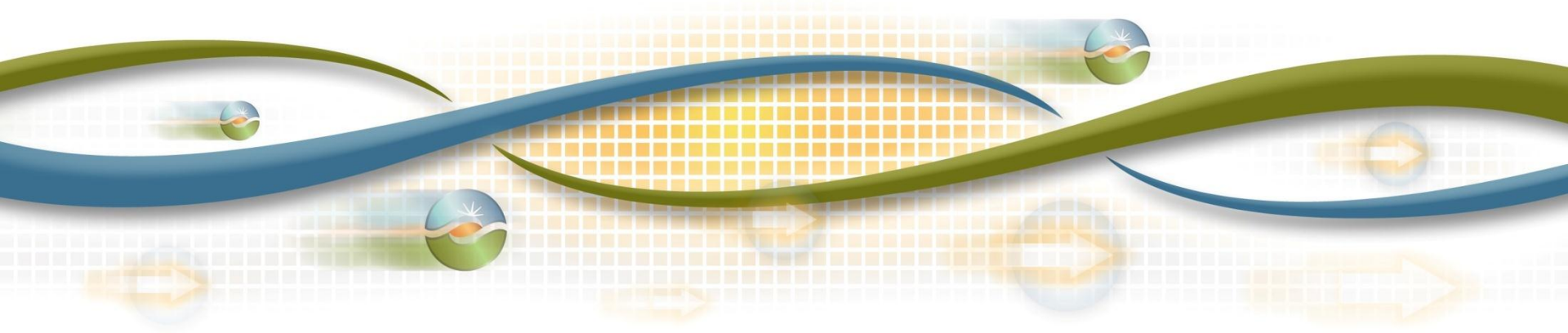
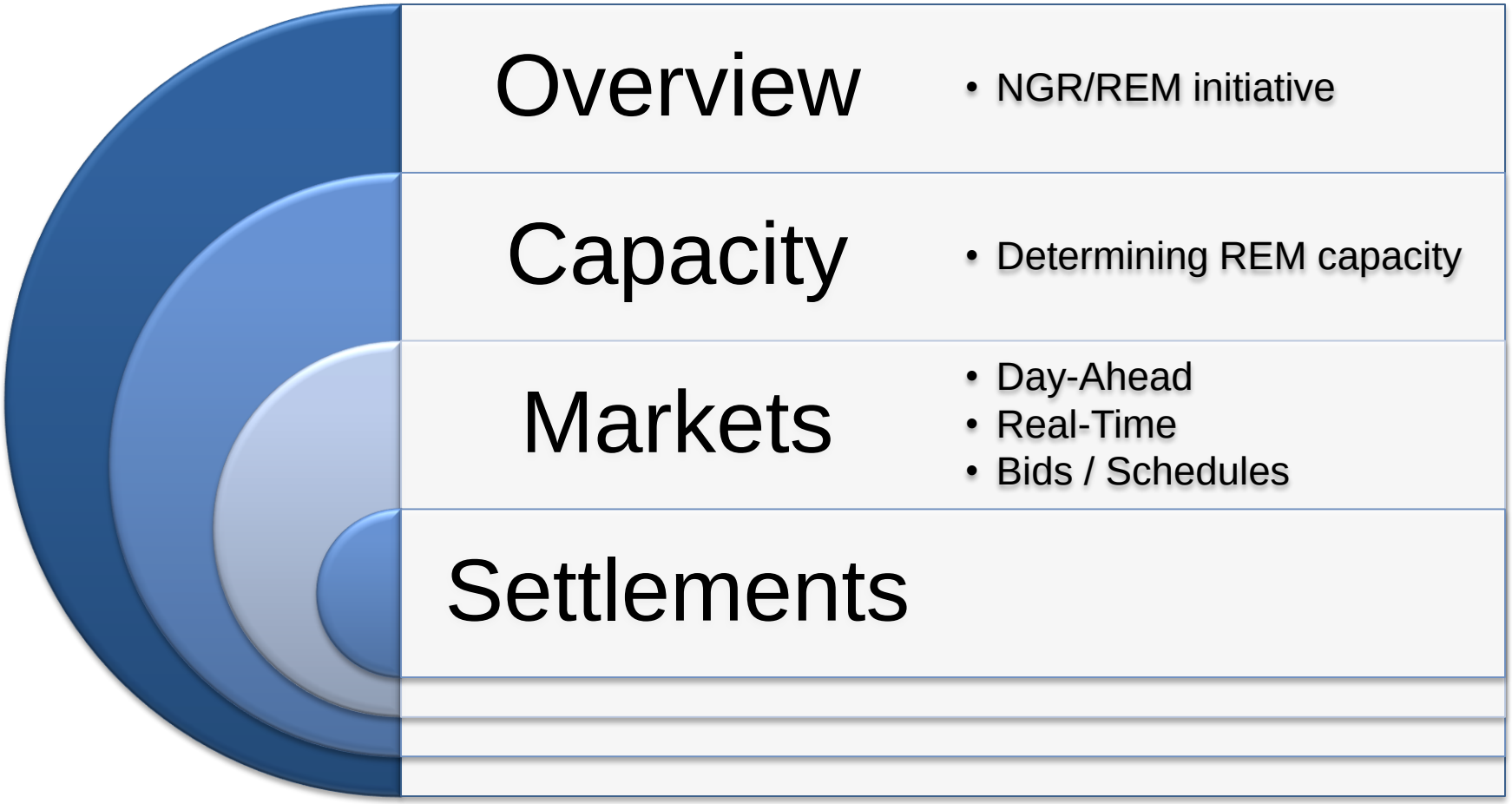
California ISO
Shaping a Renewed Future

Non-Generator Resource (NGR) and Regulation Energy Management (REM) Overview – Phase 1

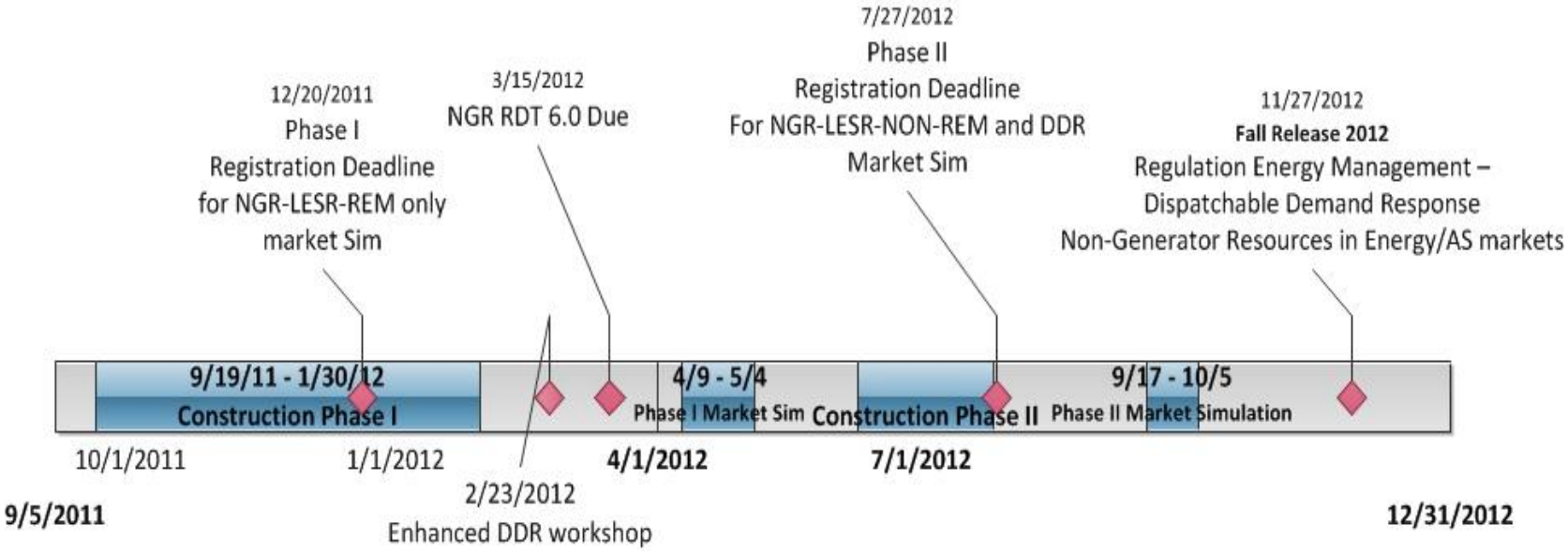
Client Training Team
Customer Services Department



Agenda – NGR/REM



Overview – NGR Phased Approach



Overview – NGR/REM

Regulation Energy Management (REM) for a Non-generating Resource (NGR) is an important market enhancement that enables new types of resources to participate the ISO regulation markets.

