Overview of Reliability Demand Response Resource

Radha Madrigal

Customer Service Department

May 8, 2014
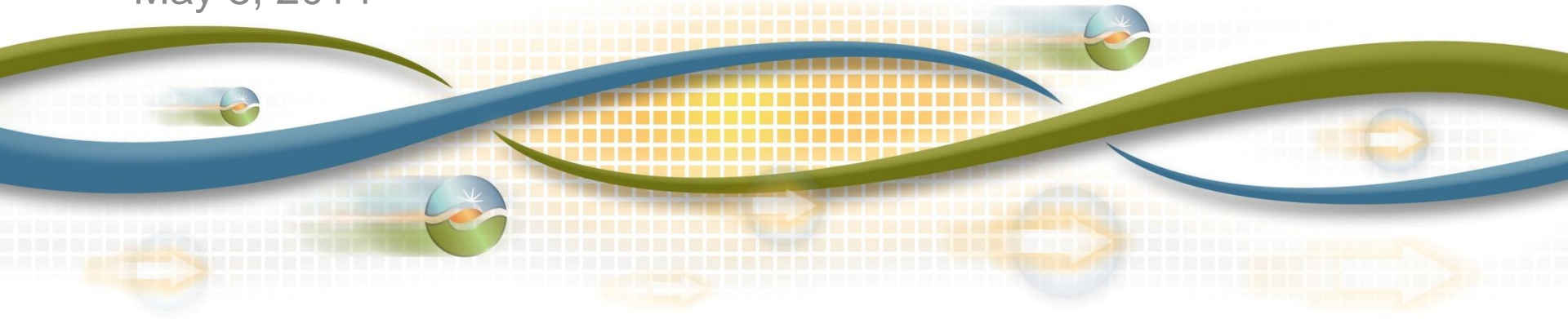
Agenda

- Product overview and purpose

- Define Reliability Demand Response Resource

- Agreements & registration

- Participating in the day-ahead and real-time markets

- Accessing the Demand Response System (DRS)

- Meter data submission

- Baseline methodology for RDRR

- Settlements – Default Load Adjustment (DLA)

PRODUCT OVERVIEW AND PURPOSE

Overview
Reliability Demand Response Resource

- Wholesale demand response product allowing emergency responsive demand response resources to integrate into the ISO market

- Created as a result of a multi-party, cross-industry settlement agreement approved by the California Public Utilities Commission (CPUC)

- Resolves issues concerning quantity, use and resource adequacy treatment of retail emergency-triggered demand response programs

Overview
Reliability Demand Response Resource

- Modeled like a supply resource relying on the functionality and infrastructure designed for *proxy demand resources* (PDR)

- Enables *reliability demand response resources* (RDRR) to offer energy economically in the day-ahead market

- Enables RDRR to offer remaining uncommitted capacity as energy in the real-time market

California ISO
Shaping a Renewed Future

RDRR is…

Compatible with existing retail emergency-triggered demand response programs including:

- Investor-Owned Utilities' interruptible load programs

- Direct-load control programs

- Agriculture and interruptible pumping program

Demand response resources that are configurable to offer day-ahead energy and respond to reliability event in real-time

- Large-single resource

- Aggregated resources

California ISO
Shaping a Renewed Future

Purpose
Reliability Demand Response Resource

- Reliability-only uses include:
  - System emergencies
    - transmission emergencies on ISO controlled grid
    - mitigation of imminent or threatened operating reserve deficiencies
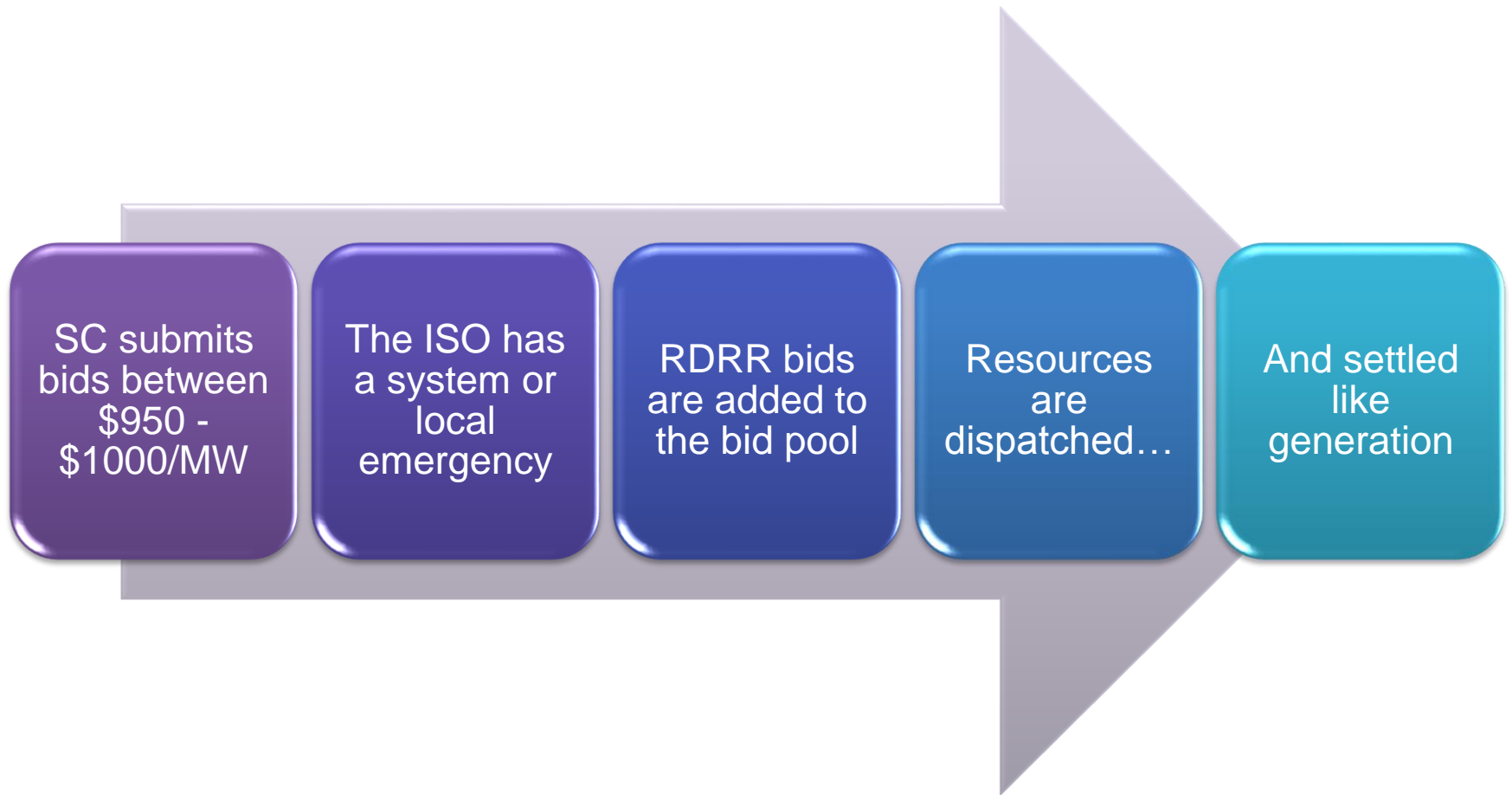 - Resolving local transmission and distribution system emergencies

