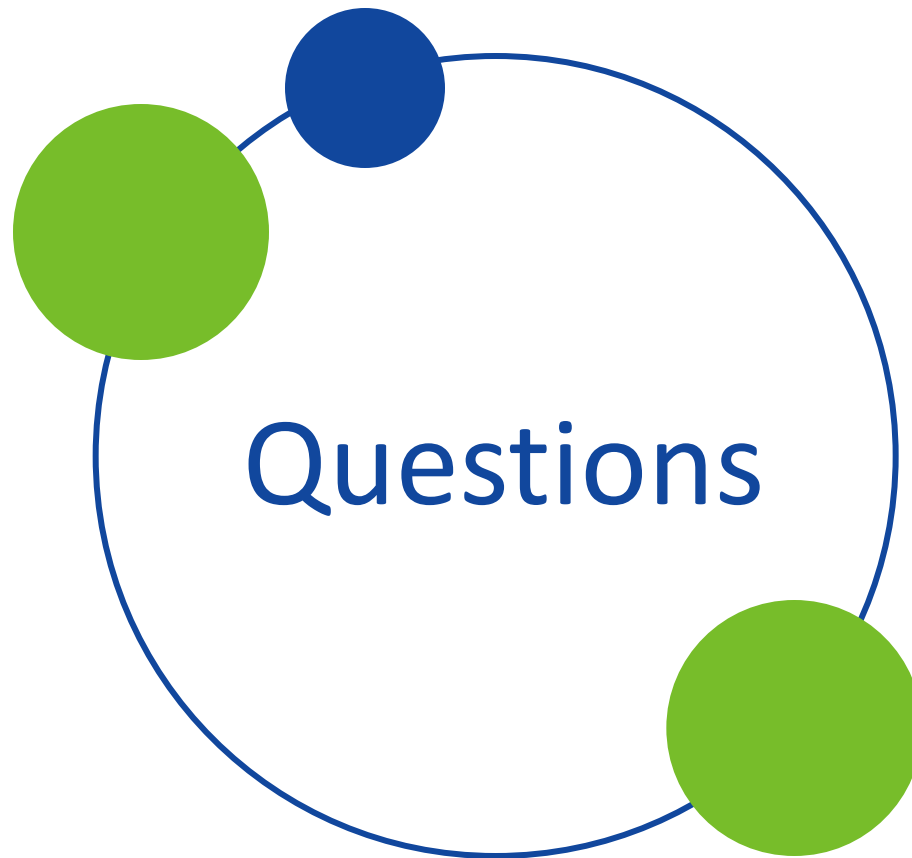
Forward Reserve Load Zone Charge Rate

(For Forward Reserve Charge Allocation)



Forward Reserve Participant Charge





Questions