The implementation of Non-generator Resources will:

- Create the initial model for energy storage devices to fully participate in ISO markets – *Phase I*
- Enable Dispatchable Demand Response to participate in Regulation – *Phase II*

Overview - NGR/REM

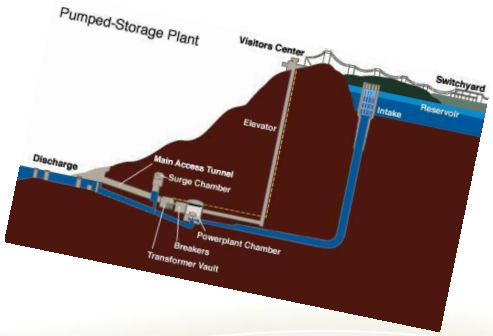
- NGR - Non Generating Resources
  - LESR – Limited Energy Storage Resource – Phase I

Lithium ion battery

Flywheel

Electric Vehicles

Pumped hydro

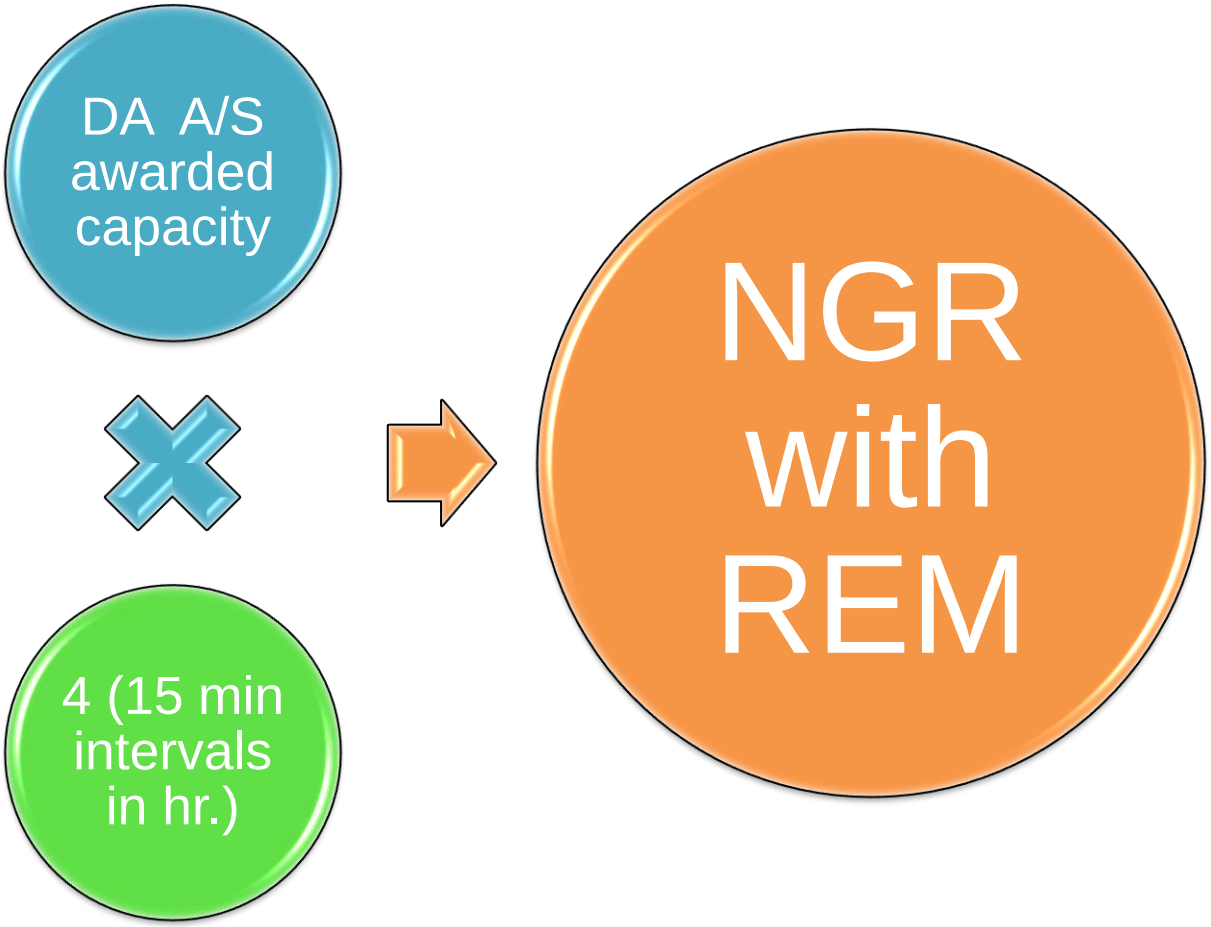


Overview - NGR/REM

Regulation Energy Management (REM)

- Enhancement of the ISO's current rules for regulation
- Allows NGR resources to bid their capacity more effectively into the ISO's regulation markets
- Maintain compliance with NERC/WECC

Overview - NGR/REM



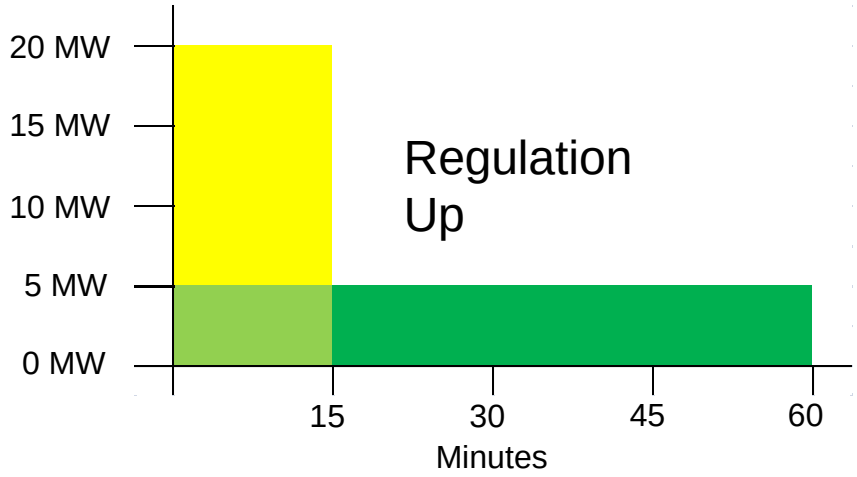
Overview - NGR/REM

- Limited energy storage resources were unable to participate in *day-ahead* regulation market at full capacity w/o regulation management (REM)