Purpose
Reliability Demand Response Resource

- Resources provide additional value to respond economically in the day-ahead timeframe yet can curtail real-time load when required under a system or local emergency

- ISO can utilize full available capacity of RDRR in the markets

California ISO
Shaping a Renewed Future

Comparison of PDR and RDRR Designs

Design	Acronym	Services	Market dispatch	Description
Proxy Demand Resource	PDR	Energy, non-spin, residual unit commitment (RUC)	Economic day-ahead and real-time	Bids into ISO markets as supply
Reliability Demand Response Resource	RDRR	Energy	Economic day-ahead, reliability real-time	Bids into ISO markets; used for reliability purposes

ISO PUBLIC © 2014 CAISO

RDRR Real-Time Example

SC submits bids between $950 - $1000/MW → The ISO has a system or local emergency → RDRR bids are added to the bid pool → Resources are dispatched… → And settled like generation

DEFINE RELIABILITY DEMAND RESPONSE RESOURCE

California ISO
Shaping a Renewed Future

Resource Characteristics

Minimum load curtailment ≥ 500kW per RDRR

Must be capable of delivering reliability energy in real-time, reaching full curtailment within 40 minutes

Cannot have a minimum run time of greater than one (1) hour

Must have sustained response period or maximum run time of at least four (4) hours

Resource Characteristics

- Must be dispatchable by the ISO's *automated dispatch system* (ADS) within a geographic location *sub-load aggregation point* (Sub-LAP) for a specific MW quantity

- In Master File, all RDRR resources will:
  - Have a Pmin Value of 0MW
  - Have $0 minimum load cost compensation value registered

Resource Characteristics

- Must be available for up to 15 Events and/or 48 hours per term

- A term is a 6 month period (summer and winter)
  - Summer term runs from June through September
  - Winter term runs from October through May

- Economic participation in the day-ahead market will not reduce availability limits

- RDRR automatically roll-over each term unless demand response provider opts out

Resource Characteristics

- RDRR may elect to participate as a resource that receives discrete dispatches (all or nothing) modeled similar to constrained output generators

  – Resource will be limited in size up to 50MW

- RDRR that do not elect to have discrete dispatches will have no ISO specified megawatt size limitation

- Discrete dispatch election through Generator Resource Data Template and maintained in Master File
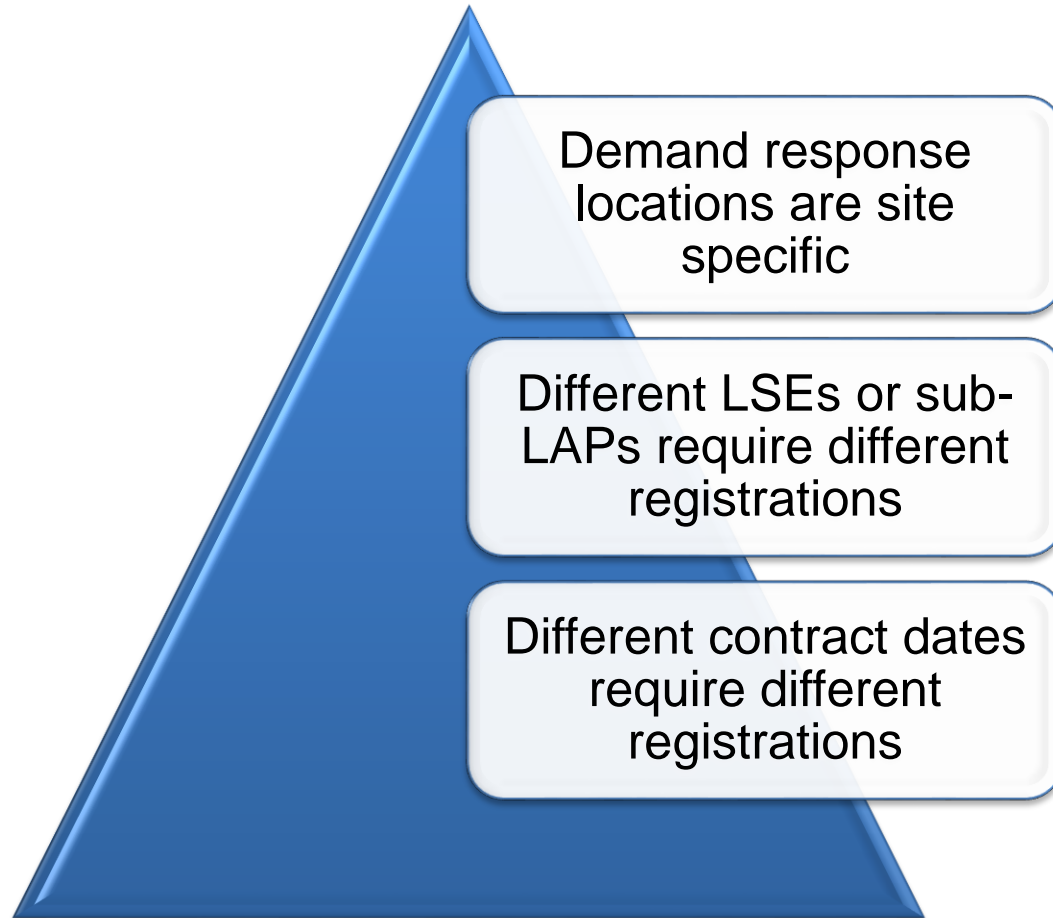
- Discrete dispatch option is for the real-time market only

