



Grid West

Module 4a Discussion Reserve Markets

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The Reserve Markets discussion will cover the following topics:

- Objectives
- Assumptions
- Challenges & Considerations
- Service Descriptions
- Process Overview
- Timeline
- Key Concepts
- Capability Summary
- Open Issues

The Reserve Market module has the following objectives:

- Create a market for Grid West to acquire sufficient operating reserves
- Allow certified resources outside the CCA to participate in the reserve markets

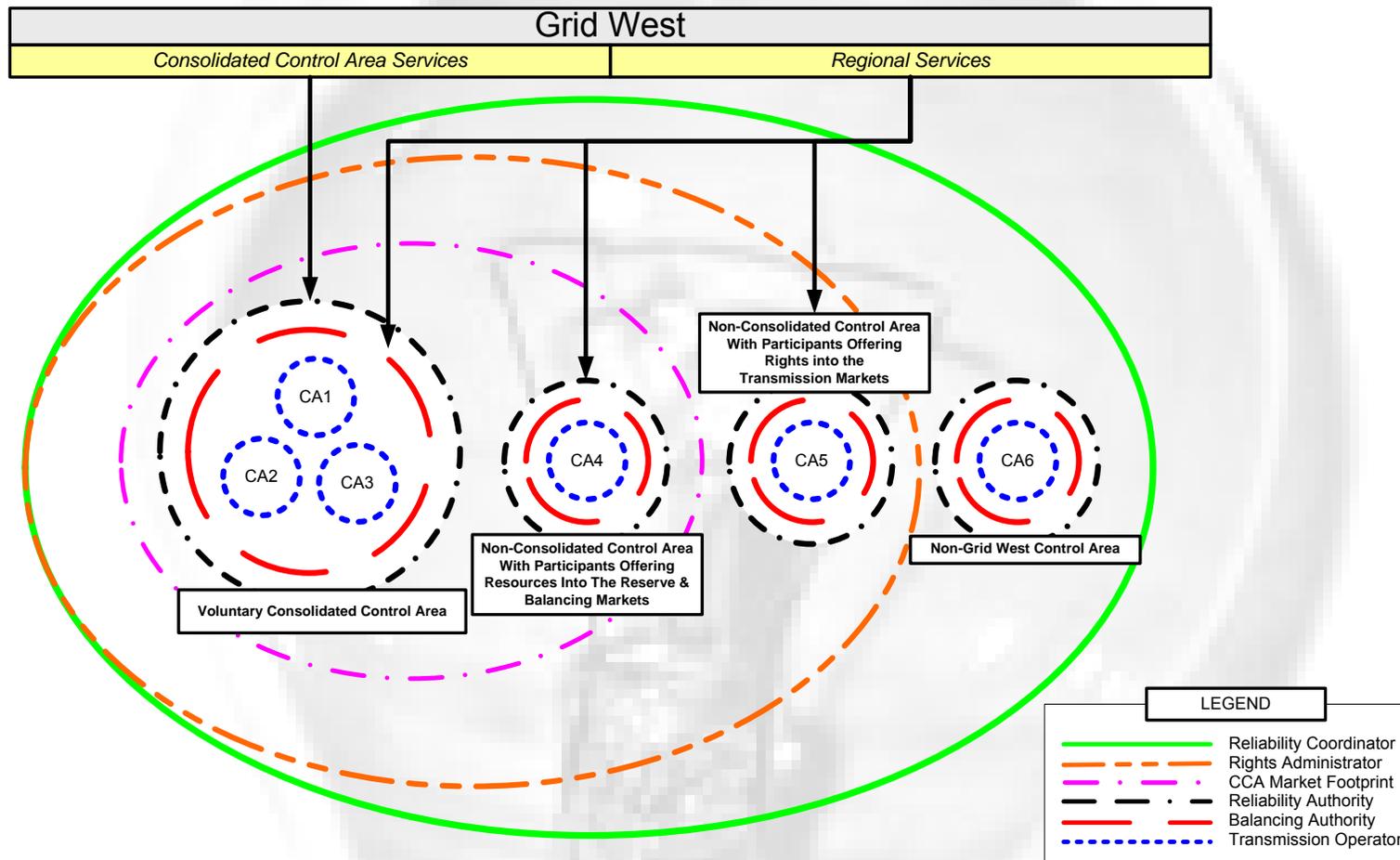
The Beginning State Reserve Markets discussion assumes the following:

- Grid West operates the Consolidated Control Area (CCA)
- Grid West administrators an operating reserves market to meet the reserve requirements of the CCA
- Grid West posts reserve requirements for the CCA
- LSEs within the CCA are required to offer (“bring to the table”) sufficient reserves * to cover their obligations. However, LSEs can offer this reserve at a price of their choosing.
- Grid West will accept voluntary and certified reserve offers from outside CCA
- Grid West is the buyer for the LSEs participating in the CCA.
- Technical requirements for reserve products will be defined by Grid West
- Market sellers will be required to obtain certification from Grid West before trading
- Existing reserve sharing arrangements administered by NWPP will be maintained

** This requirement may be certain reserve types such as regulation and contingency only.*



The following RRG Service Model defines the Grid West services that are to be provided to the Consolidated Control Area and the non-Consolidated Control Areas.



The Beginning State Reserve Market design must address the following challenges & considerations:

- The Reserve Market is being developed for the proposed CCA; however, certified suppliers in non-consolidated control areas and outside of Grid West will be able to offer reserves for sale into the market on a voluntary basis
- As the CCA operator, Grid West will pre-certify all sellers of reserve products
- The Grid West Reserve Market includes a “qualified must offer” provision* for LSE’s within the CCA including direct load customers
- Opportunity to self-provide reserve is preserved by submitting “price-taker” bids.

* LSEs within the CCA will be required to offer reserve in the market at least equal to their obligations

The Beginning State Reserve Markets design has the following basic characteristics:

- Reserves purchased by Grid West are for CCA reserve needs
- Reserve offers can come from any qualified party (inside and outside the CCA)
- Consolidating parties must offer at least their share of the CCA reserve requirement
- Awards based on lowest cost to provide from all offers
- Existing NWPP reserve sharing arrangements maintained with Grid West (CCA) as a participant

Grid West may provide the following Reserve Markets services:

Day-Ahead Reserve Market Service

- Provider of a day-ahead reserve market service by Grid West for its Consolidated Control Area. Certified suppliers outside the CCA may offer to sell reserves into the market.

Grid West may support the trading the following reserve products:

Regulating Reserves	<ul style="list-style-type: none">• Regulation Up/Down - Generation capacity on Automatic Generation Control (AGC) continuously balancing generation and demand within its control area, thereby maintaining Area Control Error, system frequency and interchange with adjacent Control Areas within acceptable limits.
Contingency Reserves	<ul style="list-style-type: none">• Spinning Reserve – Unloaded capacity from synchronized resources responsive to system frequency that can be loaded within ten (10) minutes in response to contingencies on the grid.• Non-Spinning Reserve – Capacity from resource that can be loaded or made effective within ten (10) minutes in response to contingencies on the grid.

Grid West may support the trading the following reserve products:

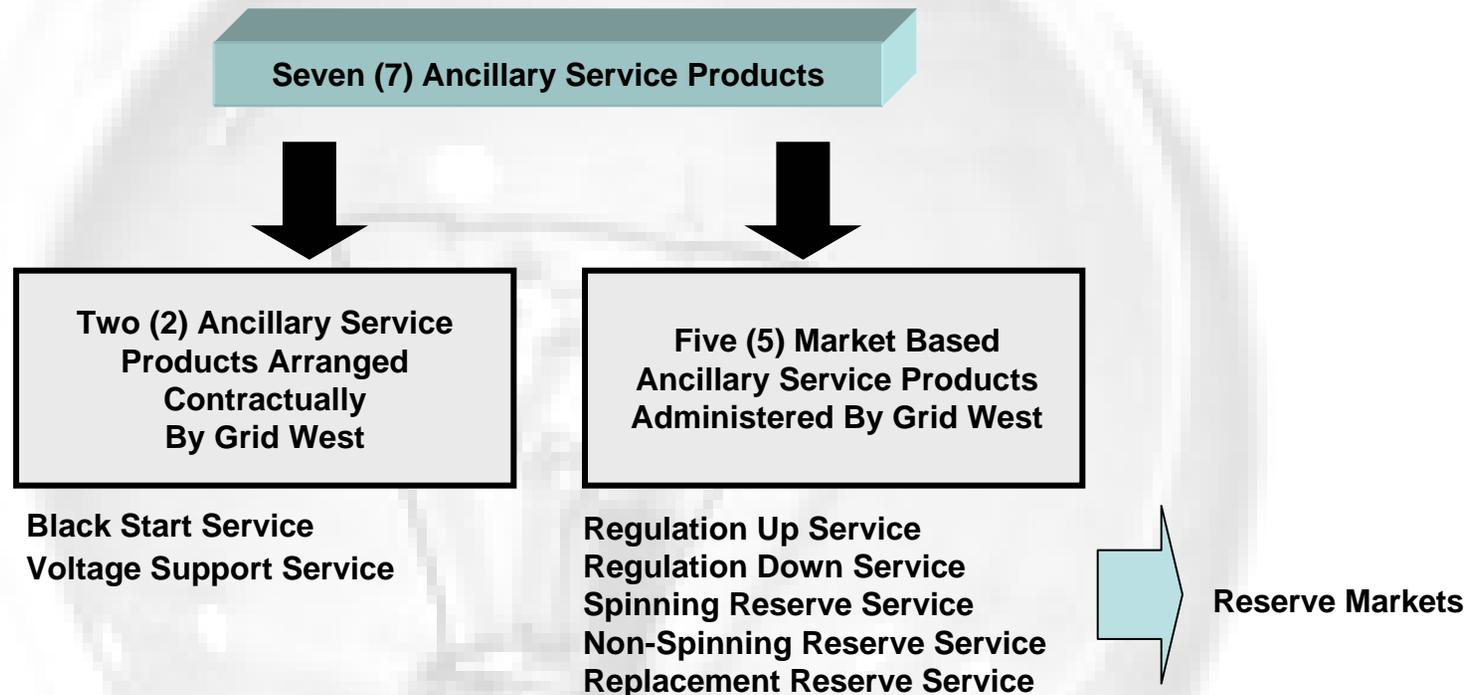
Replacement Reserve

- Replacement reserve: generation or other resources that Grid West can use within a sixty (60) minute period in order to maintain adequate reserves in the CCA.

Reserves will need to be locational when the system is congested:

- Grid West needs to forecast the system conditions and decide to what extent, if any, the reserve products are locational (needed within particular congestion regions)
- In order to bid a reserve product into a congestion region, a reserve supplier must be located in the congestion region or have the proper transmission rights to the congestion region

Ancillary Services are necessary to support reliable transmission. Some services will be procured through the market and others will be contract based:



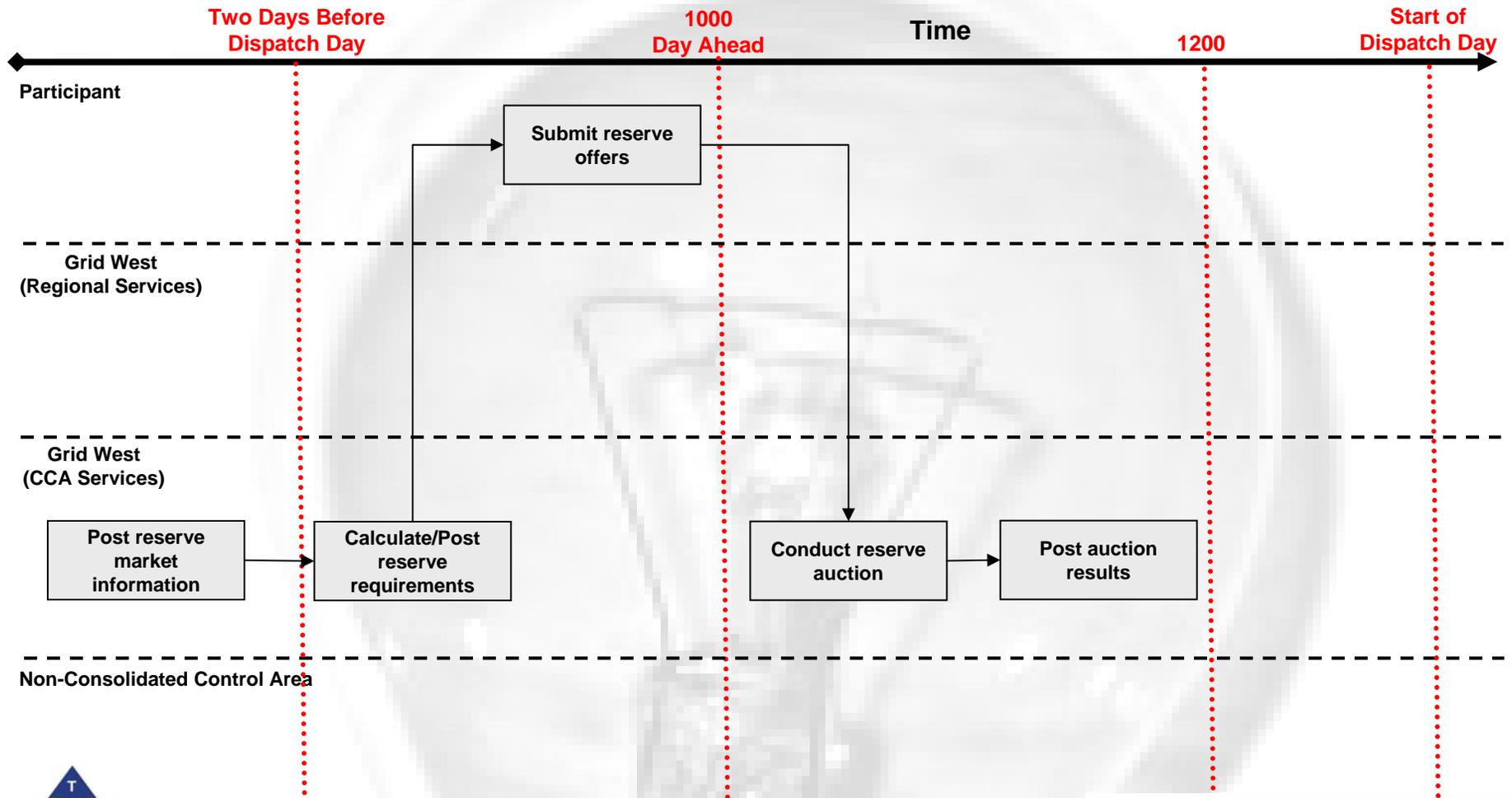
* Note: If Grid West enters into Reliability Must Run (RMR) agreements, they may be used as a source for Ancillary Services



Grid West will perform all the functions necessary to procure and deliver reserves for the Consolidated Control Area:

- Define reserve requirements
- Certify resources
- Receive and validate reserve offers
- Perform reserve auction and determine market clearing prices
- Post reserve market awards and prices
- Monitor performance
- Allocate reserve costs to users
- Settle for reserve market services

Reserve Market Process Flow



Note: Times shown are illustrative only to provide context.



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The following Reserve Markets key concepts are explained in additional detail:

Long-Term Planning

Pre-Day Ahead

Day Ahead

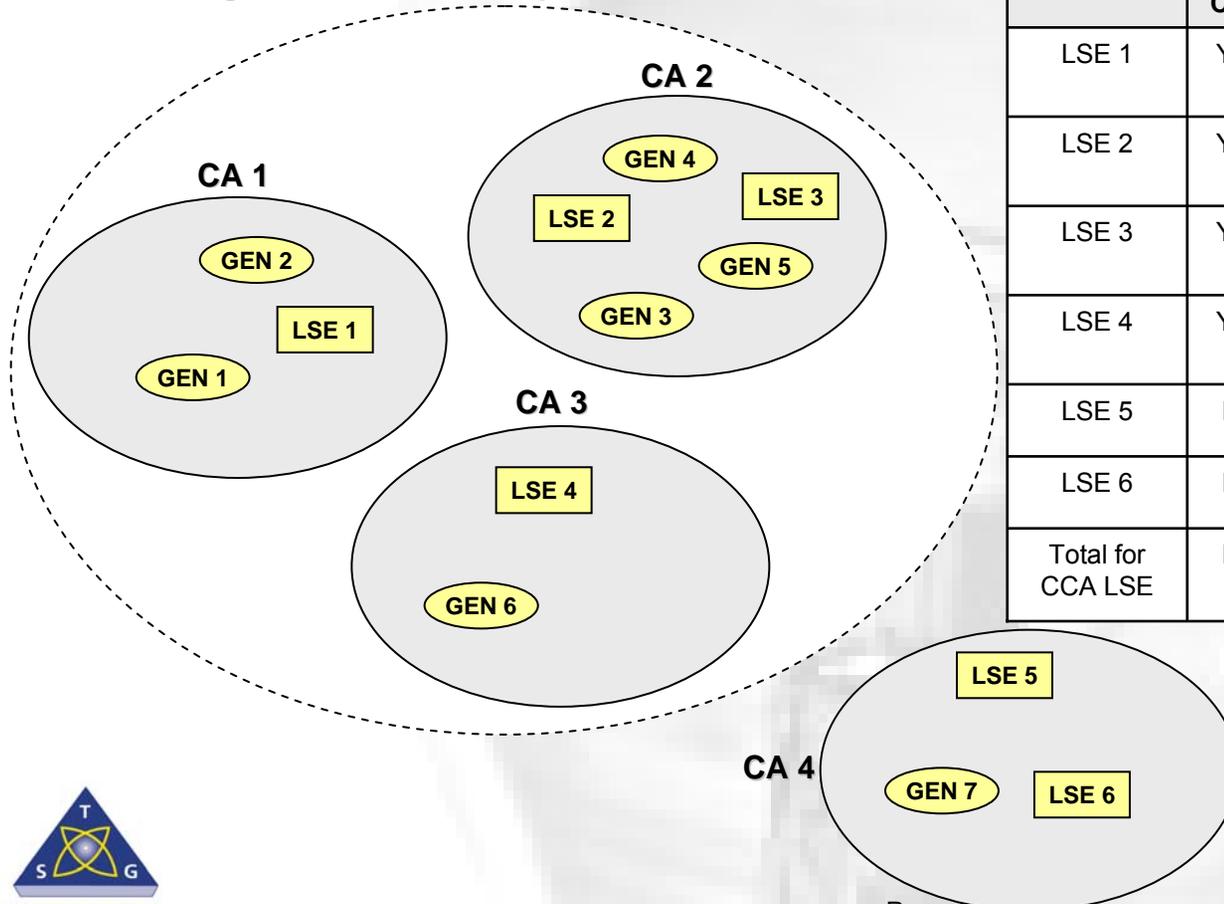
Reserve Markets
Module 4a

- Reserve Obligations & Offer Requirements
- Auction Methodology
- Dynamic Scheduling
- Interaction with energy schedules

Grid West will calculate the total reserve requirements for the CCA and determine the minimum offer requirement for each LSE:

Illustration

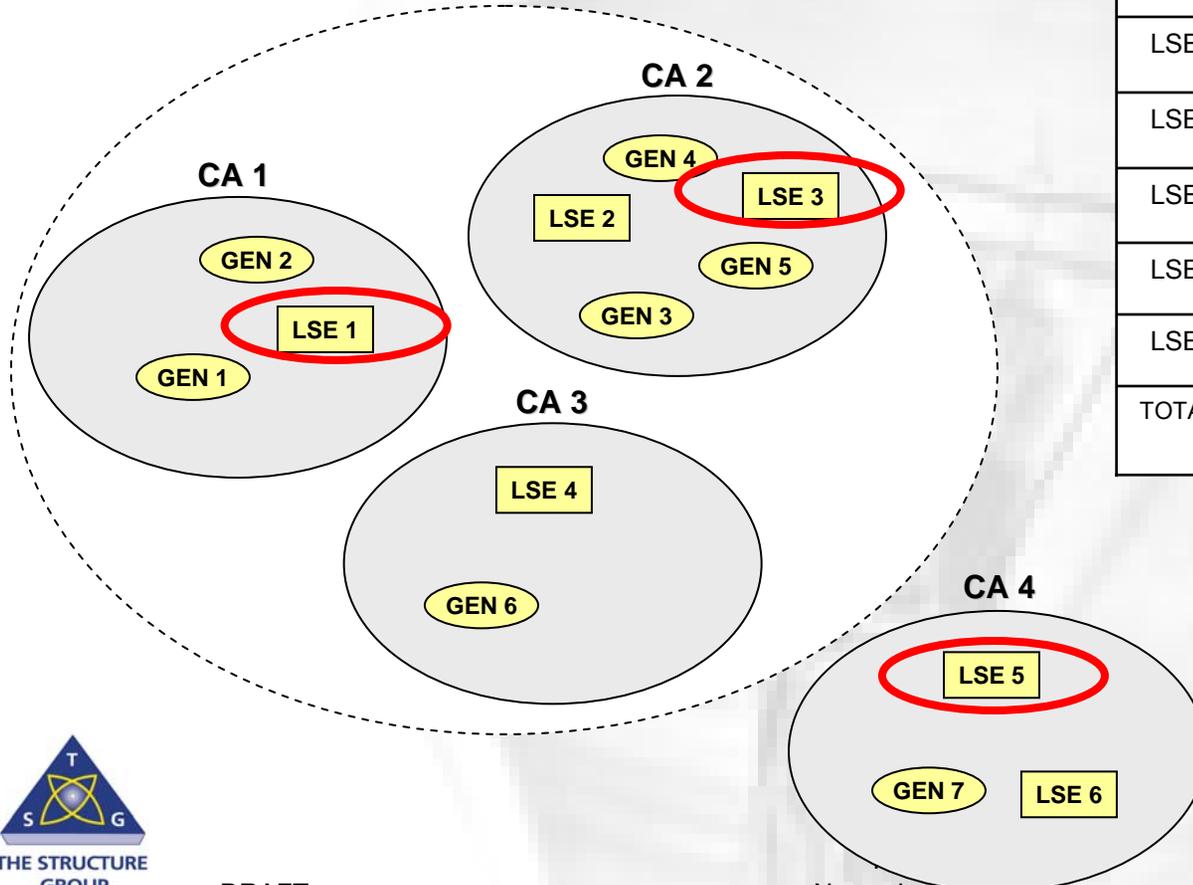
Consolidated Control Area
Regulation Reserve Requirement = 1000 MW