Example: 20 MW / 5 MWh limited energy resource

Green – prior requirement

Yellow – regulation energy management

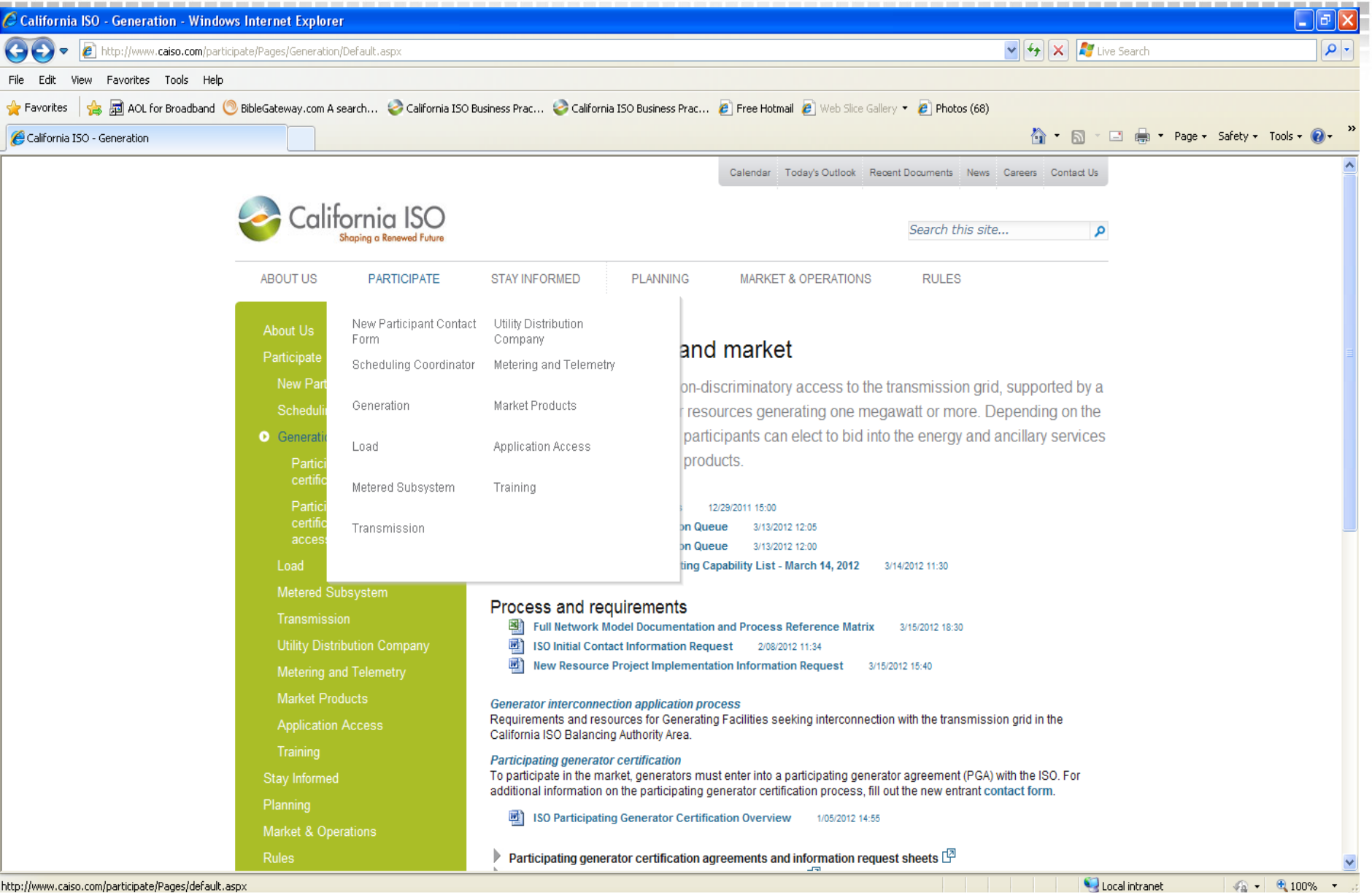


NGR/REM

Participation

Participation - NGR/REM

- To participate as NGR resource the CAISO will use existing business processes and agreements
  - Scheduling Coordinator
  - Participating Load Agreement (PLA)
  - Participating Generator Agreement (PGA)
  - Metered Entity
  - Resource Data Template (RDT) - http://www.caiso.com/Documents/Regulation%20energy%20management%20-%20implementation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Metered Subsystem
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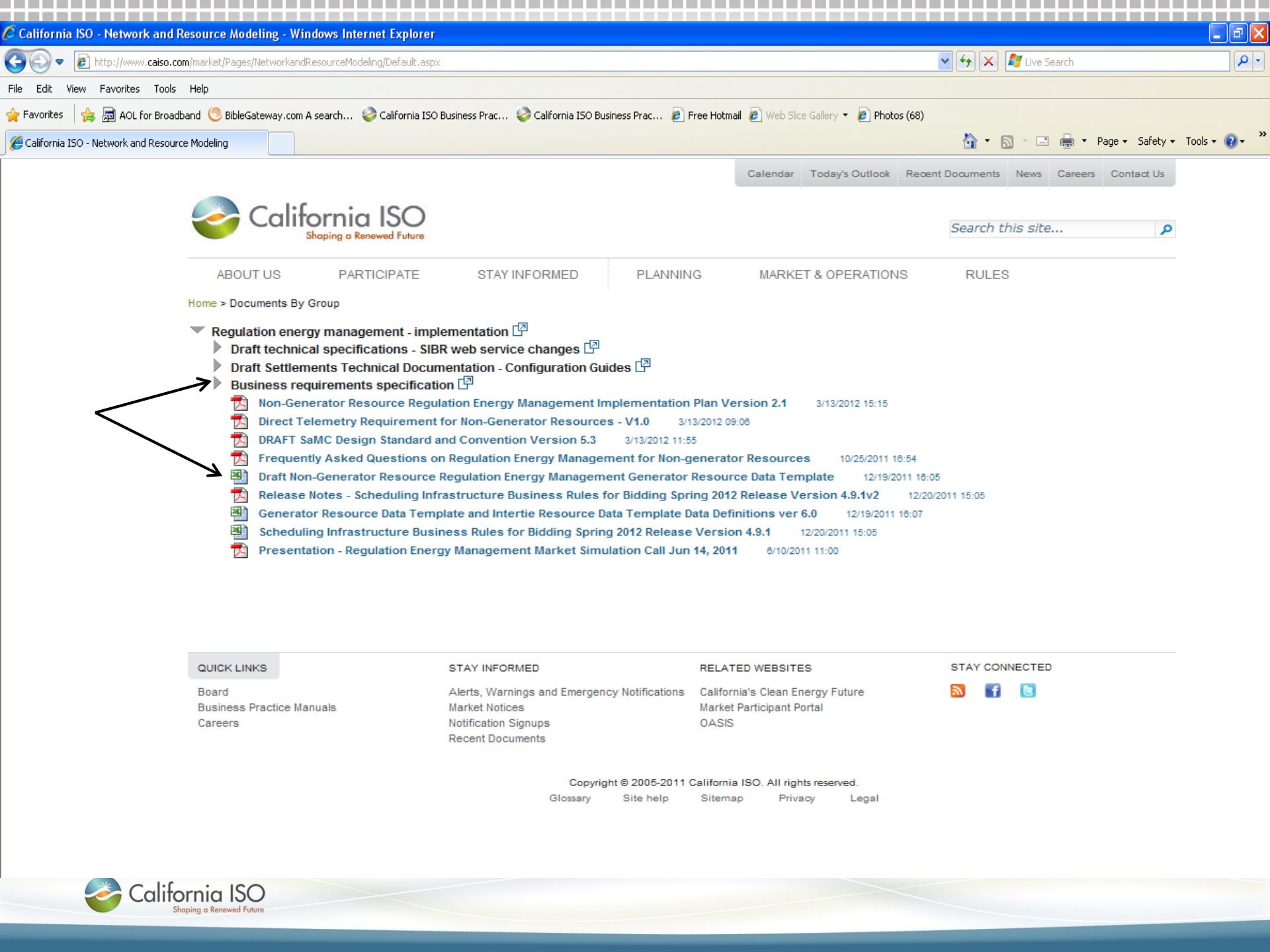
Transmission
and market
Process and requirements
Full Network Model Documentation and Process Reference Matrix 3/15/2012 18:30
ISO Initial Contact Information Request 2/08/2012 11:34
New Resource Project Implementation Information Request 3/15/2012 15:40
Generator interconnection application process
Requirements and resources for Generating Facilities seeking interconnection with the transmission grid in the California ISO Balancing Authority Area.
Participating generator certification
To participate in the market, generators must enter into a participating generator agreement (PGA) with the ISO. For additional information on the participating generator certification process, fill out the new entrant contact form.
ISO Participating Generator Certification Overview 1/05/2012 14:55
Participating generator certification agreements and information request sheets
http://www.caiso.com/participate/Pages/default.aspx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Regulation energy management - implementation
Draft technical specifications - SIBR web service changes
Draft Settlements Technical Documentation - Configuration Guides
Business requirements specification
Non-Generator Resource Regulation Energy Management Implementation Plan Version 2.1 3/13/2012 15:15
Direct Telemetry Requirement for Non-Generator Resources - V1.0 3/13/2012 09:06
DRAFT SaMC Design Standard and Convention Version 5.3 3/13/2012 11:55
Frequently Asked Questions on Regulation Energy Management for Non-generator Resources 10/25/2011 16:54
Draft Non-Generator Resource Regulation Energy Management Generator Resource Data Template 12/19/2011 16:05
Release Notes - Scheduling Infrastructure Business Rules for Bidding Spring 2012 Release Version 4.9.1v2 12/20/2011 15:05
Generator Resource Data Template and Intertie Resource Data Template Data Definitions ver 6.0 12/19/2011 16:07
Scheduling Infrastructure Business Rules for Bidding Spring 2012 Release Version 4.9.1 12/20/2011 15:05
Presentation - Regulation Energy Management Market Simulation Call Jun 14, 2011 6/10/2011 11:00
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NGR/REM