AGREEMENTS & REGISTRATION

Securing Agreements for Wholesale Participation

- Before participating in the ISO's wholesale markets, Demand Response Provider (DRP) must:
  - Have an agreement with the Load Serving Entity (LSE) who serves the demand responsive load
  - Have an agreement with the Utility Distribution Company (UDC) who distributes the energy to the demand response locations
 - Execute a Demand Response Agreement with the ISO to participate in the wholesale markets

Obtaining California ISO Agreement, DRP ID and System Access

- A guide has been developed for DRP's providing a checklist of tasks that must be completed prior to obtaining access to the Demand Response System (DRS)

  - http://www.caiso.com/participate/Pages/Load/Default.aspx

- Includes additional document links to initiate processes to obtain a DRP agreement and system access

- Documents are in the Proxy Demand Resource section of the page (the registration process is the same)

Key Points

Demand response locations are site specific

Different LSEs or sub-LAPs require different registrations

Different contract dates require different registrations

California ISO
Shaping a Renewed Future

Example 1 – DRP1 contracted with 4 locations in San Diego to provide DR in the wholesale market

San Diego

LSE1

1

3

2

LSE2

4
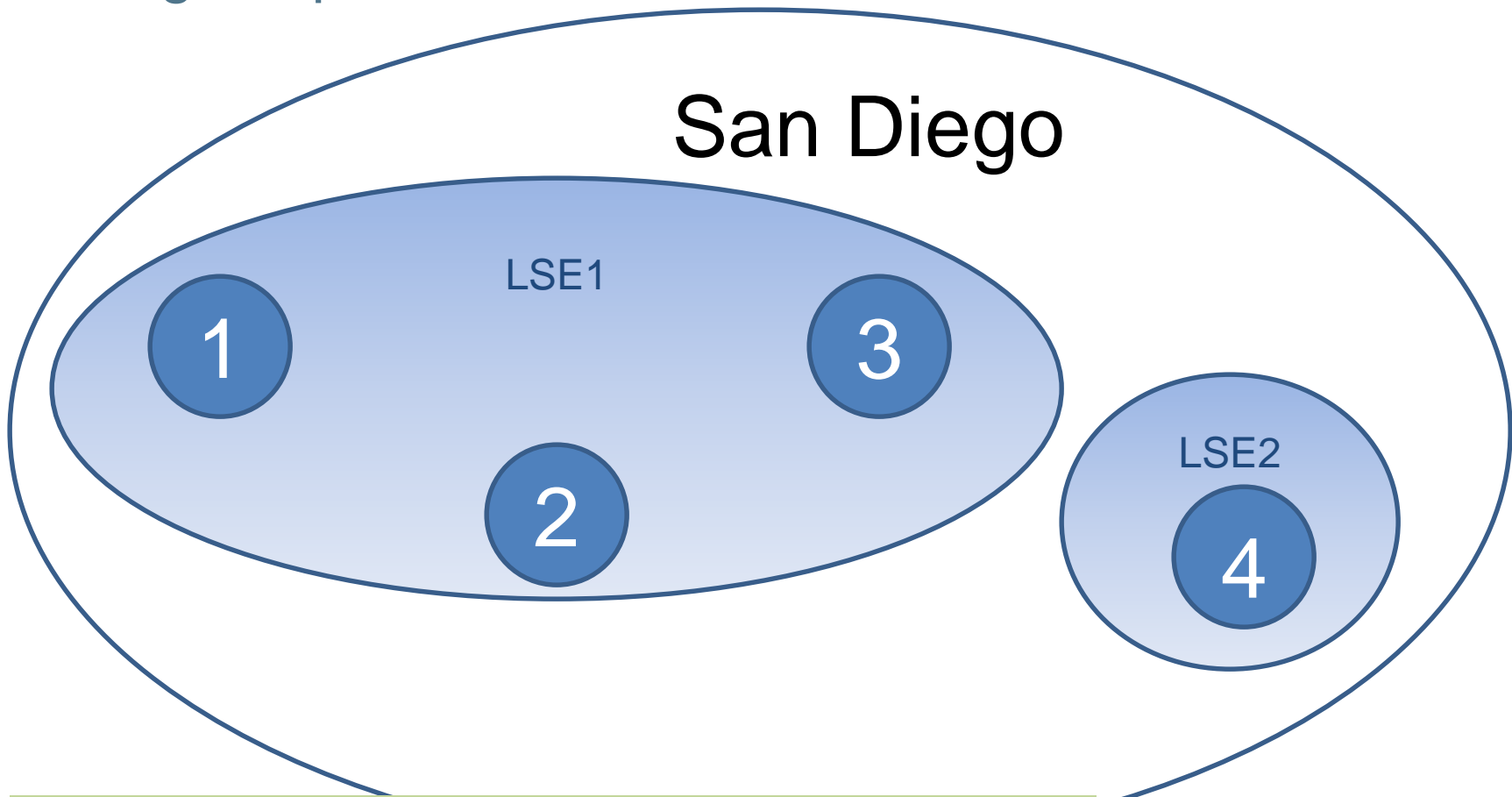
DRP1 will complete a registration for LSE1 and another registration for LSE2

