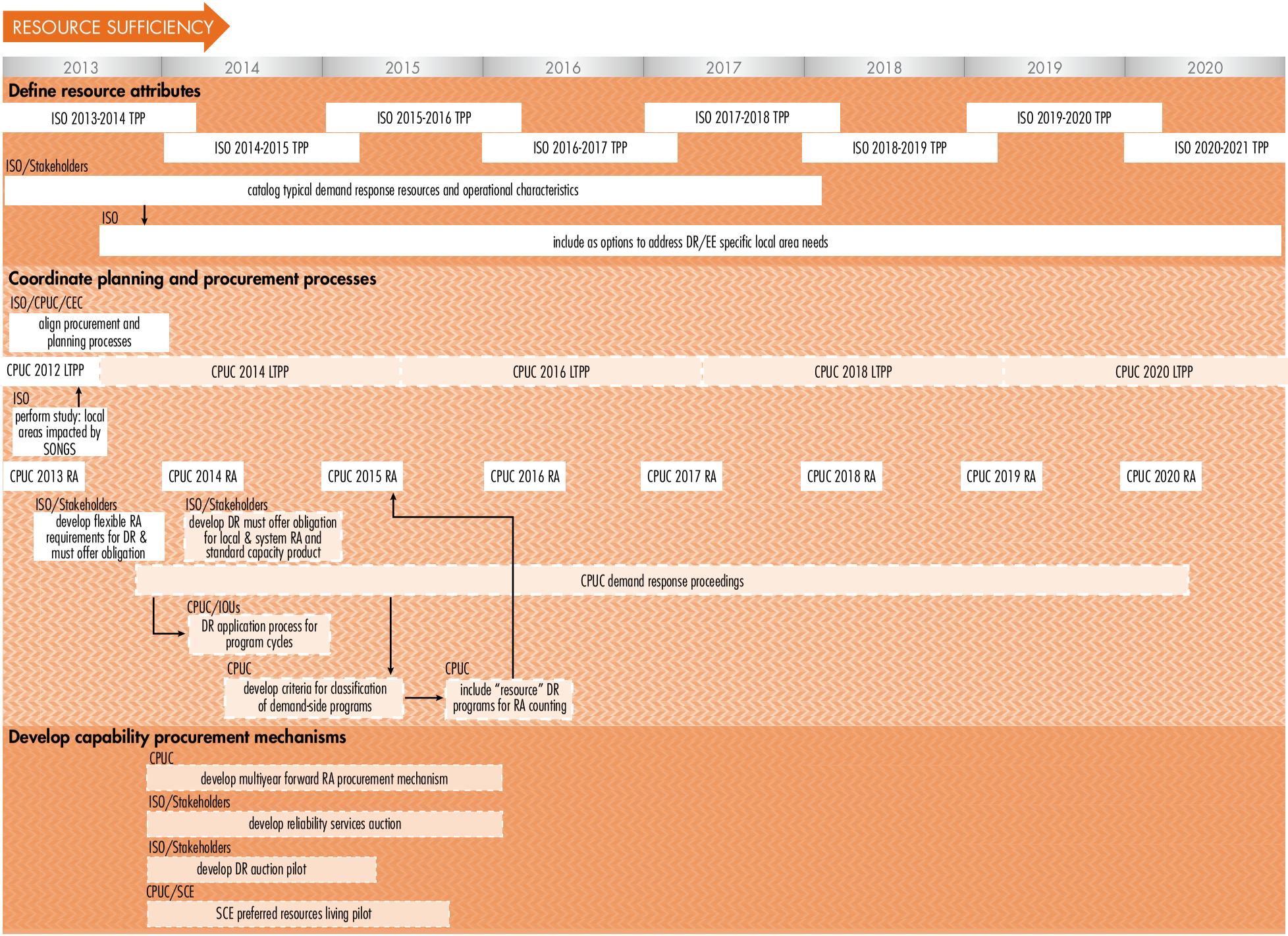

RESOURCE SUFFICIENCY
2013
2014
2015
2016
2017
2018
2019
2020
Define resource attributes
ISO 2013-2014 TPP
ISO 2014-2015 TPP
ISO 2015-2016 TPP
ISO 2016-2017 TPP
ISO 2017-2018 TPP
ISO 2018-2019 TPP
ISO 2019-2020 TPP
ISO 2020-2021 TPP
ISO/Stakeholders
catalog typical demand response resources and operational characteristics
ISO
include as options to address DR/EE specific local area needs
Coordinate planning and procurement processes
ISO/CPUC/CEC
align procurement and planning processes
CPUC 2012 LTPP
CPUC 2014 LTPP
CPUC 2016 LTPP
CPUC 2018 LTPP
CPUC 2020 LTPP
ISO
perform study: local areas impacted by SONGS
CPUC 2013 RA
CPUC 2014 RA
CPUC 2015 RA
CPUC 2016 RA
CPUC 2017 RA
CPUC 2018 RA
CPUC 2019 RA
CPUC 2020 RA
ISO/Stakeholders
develop flexible RA requirements for DR & must offer obligation
ISO/Stakeholders
develop DR must offer obligation for local & system RA and standard capacity product
CPUC demand response proceedings
CPUC/IOUs
DR application process for program cycles
CPUC
develop criteria for classification of demand-side programs
CPUC
include "resource" DR programs for RA counting
Develop capability procurement mechanisms
CPUC
develop multiyear forward RA procurement mechanism
ISO/Stakeholders
develop reliability services auction
ISO/Stakeholders
develop DR auction pilot
CPUC/SCE
SCE preferred resources living pilot

The OPERATIONS PATH

To maximize the value of supply-side demand response, the resources should participate in the ISO market optimization and provide balancing energy or ancillary service capacity. The ISO recognizes that DR resources are not the same as conventional generators and these differences must be understood so that the ISO operators (and the providers of the resources) can proceed with common expectations about performance levels and capabilities. The operations path focuses on addressing the key aspects of demand resources that distinguish them from generators, remove barriers, and provide policy and process changes that support direct participation of DR in the ISO market.

Implement enabling policy

Several CPUC, FERC and ISO market policies and models are important for enabling participation of supply-side demand response resources in the ISO markets.

The CPUC issued a decision in 2012 directing the implementation of Rule 24, which enables direct participation by DR resources in the ISO wholesale market. Rule 24 enables existing utility DR programs, as well as third-party aggregators, to fully participate in the ISO's wholesale market.