Phase 1

NGR/ REM Modeling

Phase 1 - NGR/REM - Modeling

- Phase one of the ISO's market simulation includes the deployment of the base non-generator resource model for regulation energy management.

- NGR with REM (NGR/REM) is a subset of NGR resources.

Phase 1 - NGR/REM - Modeling
Non-Generator Resource (NGR) and NGR with REM option

Project	Technology	Model	Option to REM (Special Treatment)	Regulation	Spin/Non-Spin	Energy	Qualified MW
Non-Generator Resource (NGR) (2012) **Phase I**	Limited Energy Storage Resource **(LESR)** (Flywheel, battery, energy storage)	Operation range between negative (Charge) and positive (Discharge), constrained by State of Charge (SOC)	REM	SC Bid	No	No	15 minute continuous delivery
			Non REM	SC Bid	SC Bid	SC Bid	Depending on registration and certification

Phase 1 - NGR/REM
Certified maximum capacity - REM or Non REM

Example:

Resource 1: LESR 10 MWH (4 - 15 min. intervals in hour)

Pmax = 40 MW, Pmin = -40 MW. Ramp rate = 10 MW/min

MW	REM	Non REM
Regulation Up	40	10
Regulation Down	40	10
Spinning	n/a	20
Non-Spinning	n/a	20
Pmax	40	40
Pmin	-40	-40

Phase 1 - NGR/REM – Modeling

1. NGR is modeled as a generator on positive (generation) and/or negative (consuming energy/load)
2. NGR can be dispatched seamlessly within their entire capacity range.
3. NGR are also constrained by an energy (MWh) limit to generate or consume energy on a continuous basis.

NGR with REM option

1. NGR can elect to participate only in the ISO's regulation markets.
2. The regulation capacity awarded in the day-ahead market is evaluated as 4 times the regulation energy it can provide within 15 minutes.
3. REM functionality will offset (purchase or sell) energy in real-time to meet the continuous energy requirements for regulation.

Phase 1 - NGR/REM - Modeling
Ancillary Services (A/S) Procurement

CAISO procures 100% of our A/S requirement on an hourly basis in the Day-ahead market.

- Minimum continuous energy A/S procurement requirement for NGR and NGR/REM:
  - Day-Ahead Regulation Up/Down: 60 minutes
  - Real-Time Regulation Up/Down: 30 minutes
  - Spin and Non-Spin: 30 minutes
- Minimum continuous energy measured from the period that the resource reaches the awarded energy output
  - Measurement starts once resource reaches awarded energy, not end of 10 minute ramp requirement