California ISO
Shaping a Renewed Future

ISO PUBLIC © 2014 CAISO

Example 2 – DRP2's locations are all with the same LSE but, the contract dates are not the same

San Diego

Contract period
3/1/12 – 2/28/13

Contract period
8/1/12 – 7/31/13

LSE1

1

2

3
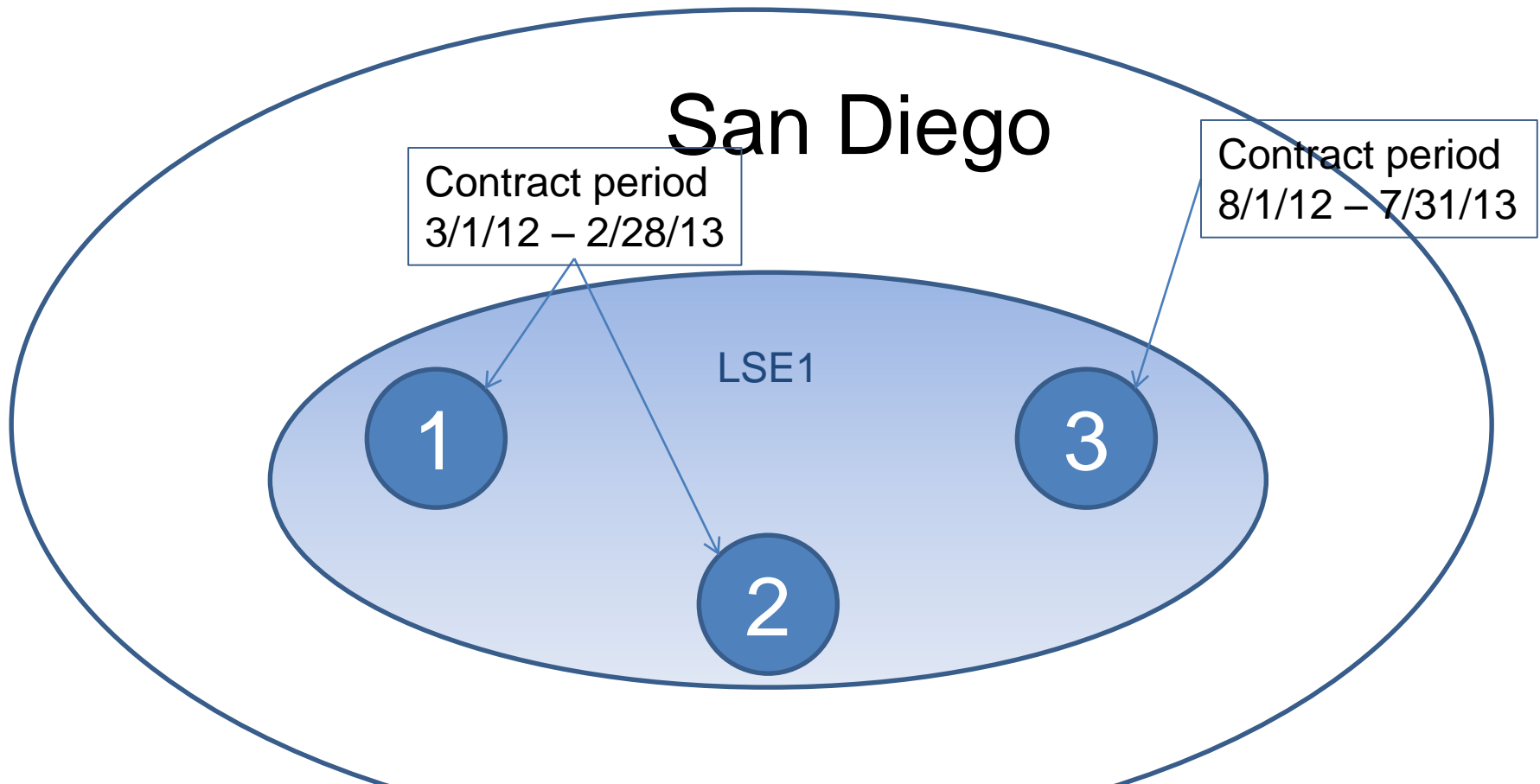
DRP2 will complete 2 separate registrations based on the contract dates

California ISO
Shaping a Renewed Future

ISO PUBLIC © 2014 CAISO

Establishing a Portfolio

- Once agreements are executed and accepted

- DRP requests system access (see checklist)

- Enters customer specific information into DRS to add demand response locations and create registrations

- Using an RDRR Registration, ISO assigns an RDRR Resource ID used in the ISO's wholesale markets

- DRP completes an ISO Generator Resource Data Template (GRDT)
  - Details resource specific characteristics
  - http://www.caiso.com/Documents/GeneratorResourceDataTemplate.xls

Periodic Performance Testing

- One unannounced test dispatch per year to ensure availability and performance of resource

- Test events will count toward RDRR availability limit of 15 events and/or 48 hours per RDRR term

- Test events instructed through exceptional dispatch and settled as test energy

- Availability standards apply for RDRR identified as resource adequacy resources

Participating in the Day-Ahead and Real-Time Markets

Market Rules for RDRR

- Minimum load curtailment must be at least 500kW

- ISO will apply a generation distribution factor to all aggregated RDRR; this is not a biddable parameter

- May not submit RUC availability or ancillary service bids

- May not self-provide ancillary services

- RDRR may receive an exceptional dispatch if system conditions warrant the action

Bidding Rules for RDRR
Day-Ahead Market

- Energy may not be self-scheduled

- Multi-segment energy bid curves may be submitted in the day-ahead market

- Day-ahead energy bids will not be constrained to be in the range of the ISO bid cap and 95% of the bid cap