In 2013, the ISO made a compliance filing as directed by FERC to make the Reliability Demand Response Resource (RDRR) tariff amendment consistent with FERC Order No. 745. The RDRR model is used to integrate emergency DR programs (also known as reliability programs) into the ISO wholesale market. The ISO target for RDRR implementation is spring 2014.

The ISO implemented the non-generator resource model in 2012, which enables energy storage and load resources to participate through both positive (output) and negative (consumption) operating modes.

The ISO has developed various models to capture and utilize the operating capabilities of all resource types. Stakeholders have expressed some concerns with these models. As a result, the ISO intends to address modeling and other concerns through pilot projects to test different approaches prior to full implementation.

The draft ISO 2013 stakeholder initiatives catalog highlights an effort to combine the features of the ISO's current non-generating resource (NGR) model and the proxy demand resource (PDR) product.[4] The combination will allow non-generating resources, which may be provided by third party aggregators, the capability to provide all ISO products including energy, spinning reserve, non-spinning reserve, and regulation service. This effort will be prioritized through the stakeholder initiatives catalog and may be scheduled depending on stakeholder feedback.

An ISO stakeholder process to define the must-offer obligation for flexible resources, including use-limited flexible resources, is in progress. It supports the recent CPUC decision for the investor-owned utilities to report flexible RA procurement for 2015 compliance. The ISO intends to initiate a subsequent stakeholder effort to address the must-offer obligation for all use-limited resources procured for local and system RA.

Once the ISO gains experience with supply-side demand response operating in its wholesale market, it will review lessons learned and investigate needed policy changes and adjustments to its DR models and baseline calculations. This effort will result in potential new ISO initiatives to be prioritized through the stakeholder market initiatives catalog process.

Gain DR operations experience

Working with the CPUC and the investor-owned utilities, the ISO will integrate as many of the existing DR programs as possible into the ISO market by 2014. This includes working with the CPUC through its regulatory processes to create and support pilot programs designed to meet ISO operational needs. This will provide much needed operational experience that will help assess the effectiveness of each DR resource type for meeting different market needs (i.e., local or system reliability or the need for flexible capacity), and how well existing ISO policies support the participation of different demand response resources.