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NGR/REM

Phase 1

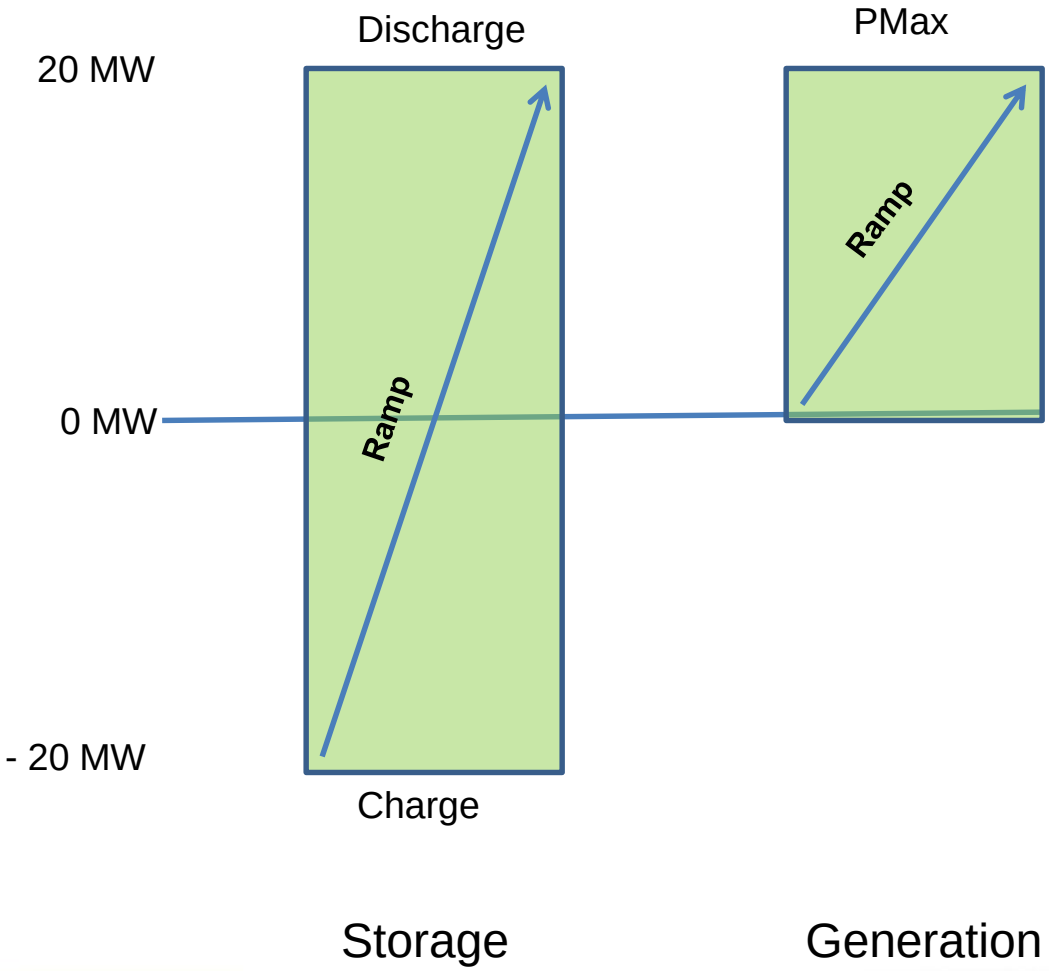
Determining Capacity

Phase 1 - NGR/REM
Determining capacity - REM or Non REM

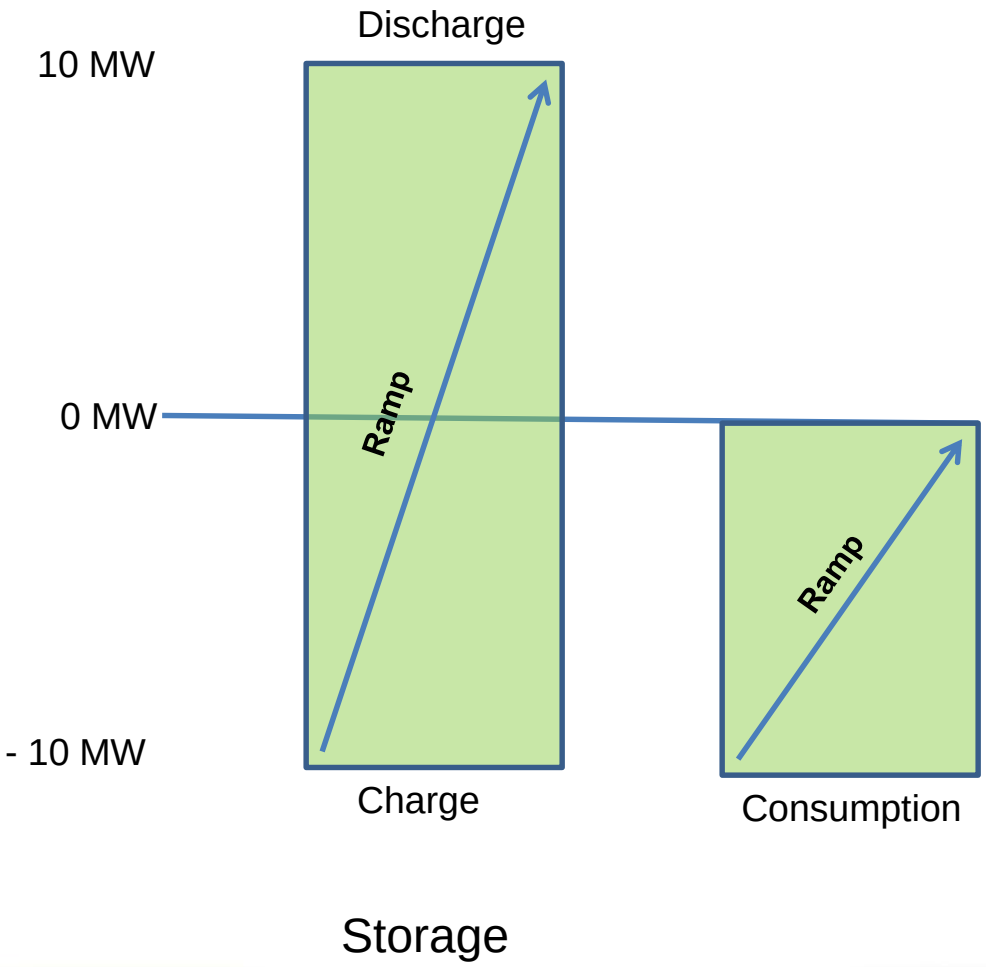
- The ISO shall conduct the regulation certification process
- NGR-REM must meet 10 minute ramping requirement, same as generator
- Regulation up capacity must meet the 15 minute continuous energy deliver requirements – fully charged
- Regulation down capacity must meet the 15 minute consumption of continuous energy requirements – fully discharged

Phase 1 - NGR/REM

Example – Fully charged 5 MWh Storage



Phase 1 - NGR/REM
Example – Completely discharged 2.5 MWh Storage



Phase 1 - NGR/REM
Determining capacity - REM or Non REM

- NGR (Non REM) will be subject to existing ISO requirements for the traditional generators

- To certify the capacity for regulation, spinning, non-spinning and maximum capacity must be dispatchable on a continuous basis for at least 60 minutes

Phase 1 - NGR/REM
Certified maximum capacity - REM or Non REM

Example:

Resource 1: LESR 10 MWH (4 - 15 min. intervals in hour)

Pmax = 40 MW, Pmin = -40 MW. Ramp rate = 10 MW/min

MW	REM	Non REM
Regulation Up	40	10
Regulation Down	40	10
Spinning	n/a	20
Non-Spinning	n/a	20
Pmax	40	40
Pmin	-40	-40

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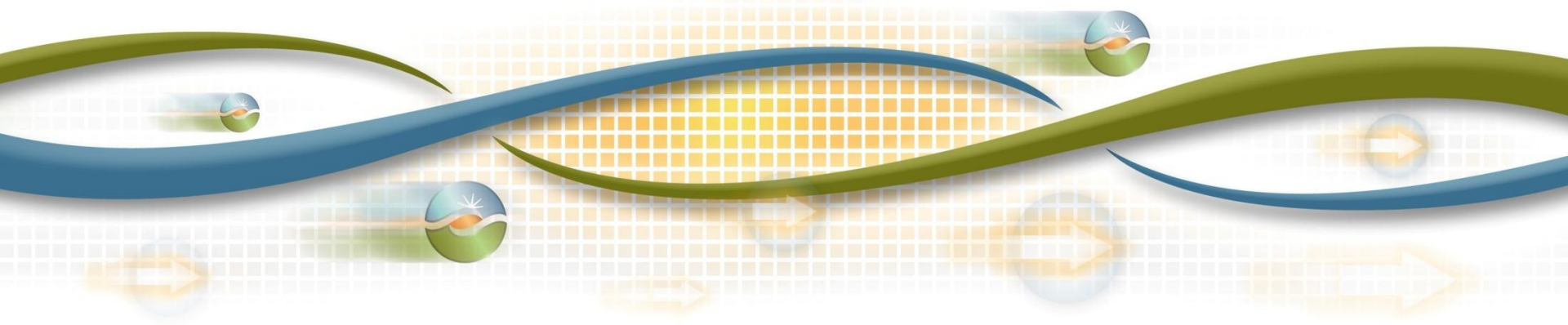
NGR/REM

Phase 1

DAM - Day-Ahead Market

RTM - Real Time Market



Phase 1 - NGR/REM
Day-Ahead and Real-Time Markets

- Optimize NGR energy and A/S awards in DAM/RTM subject to:
  - Capacity Constraints;
  - Ramping Constraints;
  - State of Charge (SOC) constraints for LESR;
- NGR optimal schedule and A/S awards shall be based on its energy bid curve and A/S bids.
- For LESR (REM), SOC constraint is enforced in the RTD. IFM and RTPD shall not include SOC constraints

Phase 1 - NGR/REM
Day-Ahead and Real-Time Markets

- DAM/RTM will model NGR with energy and/or A/S bids as on-line unit; No start up cost /time, No commitment cost recovery.

- DAM will assume LESR (Non REM) SOC initial state determined by prior day's day-ahead schedules at the end of the day.