- Economic participation in the day-ahead market will <u>not</u> reduce availability limits for the RDRR term

Bidding Rules for RDRR
Real-Time Market

- RDRR resources electing to receive discrete dispatches must submit a single segment bid in real-time

- Multi-segment bids may be submitted for RDRR resources not under a discrete dispatch election

- Real-Time energy bids for all RDRR resources must be in the range of the ISO bid cap and 95% of the ISO bid cap

Real-Time Dispatches for Reliability

- Real-time dispatch of RDRR in event of imminent or actual system or transmission emergency as specified in ISO Operating Procedure 4420

- RDRR may be a marginal resource and may be dispatched as such, unless the resource has a discrete dispatch election

- RDRR identified as marginal resource may set the LMP

- RDRR dispatched in real-time settled on a 15-minute (FMM) or 5-minute time scale (RTD)

Real-Time Dispatches for Reliability

- Real-time RDRR dispatches will be received through ADS

- Dispatches of RDRR in real-time will be based solely on the energy bids of RDRR between the ISO bid cap and 95% of the ISO bid cap

- Upon system conditions returning to normal, RDRR returned to "emergency-only" status

- Event (#) and event duration (hours) will be recorded in DRS and counted against total RDRR eligible availability limits of 15 and/or 48 hours within any six (6) month RDRR term

Accessing the Demand Response System (DRS)

https://portal.caiso.com/

California ISO | Market Applications

Application Access

🔓 **AIM** — Access and Identity Management

Inquiries & Disputes

CIDI — Customer Inquiry Dispute and Information

Market & Operations

CMRI — Customer Market Results Interface

CRR — Congestion Revenue Rights

SIBR — Scheduling Infrastructure & Business Rules

SIBR Reports — Scheduling Infrastructure & Business Rules Reports

Metering

OMAR — Operational Meter Analysis & Reporting

OASIS

OASIS — Open Access Same-Time Information System

Outage Coordination

SLIC — Scheduling & Logging for ISO of California

Reliability Requirements

CIRA — California ISO Interface for Resource Adequacy

RAAM — Resource Adequacy Availability Management

Renewables & Demand Response

DRS — Demand Response System

PIRP — Participating Intermittent Resource Program

Settlements

MRI-S — Market Results Interface - Settlements

Systems & Resource Modeling

TR — Transmission Registry

Master File

RIMS — Resource Interconnection Management System

RIMSG — Resource Interconnection Management System - Generation

⚠ Information available   ⚠ Limitted availability   ⚠ Scheduled maintenance or outage   ✕ Unscheduled Outage

California ISO — Shaping a Renewed Future

Purpose of DRS

DRP and SC must provide
an external point of contact

- Registration
- Meter Data Submission
- Calculate energy measurement
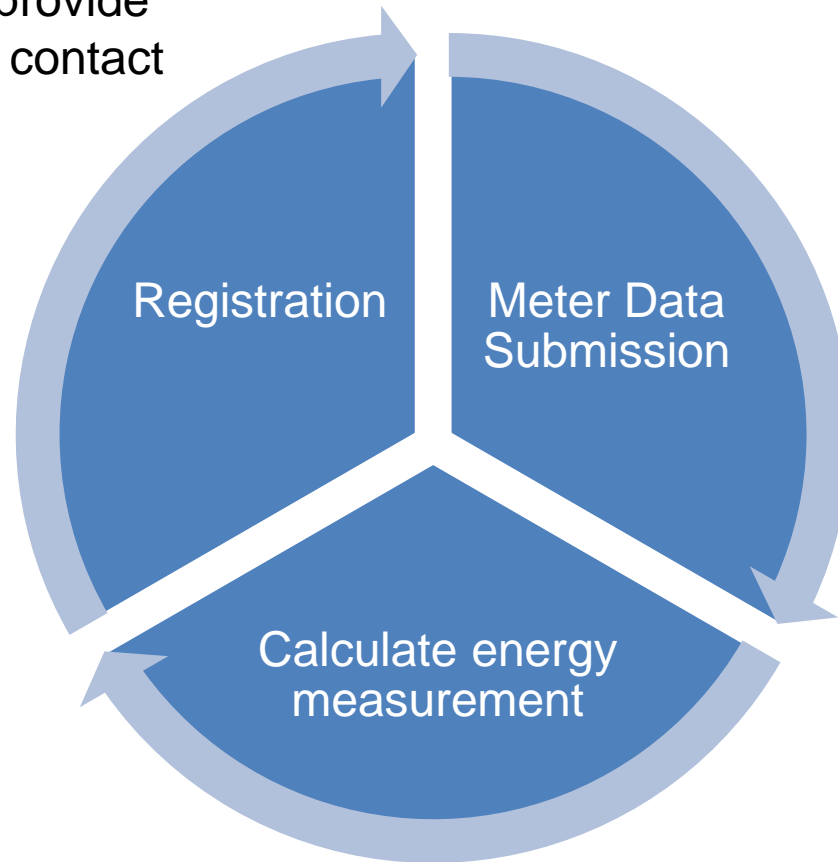
Participants need a
digital certificate for
access to DRS

California ISO
Shaping a Renewed Future

DRPs may perform the following functions in DRS:

Create & modify locations	Create & modify registrations
Review and comment by LSE and UDC	Upload & download meter data
Calculate & download customer baseline information	Evaluate compliance and event information

California ISO
Shaping a Renewed Future

Defining the Terms – Demand Response System

- Locations
  - Physical location of the demand responsive entity
  - Includes customer data like UDC account number, physical service location, curtailable load amounts

- Registration
  - May be comprised of a single location or an aggregation of many locations
  - Aggregation of locations must be served by same LSE and located in same Sub-LAP for approval by LSE and UDC
  - Meter Data information submitted at registration level for baseline calculation prior to market participation