ISO operators must coordinate with distribution system operators to ensure that central dispatch of demand response resources does not inadvertently result in local distribution system problems or vise versa. The timing for this coordination will be driven by the inclusion of DR programs in the ISO market. As a result of Rule 24 and corresponding pilot programs, the expectation is that there will be considerably more experience with DR participation in the ISO market.

The ISO will work with the local distribution companies to understand their processes and help coordinate centralized ISO and utility distribution dispatch procedures and processes.

[4] http://www.caiso.com/Documents/2013_StakeholderInitiativesCatalog.pdf

Review and refine DR participation processes

The ISO's current demand response resource registration process is time consuming, which can be burdensome for programs with large numbers of participating customers. At a high-level, this process requires DR providers to manually register with the ISO all individual end user service accounts associated with an aggregated dispatchable demand resource. This process is necessary to provide the load serving entities with information about each underlying account to facilitate their review to ensure appropriate participation in DR programs and prevent duplicative registrations and gaming.

Additionally, providers must furnish resource characteristics to the ISO's centralized resource database and obtain a specific resource ID to then be linked with the DR resource registration. The ISO's goal is to streamline the current process for assigning resource IDs as well as registering the individual customer accounts. This will provide the basis to better define necessary requirements and to develop an automated interface for supplying registration data to the ISO.

Leverage new enabling technology

Smart grid technologies offer key capabilities including two-way communication and devices for dispatch and performance measurement, enabling greater demand response participation in the ISO market. These technologies also provide consumers the ability to configure end-use devices to respond to market signals. During the next DR and EE rule making, the ISO will support CPUC and investor-owned utility programs that facilitate and encourage consumer adoption of enabling technology, providing the foundation for pilot programs and longer-term capabilities for ISO market participation or automated device responses that favorably shape load.

As more DR resources are configured to participate as ISO grid resources, new business scenarios will emerge to optimize data aggregation models and the provision of data by third parties. The current ISO requirements for metering and telemetry stipulate direct telemetry and direct ISO metering of individual resources. The ISO recognizes these requirements have not leveraged the capabilities and new models that new technology enables at a much lower cost. The ISO began a stakeholder process in 2013 to evaluate the expansion of metering and telemetry options to support emerging business models and to find lower cost solutions. This effort focuses on alternative cost effective architectures that will provide comparable, secure and reliable data acquisition, communication and response from DR dispatchable resources. This stakeholder process will continue through 2014. Changes will be implemented in phases, starting in 2013, and continuing through 2014 and 2015.

For a resource to become active in the ISO system, it must be added to the network model. This process can take from two to six months depending upon the timing of when the resource enters the process. The ISO has taken steps to reduce this time for DR providers who elect to use pre-defined proxy demand resource registrations, but further improvements are necessary to support resources that would like to leverage other ISO models or wish to customize their registrations. These updates are part of a key architectural project to implement a centralized model management system that will significantly reduce resource activation time. This system is expected to be activated by 2016.

The roadmap identifies the need for a centralized system that maps customer service account locations to ISO pricing nodes that supports registration for ISO market participation. It is the responsibility of the DR provider to perform this mapping prior to registering with the ISO. Providers have advised that this information can only be obtained from the utility in which the customer service account resides and there is no established process to get this information consistently in a timely manner. This tool will also be critical for mapping to the correct price signal by end-use devices that respond to locational signals, but do not participate in the ISO market. The ISO sees a need for the development and management of this central system and recognizes that this information is primarily held by the utilities. The roadmap contemplates an effort led by the CEC or CPUC, with the timing to be determined at a later date.