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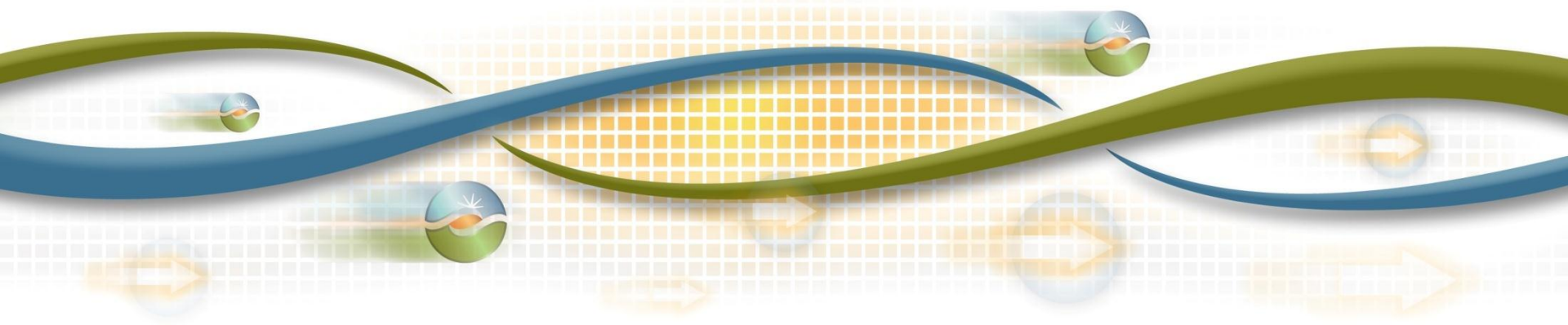
NGR/REM

Phase 1

Bids / Schedules



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Market Participant Portal

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Applications

- **AIM** Access and Identity Management
- **CIDI** Customer Inquiry Dispute and Information
- **CIRA** California ISO Interface for Resource Adequacy
- **CMRI** Customer Market Results Interface
- **MRI-S** Market Results Interface - Settlements
- **OASIS** Open Access Same-Time Information System
- **OASIS History** through Trade Date 3/31/09
- **PIRP** Participating Intermittent Resource Program
- **RAAM** Resource Adequacy Availability Management
- **SIBR** Scheduling Infrastructure & Business Rules
- **SIBR Reports**

Applications below require separate log on

- **DRS** Demand Response System
- **OMAR** Operational Meter Analysis & Reporting

Welcome to the California ISO Market Participant Portal,
the centralized access point for secure applications and business critical information.

Market Operations

Market Status | Market Event Log | System Operating Messages

Day Ahead Market

Select Trade Date 12/31/2014

Bids & Schedules	Inter SC Trades
CLOSE	PUBLISHED

Hour Ahead and Real Time Market

Select Trade Date 12/30/2014 View All 24 Hours

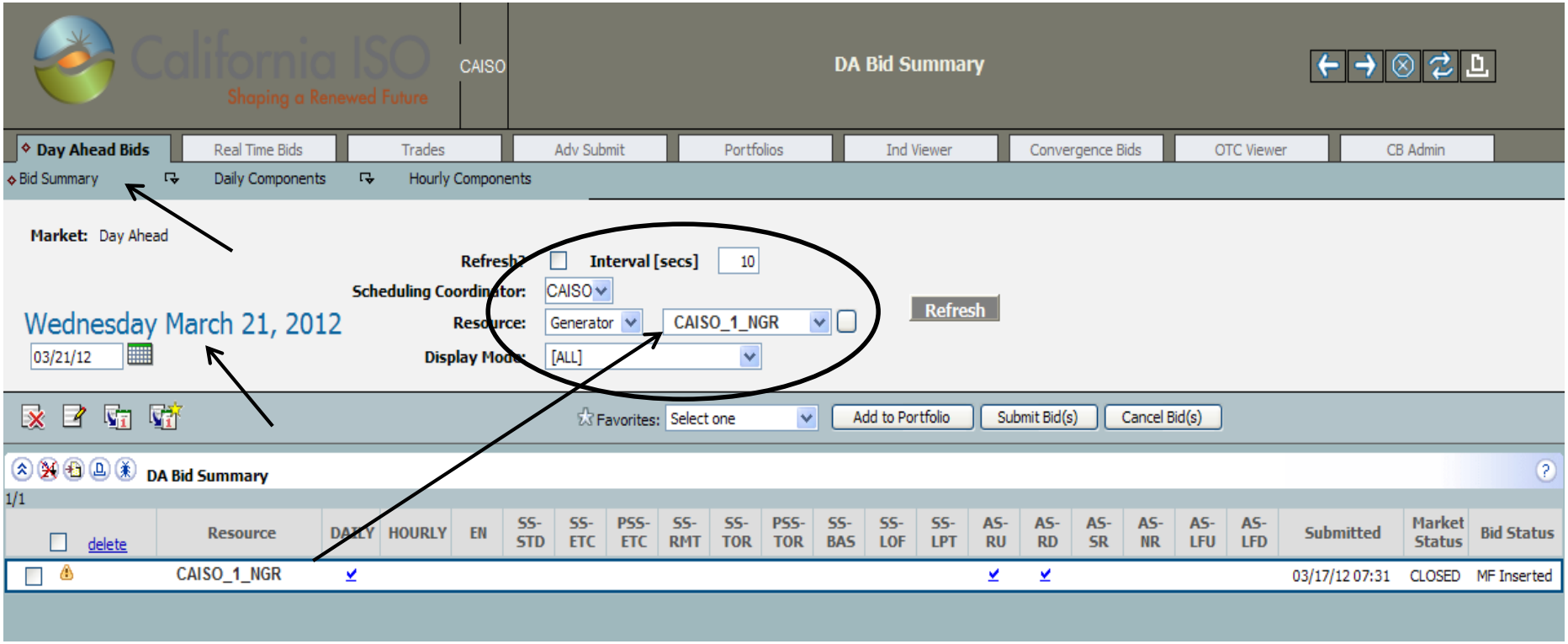
Hour Ending	Bids & Schedules	Inter SC Trades
13	CLOSE	PUBLISHED
14	CLOSE	PUBLISHED
15	OPEN	OPEN
16	OPEN	OPEN