Defining the Terms

- Registration submitted for LSE, UDC review and ISO approval

- RDRR Resource ID assigned by ISO
  - One Registration to One RDRR Resource ID
  - Unique RDRR Resource ID used as identifier for the ISO wholesale markets
  - RDRR Resource ID is utilized for participation in the wholesale markets (scheduling/bidding and settlement)
  - Resource specific information for RDRR Resource ID resides in the ISO Master File

DRS Application Updates
Fields

- Registration Details Screen:
  - Program
  - Season (visible when Reliability program is selected)
  - Discrete Dispatch (visible when Reliability program is selected)
  - Start Date (defaults to today's date)
  - End Date (populated based on end of season date)

- Performance Tab:
  - Method

California ISO
Shaping a Renewed Future

DRS Application Updates
Fields

DRS Application Updates
Fields

DRS Application Updates
Screens

- Seasonal Resource Usage (new)
  - Displays season summary data

- Event Search page
  - Season column added to this page

- Performance Search page
  - Season column added to this page

California ISO
Shaping a Renewed Future

DRS Application Updates
Seasonal Resource Usage

ISO PUBLIC © 2014 CAISO

DRS Application Updates
Event Search Page

DRS Application Updates
Performance Search Page

ISO PUBLIC © 2014 CAISO

Using the Demand Response System

- Instructions for submitting/retrieving information from DRS can be found in the user guide:

  - http://www.caiso.com/Documents/DemandResponseSystem_DRS_ISOUserGuideVersion2_0.pdf

- Technical interface specifications for DRS Exchange Services v20111001 are available: http://www.caiso.com/Documents/TechnicalInterfaceSpecification_DRS_ExchangeServices_20111001_v1-0-1_Clean.pdf

METER DATA

Meter Data Submission

- A RDRR is a scheduling coordinator metered entity
  - SCs submit Settlement Quality Meter Data (SQMD) to the DRS for DRPs they represent

- Used to establish Customer Baseline Load
  - Baseline established using "10 in 10" methodology
  - Simple average of 10 similar non-event days using most recent days prior to an "event"

- A written application may be submitted to the ISO for approval of a methodology for deriving Settlement Quality Meter Data that consists of a statistical sampling of energy usage data

Meter Data Submission - Post Market

- Only the scheduling coordinator for the DRP may submit meter data

- DRP must identify their SC during the registration process and submit User Application Authorization Request Form (AARF) on the SC's behalf

- Only the scheduling coordinator for the LSE can retrieve meter data for the RDRRs associated to their DLAP Resource IDs

- Scheduling coordinator for LSE will need to obtain DRS access (AARF) to see active RDRR resources that impact DLAP Resource IDs

Meter Data Submission - Post Market

- Actual SQMD must be submitted into DRS for the RDRR Resource ID following the ISO meter data submittal timelines
  - T+8B
  - T+48B
  - T+168B - 172B resubmittal window
    - Data submitted during this time period will be subject to the Rules of Conduct, which include a penalty of $1000 per Trade Date affiliated with an SCID

- RDRR resources participating in the day-ahead market may submit data in 60-minute (hourly) interval format for each of the 24 hours in a day

- RDRR resources must submit sufficient SQMD after an event has occurred (historical/event day data)

- All meter data submitted in GMT

Meter Data Submission

- Data needs to be provided for 24 hours for each day
  - hourly intervals for day ahead only, 5-minute intervals for real-time

- Meter data submittal file will accommodate multiple resources and multiple trade days

- For multiple locations in a registration, meter data must be aggregated from underlying loads and submitted

- Meter data is used for different calculations in DRS

- Meter data may be uploaded to DRS in XML format or submitted via API

- XSD Technical specifications for meter data submission can be found in the technical interface specifications

How Meter Data is Used

- Raw Customer Baseline

- Load Point Adjustment (Morning Adjustment)

- RDRR Energy Measurement

California ISO
Shaping a Renewed Future

Validating Performance

- Performance calculation based on a 10-in-10 baseline methodology with a bi-directional morning adjustment capped at 20%

- If approved by the ISO, a DRP may use a different methodology for deriving performance measurement
  - Conform to North American Energy Standards Board (NAESB) standards
  - Will require FERC approval of tariff amendment
    - "Hourly Gen" choice in DRS to accommodate this option

California ISO
Shaping a Renewed Future

Baseline Methodology for RDRR

Standard Baseline Types

- RDRR will rely on 2 North American Energy Standards Board measurement and verification standard baseline types
  - Baseline Type – I
    - Performance evaluation based on historical interval meter data
  - Baseline Type – II
    - Performance evaluation based on statistical sampling to estimate energy consumption of aggregated demand resource where interval metering is not available

Baseline methodology for RDRR Resources using Baseline Type – I

Using Interval Meter Data to Settle for RDRR Resources
Baseline Type – I

- Raw baseline will be calculated

- After the event, the Load Point Adjustment will be calculated for the resource

- Meter data will be used to measure performance

- Resource will be paid based on performance

California ISO
Shaping a Renewed Future

Defining a Customer Baseline

- A customer baseline is an average performance measurement of RDRR when the resource is in a "non-event" state

- Events are defined as anything that would change the performance output of a resource.
  - SLIC outage
  - Day-ahead schedule
  - Real-time dispatch
  - Capacity award

- Calculated using Settlement Quality Meter Data

- Requires 45 days of historic meter data

Defining a Customer Baseline

- When an event occurs, DRS selects the most recent, similar non-event days

- Customer baseline established using "10-in-10" methodology

- Simple average of 10 similar non-event days using most recent days prior to an "event"

- The raw customer baseline can be adjusted up or down by no more than 20% - called a Load Point Adjustment (Morning Adjustment) for the day

- Revised customer baseline is used for the RDRR energy measurement

California ISO
Shaping a Renewed Future

Example of How to Calculate the Baseline

Meter Data Submission HE 16
for 45-Day Historical Customer Baseline Calculation
Trade Date: 6/15 - HE 16