Entity	In CCA	Load	CCA Load Ratio Share	Obligation
LSE 1	Yes	1000	42% (1000/2400)	420 MW (42% of 1000)
LSE 2	Yes	200	8% (200/2400)	80 MW (8% of 1000)
LSE 3	Yes	400	17% (400/2400)	167 MW (17% of 1000)
LSE 4	Yes	800	33% (800/2400)	333 MW (33% of 1000)
LSE 5	No	500	0%	0 MW
LSE 6	No	600	0%	0 MW
Total for CCA LSE	No	2400	100% (2400/2400)	1000 MW (100% of 1000)

LSEs within the CCA are required to submit offers to cover their obligation (at a minimum). Certified resources outside of the CCA can submit reserve offers into the market:

Consolidated Control Area
Regulation Reserve Requirement = 1000 MW



Entity	Obligation	MW Offer	Price
LSE 1	420	420 MW	\$25/MW
LSE 2	80	80 MW	\$55/MW
LSE 3	167	200 MW	\$30/MW
LSE 4	333	400 MW	\$35/MW
LSE 5	0	380 MW	\$15/MW
LSE 6	0	0	N/A
TOTALS	1000 (Obligation)	1480 MW (Offers)	

In this case, LSE 1, 3, and 5 would be selected to provide reserves to the region. Marginal Price will be \$30/MW-h

The following options are available for evaluating reserve market offers:

Option	Name	Description
A	“Single Step, Capacity Only”	<ul style="list-style-type: none"> • The offers are ranked for each product and location based on capacity bids only (no energy component) • Last winning bid sets the capacity clearing prices
B	“Single Step, Capacity & Energy”	<ul style="list-style-type: none"> • Reserve offers are ranked for each product and location based on the capacity price bid and its weighted energy price bid • Last winning bid sets the capacity clearing prices
C	“Multi-Step, Capacity & Energy”	<ul style="list-style-type: none"> • Extension of Option B with multi-buy blocks • Efficiency of multi-product auction (CAISO’s “rational buyer”)

The following are examples of potential Reserve Market offer:

Participant	Capacity Offer	Energy Price	MW
1	5	30	10
2	7	20	10
3	9	30	10
4	10	18	10
5	11	26	10