Meetings and Training Calendar

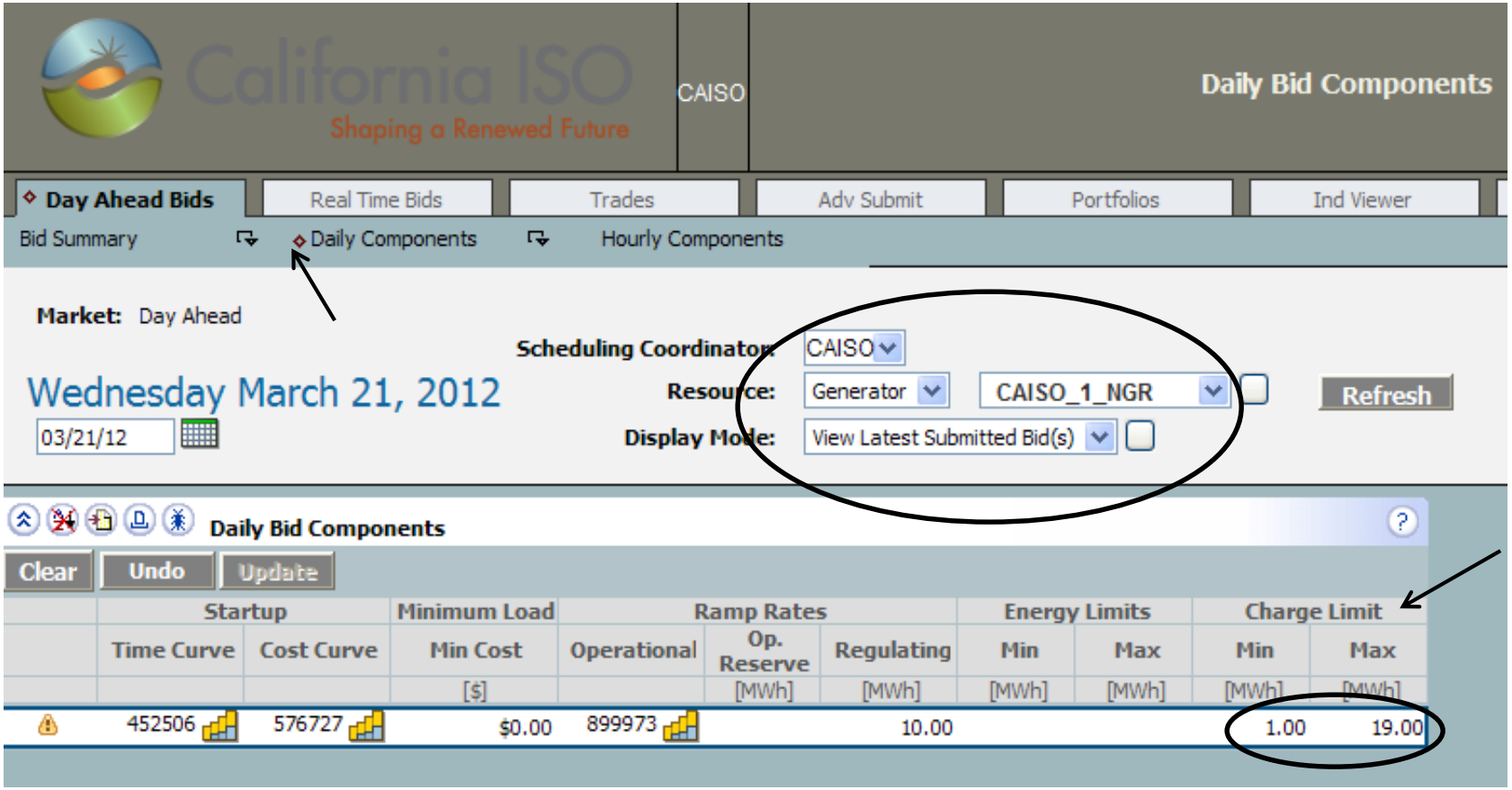
TUESDAY, 12/30/2014

iCal 12:00 AM - 11:59 PM Comments - Bidding Rules Enhancements Issue Paper Documents