May 2010

SUN	MON	TUES	WED	THUR	FRI	SAT
						1 15.00 WE
2 6.75 WE	3 14.75 E	4 15.50 NE	5 14.20 E	6 14.50 NE	7 13.85 E	8 6.75 WE
9 8.75 WE	10 13.75 NE	11 14.75 NE	12 15.50 NE	13 15.25 NE	14 15.75 NE	15 15.00 WE
16 6.75 WE	17 14.75 E	18 15.50 NE	19 14.20 E	20 14.50 NE	21 13.85 E	22 6.75 WE
23 8.75 WE	24 13.75 NE	25 14.75 NE	26 15.50 NE	27 15.25 NE	28 15.75 NE	29 15.00 WE
30 14.80 WE	31 15.75 H					

June 2010

SUN	MON	TUES	WED	THUR	FRI	SAT
		1 13.75 NE	2 14.00 NE	3 14.75 NE	4 14.00 E	5 6.25 WE
6 8.75 WE	7 13.75 NE	8 15.50 NE	9 14.20 E	10 14.50 NE	11 13.85 E	12 6.75 WE
13 6.75 WE	14 14.75 E	15 ★	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

NE = Non-Event Day
E = Event Day
WE = Weekend
H = Holiday

California ISO
Shaping a Renewed Future

Date	Type	Event	HE 16 Meter Value
5/25/2010	Weekday	N	14.75
5/26/2010	Weekday	N	15.50
5/27/2010	Weekday	N	15.25
5/28/2010	Weekday	N	15.75
6/1/2010	Weekday	N	13.75
6/2/2010	Weekday	N	14.00
6/3/2010	Weekday	N	14.75
6/7/2010	Weekday	N	13.75
6/8/2010	Weekday	N	15.50
6/10/2010	Weekday	N	14.50
	Total		147.5
	Average for Baseline		14.75

- Baseline calculation used for performance evaluation of RDRR resource for Trade Date 6/15/10 – HE 16

  - Raw Customer Baseline = 14.75

How the Baseline is Used

- Raw customer baseline is established as an average of normal (no curtailment) load use

- A Load Point Adjustment (morning adjustment) ratio is applied to the Raw Customer Baseline once per day for each hourly event

- Revised customer baseline establishes basis against which actual meter data is used to determine RDRR energy measurement

California ISO
Shaping a Renewed Future

Defining the Load Point Adjustment
(Morning Adjustment)

- Load Point Adjustment (morning adjustment) triggered by first event of a trade day

- Ratio applied to the raw Customer Baseline based on how the load is behaving on the event day
  - Based on a calculation using 3 prior hours (excludes hour immediately prior to event start) of average load compared with average RDRR Customer Baseline for the same hours
  - Load Point Adjustment ratio has a floor at 80% and a ceiling of 120%
  - If the Load Point Adjustment remains between 80% and 120%, then the calculated ratio is used

Calculating the Load Point Adjustment
ABC Company's Resource

Using ABC Company's RDRR:
Event Day/Hour: June 15, 2010 – HE 16

Load	DR Meter	Raw Baseline
HE12	13.00	14.00
HE13	12.50	14.20
HE14	14.75	15.50
Average	**13.42**	**14.57**

Load Point Adjustment = 13.42 / 14.57
= .9210 or 92.10%

Load Point Adjustment will use 0.9210 multiplier against raw Customer Baseline to establish adjusted Customer Baseline

Calculating the Load Point Adjustment

- Load Point Adjustment factors in actual performance conditions of the trade date (weather-related or other conditions that would affect the RDRR performance)

- Re-adjusts the raw baseline to provide a more accurate adjusted baseline for the event to measure RDRR energy measurement

Raw Customer Baseline		Load Point Adjustment		Adjusted Customer Baseline		Meter Load (6/15/10 – HE16)		RDRR Resource Energy Measurement
14.75	X	0.92	=	13.57	-	12.42	=	1.15 MWH

Comparison – Raw Baseline and Baseline with Load Point Adjustment

Raw Baseline

Adjusted Baseline
Using Load Point Adjustment

Metered Load

06:00

Noon

18:00

Represents actual RDRR performance

California ISO
Shaping a Renewed Future

SETTLEMENTS – DEFAULT LOAD ADJUSTMENT (DLA)