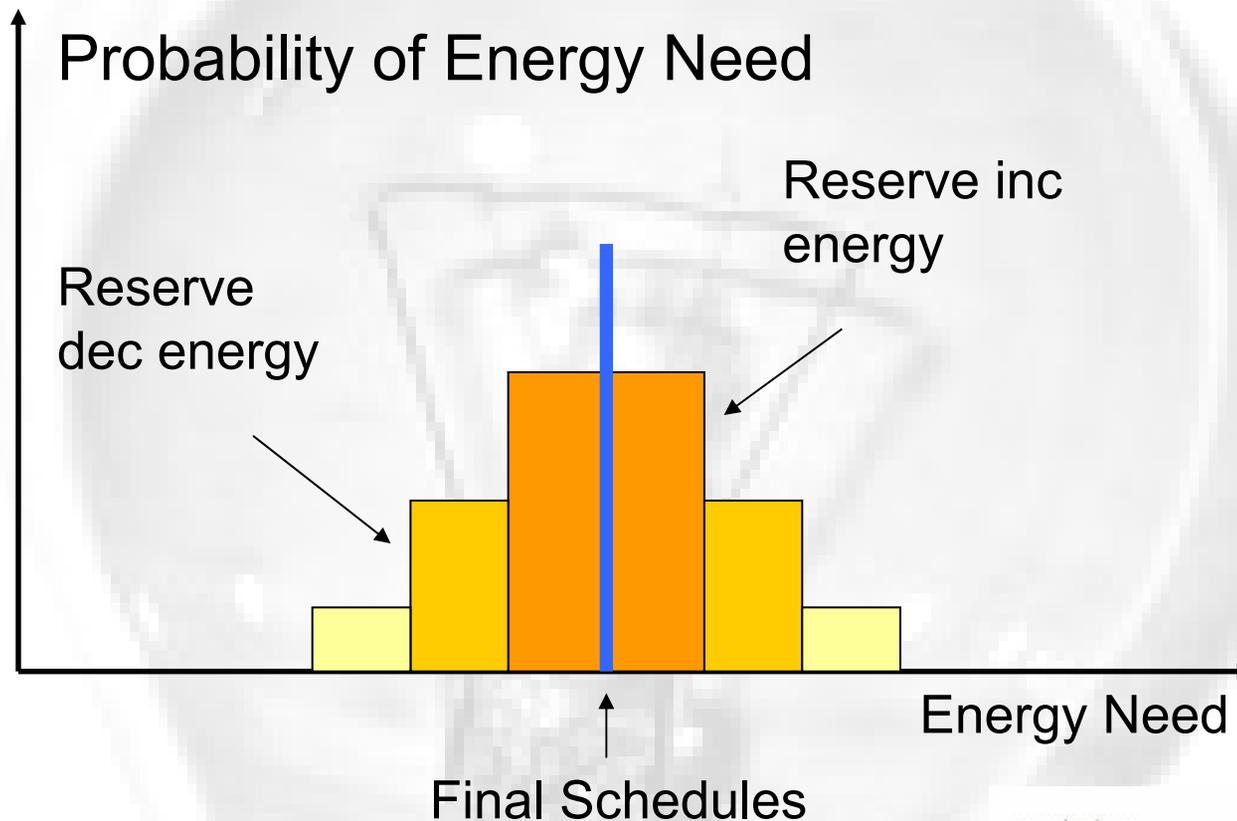
Example of single-step Reserve Market Auction based upon capacity price only.

Capacity Only

- Reserve Requirement: 30 MW
- Winning Participants: 1, 2, and 3
- Clearing Price: \$9/MW

Bidder	Capacity Bid	Energy Price	MW	Total MW
1	5	30	10	10
2	7	20	10	20
3	9	30	10	30
4	10	18	10	40
5	11	26	10	50

Both capacity price and energy price (based on a probability of dispatch) may be used for offer evaluation.



Example of single-step Reserve Market Auction based upon both capacity and energy price.

Simple Capacity and Energy

- Probability factor=0.5 - new ranking below:
 - Winning participants are 1,2 and 4
 - Capacity clearing price is \$10/MW

Offer Ranking Probability=.5

1	20
2	17
3	24
4	19
5	24

Example of a multi-step Reserve Market Auction based upon both capacity and energy price.

Multi-Step Capacity and Energy:

1st Step: 10 MW with Probability factor=0.50

2st Step: 10 MW with Probability factor=0.25

3st Step: 10 MW with Probability factor=0.10

Bidder	Ranking prob=0.5	Winning	Ranking prob=0.25	Winning	Ranking prob=0.1	Winning
1	20		12.5	x	8	x
2	17	x	12	x	9	x
3	24		16.5		12	
4	19		14.5		11.8	x
5	24		17.5		13.6	

We recommend Option A (“Single Step, Capacity Only”) for evaluating reserve market offers. This option can be further developed to allow the energy output from reserve products to be treated as “price-takers”.