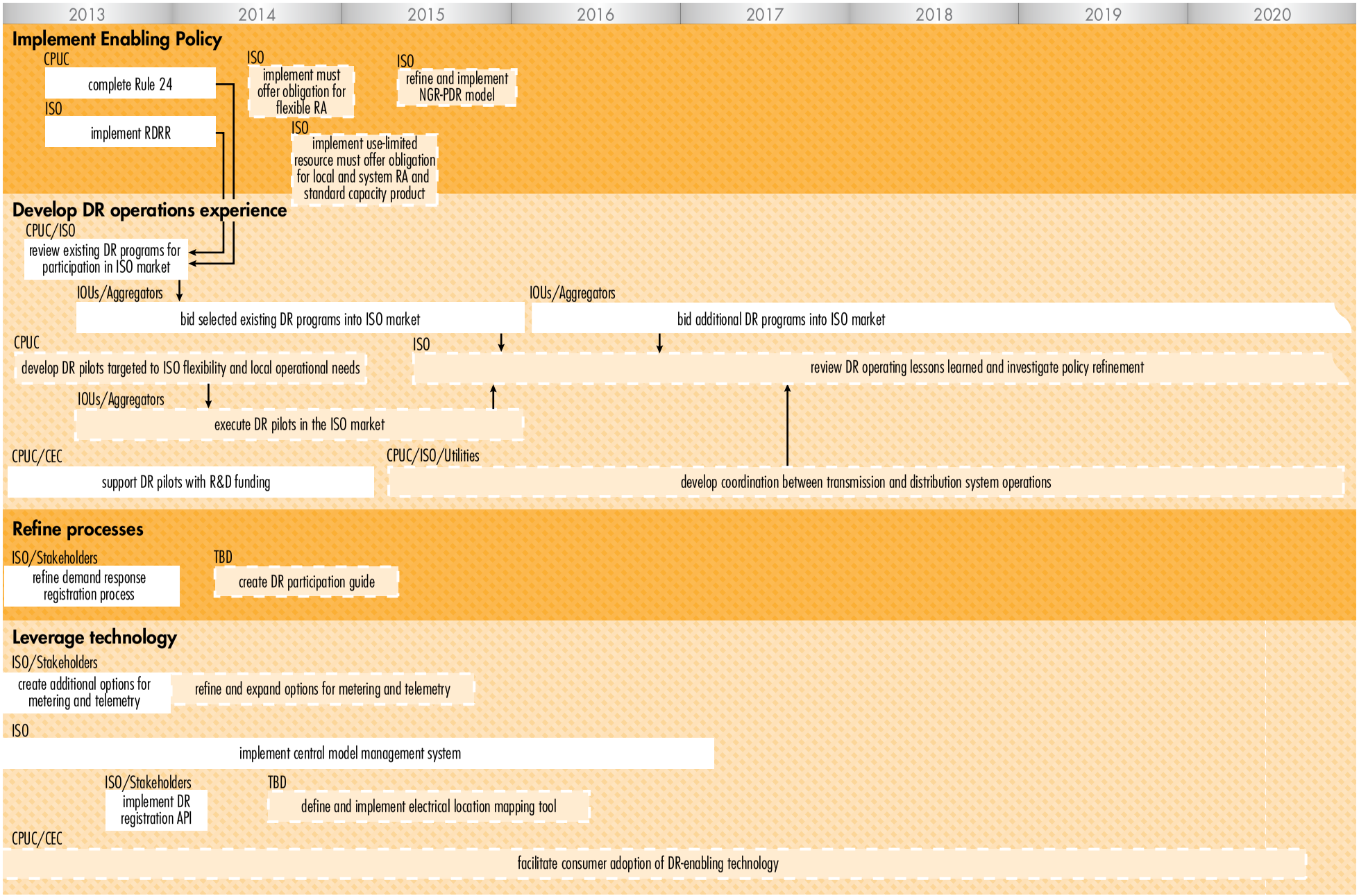
Wholesale demand response models vs. Demand response programs and products

In the wholesale market, there is often confusion regarding DR models, products or programs. The ISO operates a wholesale electricity spot market that clears submitted supply and demand bids and procures sufficient resources and services to reliably serve the balancing area authority and satisfy applicable mandatory reliability criteria. The ISO does not operate or offer programs, but has market systems, tools and rules that allow different resource types to competitively offer energy and ancillary services on a level playing field, while striving to accommodate and balance the unique characteristics of different resource types. For instance, a supply-side DR resource, whether classified as participating load, proxy demand resource, or non-generator resource, may be loosely referred to both within the ISO and externally as a "program" or "product." The different wholesale DR opportunities listed in the table below are more properly characterized as models or market mechanisms rather than as programs or products. These market models, along with their respective tariff-based rules, enable differently configured demand resources that have different relationships between the DR provider and load-serving entity to participate and settle in the ISO market under the ISO tariff as a dispatchable resource, akin to a generator. No single model can accommodate all demand resource configurations and relationships, thus several market models exist under the ISO tariff, each having different benefits and limitations. The following table summarizes the different existing and proposed demand models in the ISO market.