California ISO
Shaping a Renewed Future
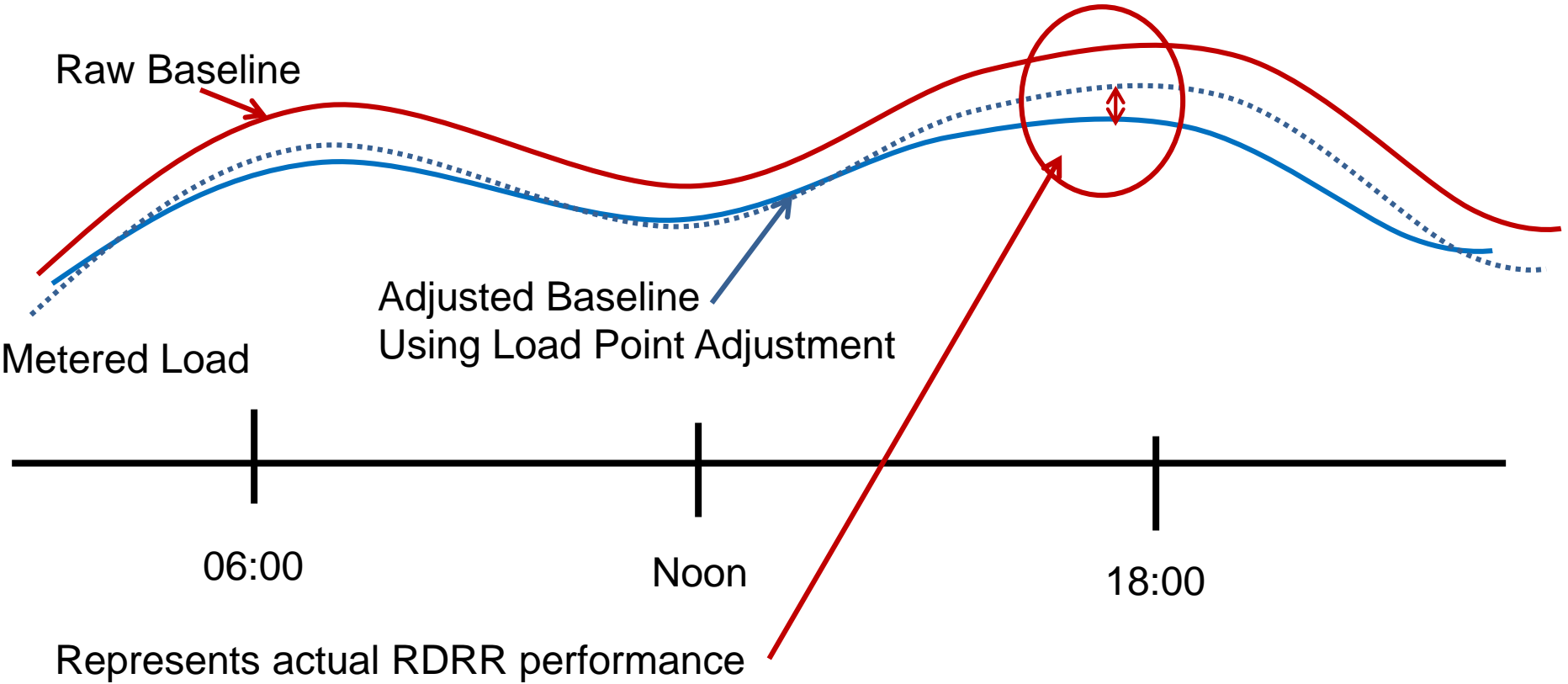
Unique Settlement Rules for Demand Response

- FERC Order 745 required the ISO to implement a Net Benefits Test (NBT)

- NBT establishes price threshold above which demand response resource bids are deemed cost effective

- Settlement impact is to LSE's only

- More information on NBT available on ISO website: http://www.caiso.com/informed/Pages/StakeholderProcesses/DemandResponseNetBenefitsTest.aspx

Default Load Adjustment

- Net benefits test price is used to determine whether or not a Default Load Adjustment (DLA) is applied

- DLA represents the amount of load curtailed (not meeting the net benefits test) within a Default LAP for a specific LSE

- When applicable, a resource-specific DLA will be applied to the LSE's Default LAP Resource ID's metered load

California ISO
Shaping a Renewed Future

Default Load Adjustment

- LSE will see the DLA in the SC bill determinant file

- Detailed information on the calculation and application of the DLA to calculate the LSE Uninstructed Imbalance Energy (UIE) can be found in the BPM configuration guide for pre-calculation of the real-time energy quantity
  - Variable name is: Resource STLMT Interval PDR NBT Load Adjustment Quantity

California ISO
Shaping a Renewed Future

WRAPPING IT UP

Course Summary

- Wholesale demand response product allowing emergency responsive demand response resources to integrate into the ISO market

- Enables Reliability Demand Response Resources (RDRR) to participate in the day-ahead and real-time energy markets

- May not offer RUC capacity

- May not offer ancillary services capacity

- Must complete agreements with LSE, UDC, and ISO

- Registration through the Demand Response System (DRS)

Course Summary

- RDRR design is compatible with existing retail emergency-triggered demand response programs including:

  - Investor-Owned Utilities interruptible load programs

  - Direct-load control programs

  - Agriculture and interruptible pumping program

- RDRR respond to a reliability event for the delivery of "reliability energy" in real-time

  - May be dispatched due to system emergencies

  - May be dispatched to resolve local transmission and distribution emergencies

Course Summary

- Meter data submission through DRS

- Performance evaluated against 10-in-10 baseline methodology

- RDRR is settled similar to generators

- Default Load Adjustment may be applied to Load Serving Entities' metered load based on net benefits test

REFERENCES

California ISO
Shaping a Renewed Future

References

- Reliability Demand Response (initiative page)
  - http://www.caiso.com/informed/Pages/StakeholderProcesses/ReliabilityDemandResponseProduct.aspx
- Reliability Demand Response Product, Revised Draft Final Proposal, Version 2.0. October 14, 2010
  - http://www.caiso.com/Documents/RevisedDraftFinalProposalVersion2-ReliabilityDemandResponseProduct.pdf
- Demand Response System User Guide, Version 2.0, August 11, 2010
  - http://www.caiso.com/Documents/DemandResponseSystem_DRS_ISOUserGuideVersion2_0.pdf
- Business Practice Manual for Metering, Version 9. February 3, 2014
  - http://www.caiso.com/participate/Pages/MeteringTelemetry/Default.aspx
- Implementation Link for RDRR http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=951924EF-AFDA-49D1-93B2-675A3045ED69
- Market Simulation Structured Scenarios (updated May 1, 2014):
- http://www.caiso.com/Documents/FERCOrderNo745-ReliabilityDemandResponseProductStructuredScenario1_0.pdf

California ISO
Shaping a Renewed Future

Acronyms

ADS	• Automated Dispatch System
DLAP	• Default Load Aggregation Point
FMM	• Fifteen-Minute Market
DRP	• Demand Response Provider
DRS	• Demand Response System
LMP	• Locational Marginal Price
LSE	• Load Serving Entity
PDR	• Proxy Demand Resource
RDRR	• Reliability Demand Response Resource
RTD	• Real-Time Dispatch
RUC	• Residual Unit Commitment
SC	• Scheduling Coordinator
SQMD	• Settlement Quality Meter Data
UDC	• Utility Distribution Company

California ISO
Shaping a Renewed Future