- The settlement of energy from reserve products is based on real-time market.
- Grid West may need to settle with external control areas for shared contingency reserves.

Certified resources outside the CCA can offer into the markets. If awarded, these reserves can be dynamic scheduled into the CCA:

- Technical requirement and certification process will be different for dynamic scheduling resources
- Dynamic schedules are implemented with either pseudo-ties (dynamic actuals) or dynamically updated interchange schedules.
- Grid West will require IWR rights at the time of scheduling for resources within Grid West
- Dynamic schedules offered at external ties will not require IWRs (need to discuss)
- Technical challenges
 - Telemetry
 - Jointly owned units
 - Curtailments
 - ACE modification within AGC for both CCA and a supplying control area

Reserve markets are NOT standalone. They are highly interrelated with energy schedules:

- Reserve requirements are directly impacted by the “energy picture”
- Regulation offers need to be validated against capacity ratings and energy schedules
- Suppliers outside CCA may need IWRs, depending on system conditions, to participate in the Reserve Markets
- IWRs must account for both energy and reserve uses
- Schedules must account for both energy and reserves
- Minimum Offer Reserve Obligations can be met through contract with a certified third party

Reserve Market Administration Service	
Description of Function	Provide an auction marketplace for acquiring the needed reserve services for the CCA
Timing & Frequency	Daily, as a part of the Day-Ahead process.
Grid West Responsibilities	<ul style="list-style-type: none"> • Certify reserve resources • Post reserve requirements • Forecast system condition and determine congestion regions, if any • Receive reserve offers • Validate reserve offers • Administer the reserve auction • Post auction awards and prices
Transmission Owners Responsibilities	<ul style="list-style-type: none"> • Supply certification
Consolidated Control Area (LSEs)	<ul style="list-style-type: none"> • Submit offers and parameters for minimum requirements to Grid West (Self-provision may be accomplished by a price taker offer). • Deployment of reserves • Submit voluntary additional offers, as desired
Participant (Seller) Responsibilities	<ul style="list-style-type: none"> • Obtain reserve certification through Grid West • Submit voluntary reserve offers to Grid West, as desired
Methodology	<ul style="list-style-type: none"> • Simultaneous clearing auction for all reserve products for CCA • Determine market clearing prices (and quantities) for each reserve product
ISO / RTO Benchmarks	Close to standard reserve markets with some minor exceptions - mature auction solutions exist today.

The following matrix summarizes the Beginning State design for CCA Reserve Market Service:

Description	Current Practice	Proposed Change	Opportunities/ Value
Reserve Markets	<ul style="list-style-type: none"> No central market exists for reserves. 	<ul style="list-style-type: none"> Voluntary auction market for required CCA reserves. 	<ul style="list-style-type: none"> New market for participants to sell reserves. Economic optimization of reserve costs.
Contingency Reserve Sharing	<ul style="list-style-type: none"> Many participants in the region are members of the NWPP. 	<ul style="list-style-type: none"> Non-CCA participants will remain direct members of the NWPP. Grid West will become a new member of the NWPP for the CCA. NWPP will coordinate with Grid West during contingency events. 	<ul style="list-style-type: none"> Maintenance of existing reserve sharing program. Regional coordination of contingency events.
Reserve Margins (Regulating Reserves)	<ul style="list-style-type: none"> Each control area must meet its reserve requirements. 	<ul style="list-style-type: none"> Control Area consolidation will allow consolidated participants to pool regulating reserves. 	<ul style="list-style-type: none"> Capacity savings resulting from pooling regulating reserve margins and use of RTEM.

The following issues have been identified during the initial round of design:

- **Dynamic Scheduling**– What are the transmission interactions for dynamic scheduling?
- **Reserve Offers** – How will energy prices be accounted for in bid evaluation, if at all?
- **Congestion & Reserves** – How will “locational markets” be implemented in the presence of congestion, if at all?
- **Long-term Resource Adequacy** – How will Grid West ensure long-term resource adequacy? (e.g., ICAP, etc.)
- **Reserve Market Power** – How will market power issues related to reserves be dealt with?
- **Replacement Reserve Service** – Should LSEs within the CCA will be required to “bring to the table” sufficient replacement reserves?
- **Reserve sharing settlement** – The current NWPP reserve sharing between CAs is financially settled with index price while the CCA settles with its providers based on market clearing prices.

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- ✓ Open Issues