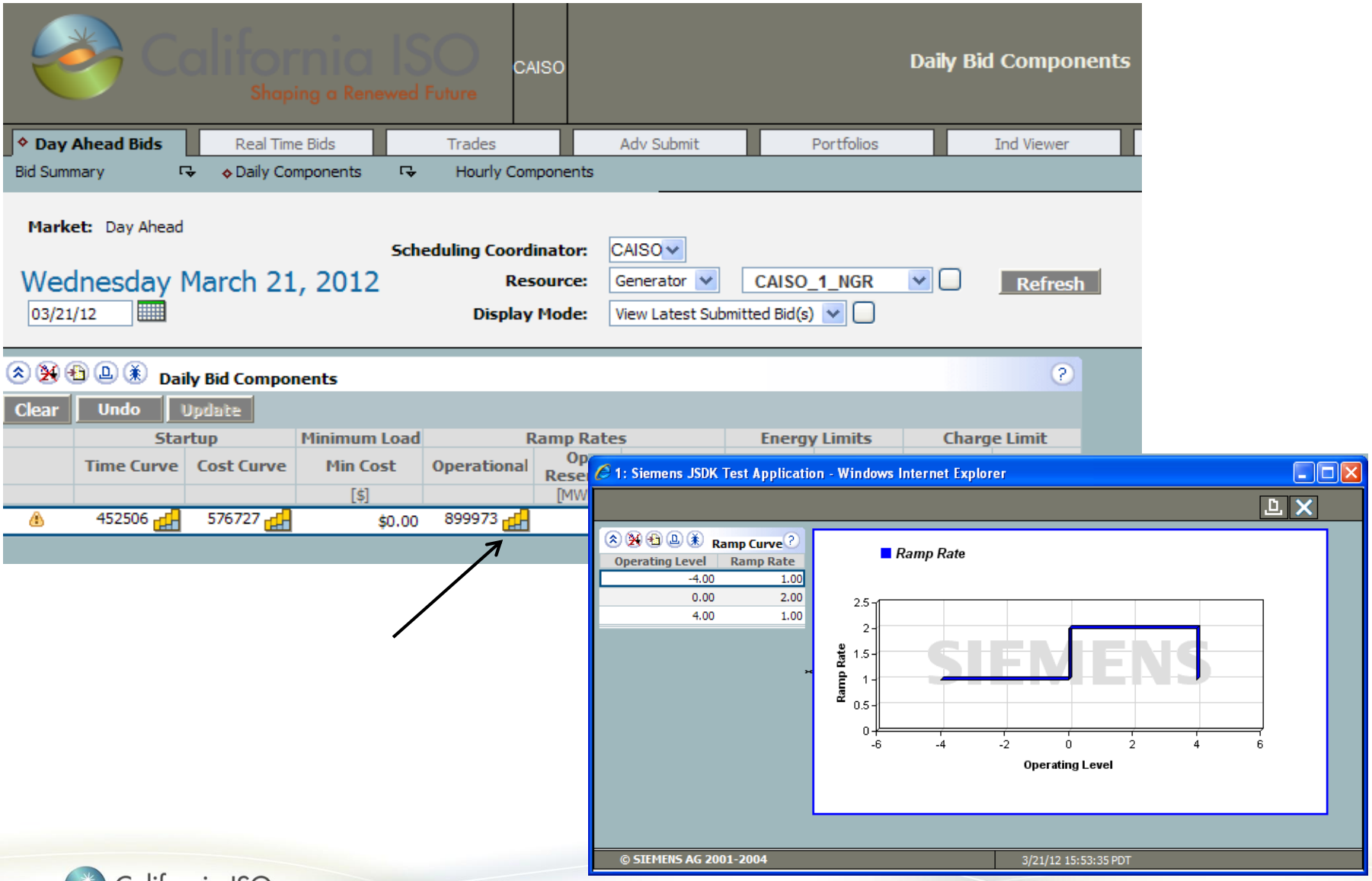
Phase 1 - NGR/REM – Regulation only

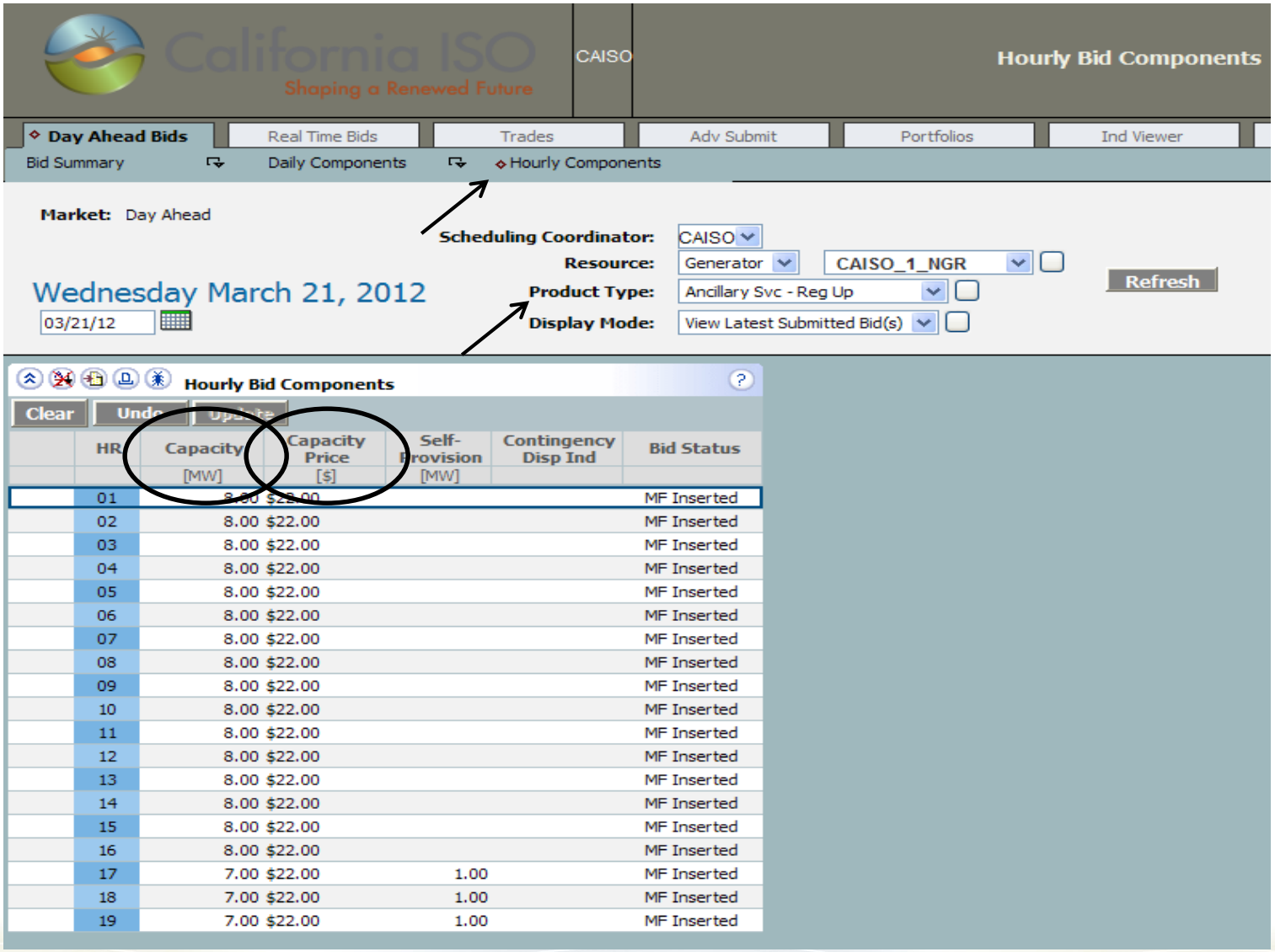


Phase 1 - NGR/REM – Regulation only



Phase 1 - NGR/REM – Regulation only

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Real Time Bids
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Bid Summary
Daily Components
Hourly Components
Market: Day Ahead
Scheduling Coordinator: CAISO
Resource: Generator CAISO_1_NGR
Product Type: Ancillary Svc - Reg Up
Display Mode: View Latest Submitted Bid(s)
Refresh
Wednesday March 21, 2012
03/21/12
Hourly Bid Components
Clear
HR
Capacity [MW]
Capacity Price [$]
Self-Provision [MW]
Contingency Disp Ind
Bid Status
01 8.00 $22.00 MF Inserted
02 8.00 $22.00 MF Inserted
03 8.00 $22.00 MF Inserted
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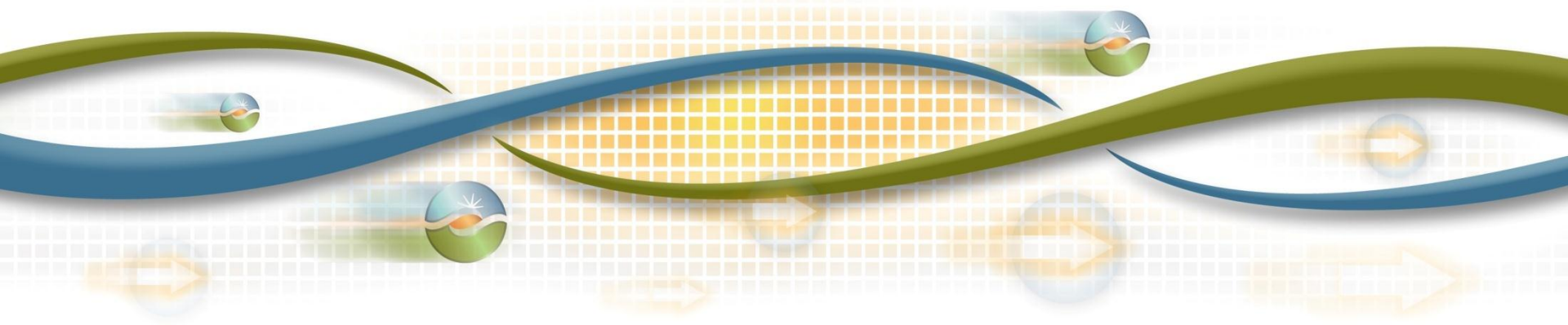
NGR/REM

Phase 1

Energy Management System (EMS)



Phase 1 - NGR/REM
Energy Management System (EMS)

- EMS shall receive NGR telemetry of the following data every four (4) seconds and send to the RTM every minute:
  - Resource Instantaneous Output (MW);
  - For LESR, State of Charge (SOC), which is the actual stored Energy (MWh) in the device;

Phase 1 - NGR/REM
Energy Management System (EMS)

- EMS shall model NGR as a generation resource with supply range of negative to positive.
  - For LESR

    Ex: A battery is discharging at 2 MW, the operation output will be 2MW. A battery is charging at 2 MW, the output will be -2 MW.

- EMS shall control NGR regulation up and down through Automatic Generation Control (AGC) based on NGR Dispatch Operating Target (DOT)
  - NGR provides regulation up if AGC dispatches the NGR above its DOT
  - NGR provides regulation Down if AGC dispatches the NGR below its DOT

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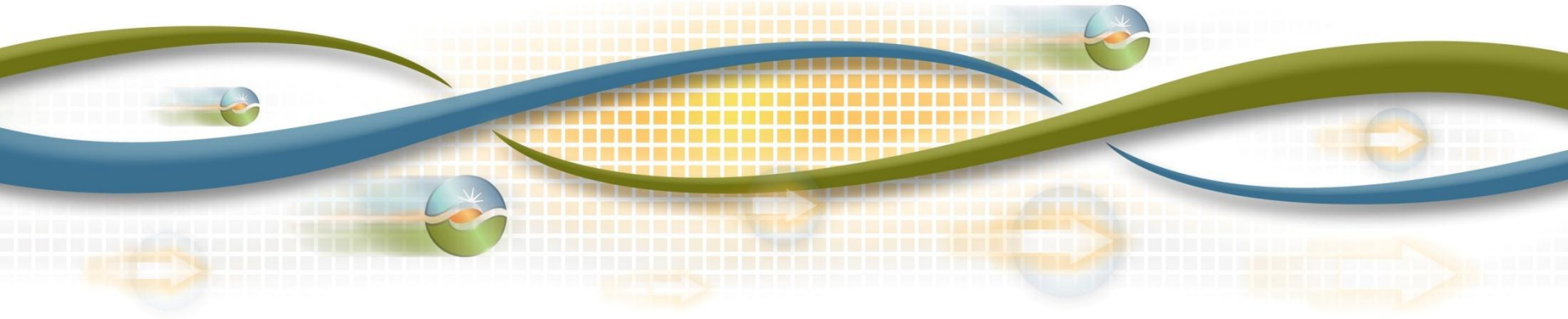
NGR/REM

Phase 1

Settlements



Phase 1 – NGR/REM Settlements

- NGR/REM shall be subject to all existing A/S No Pay categories.
- All energy will be still calculated based on algebraic difference between different MWs.
  - For example, a DOT of 7MW with a DA schedule of -3MW will possibly result in Optimal Energy of 10MW;
- Energy settlement are still based on resource level Locational Marginal Prices (LMP) and resource MWs. A decrease in energy off the CAISO grid normally results in a charge. An increase in energy onto the CAISO grid normally results in a payment.

Phase 1 – NGR/REM Settlements

- CG CC 6474 Real-Time Unaccounted for Energy Settlement
- CG CC 6490 MER WECC Charge
- CG PC Metered Demand TAC Area and CPM
- CG PC Measured Demand Black Start Excluding Exports
- CG PC HVAC Metered Load
- CG PC Measured Demand Emissions Over Control Area
- CG PC Measured Demand Over Control Area Excl Transmission Loss
- CG PC Measured Demand Over Control Area Excluding MSS Energy
- CG PC Measured Demand Over Control Area
- CG PC MSS Netting
- CG PC Real-Time Energy Quantity

****Web location: CAISO.com > Rules > Business Practice Manuals*

Thank You for Attending!!

Please send additional questions to:

MarketTraining@caiso.com