MODEL	INCEPTION	ELIGIBLE MARKET SERVICES	DRP/LSE RELATIONSHIP
Participating load	1999	Non-spinning reserves	DRP and LSE must be the same entity
Proxy demand resource (PDR)	2010	Day-ahead and real-time energy, non-spinning reserves, and spinning reserves*	DRP can be a separate entity than the LSE
Non-generator resource (NGR)	2012	Day-ahead and real-time energy, non-spinning reserves, spinning reserves,* and regulation*	DRP and LSE must be the same entity
Reliability DR resource (RDRR)	To be re-filed at FERC	Day-ahead and real-time energy	DRP can be a separate entity than the LSE
NGR/PDR	Under consideration in 2013 stakeholder initiatives catalog	Day-ahead and real-time energy, spinning reserve, non-spinning reserve, and regulation service	DRP can be a separate entity than the LSE

**The Western Electricity Coordinating Council (WECC) Standard BAL-002-WECC-2 contingency reserve standard has been approved by FERC. Implementation by WECC is expected in 2014.*

OPERATIONS


2013
2014
2015
2016
2017
2018
2019
2020
Implement Enabling Policy
CPUC
complete Rule 24
ISO
implement RDRR
ISO
implement must offer obligation for flexible RA
ISO
refine and implement NGR-PDR model
ISO
implement use-limited resource must offer obligation for local and system RA and standard capacity product
Develop DR operations experience
CPUC/ISO
review existing DR programs for participation in ISO market
IOUs/Aggregators
bid selected existing DR programs into ISO market
IOUs/Aggregators
bid additional DR programs into ISO market
CPUC
develop DR pilots targeted to ISO flexibility and local operational needs
ISO
review DR operating lessons learned and investigate policy refinement
IOUs/Aggregators
execute DR pilots in the ISO market
CPUC/CEC
support DR pilots with R&D funding
CPUC/ISO/Utilities
develop coordination between transmission and distribution system operations
Refine processes
ISO/Stakeholders
refine demand response registration process
TBD
create DR participation guide
Leverage technology
ISO/Stakeholders
create additional options for metering and telemetry
refine and expand options for metering and telemetry
ISO
implement central model management system
ISO/Stakeholders
implement DR registration API
TBD
define and implement electrical location mapping tool
CPUC/CEC
facilitate consumer adoption of DR-enabling technology

The MONITORING PATH

To ensure that the initiatives described in this roadmap are accomplishing their objectives, and to be able to design suitable modifications as needed, it is essential to design, from the beginning, mechanisms for monitoring progress and outcomes. This, in turn, can provide feedback to the people and organizations responsible for the initiatives. As the essential feedback loop to the other three paths, the monitoring path focuses on a number of key questions, including, but not limited to the following:

- *Are committed DR and EE programs and resources being developed on schedule to be in service and, therefore, available by the time they will be needed to ensure grid reliability?*
- *Are the actual impacts and performance characteristics of DR and EE programs and resources at least as good as they were expected to be?*
- *Are the DR and EE programs and resources that were targeted to achieve specific load shaping effects meeting those objectives?*
- *Are DR product definitions and other provisions for ISO market participation attracting the expected volume and quality of DR resources?*

Through ongoing monitoring of these and other questions regarding the outcomes of the various initiatives, the ISO and the state agencies can, in collaboration with stakeholders, identify and make needed adjustments or, as appropriate, develop alternative approaches to better achieve the desired results.

Track DR and EE program development

The roadmap targets 2014 for the ISO, CEC and CPUC to reach consensus on a process to track the development of DR and EE programs. This activity is crucial for the ISO's transmission planning process to ensure that DR and EE resources selected as alternatives to transmission upgrades will be in operation by the time the identified transmission solution is needed. Because of the lead time needed to build transmission and generation, a subsequent cycle of the ISO's transmission planning process would be the appropriate venue for the ISO to assess, based on information coming from the monitoring process, whether the selected DR or EE resources will be completed in a timely manner. If it appears these resources will not be available within the prescribed time frames, the ISO and CPUC will then be in the position to determine an alternative course of action for meeting the need for transmission upgrades or generation capacity.

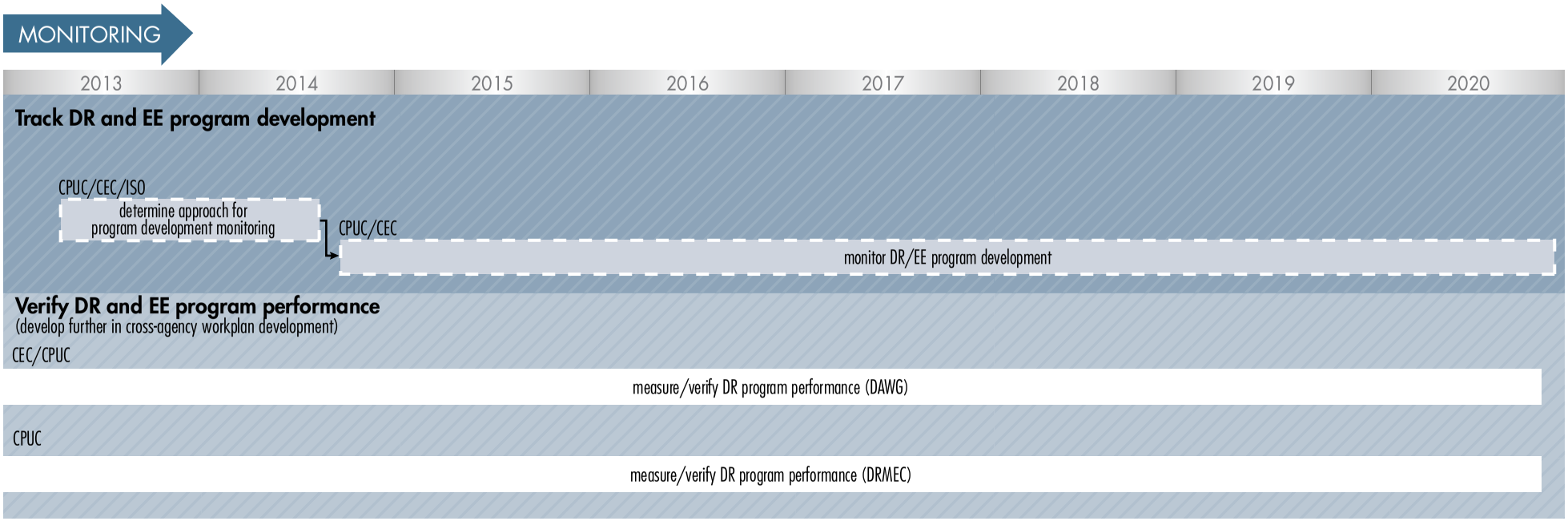
Verify DR and EE program performance

Performance verification for alternative resources such as demand response and energy efficiency is essential for at least two main reasons. First, it provides the needed feedback to ensure resource adequacy, and it enables the CPUC to make program adjustments or choose alternative approaches when needed. Second, it provides the means to determine whether subsequent cycles of the demand forecast are correctly accounting for DR and EE load impacts.

With regard to the first point, this roadmap envisions a collaborative stakeholder process to assess resource performance needs for ISO system operation (response time, speed and duration of response, location, etc.) in concert with the needs of market participants that will provide demand response resources (operational limitations and expectations, adequate compensation for value provided, etc.)

The end goal is to cooperatively develop EE and DR resources that meet the needs of the system operator, market participants and customers. Performance verification will subsequently be needed to assess whether what was designed in theory is achieving the objectives of real-time markets, or if the rules and requirements of the ISO market for alternatives need to be modified.

Currently, two working groups—DAWG and Demand Response Measurement Evaluation Committee (DRMEC)—assess EE and DR program impacts, respectively. Each working group has sub-groups that focus on different aspects of load modifying and DR resource performance results. The evaluation, measurement and verification processes provide valuable feedback to assess the program effectiveness for future program development and for any needed adjustments in forecasting program impacts on the state's mission of creating a greener and more reliable power grid to serve California.


MONITORING
2013
2014
2015
2016
2017
2018
2019
2020
Track DR and EE program development
CPUC/CEC/ISO
determine approach for program development monitoring
CPUC/CEC
monitor DR/EE program development
Verify DR and EE program performance
(develop further in cross-agency workplan development)
CEC/CPUC
measure/verify DR program performance (DAWG)
CPUC
measure/verify DR program performance (DRMEC)

NEXT STEPS

On June 17, 2013 the ISO presented a roadmap draft at the CEC's IEPR demand response workshop. Stakeholders then submitted comments to the ISO and to the CEC on the workshop as a whole.[5] The ISO reviewed and considered the comments in developing this revised version. It was evident that stakeholders spent considerable time and effort in composing their feedback and opinions. Overall, the comments supported the ISO roadmap structure and related activities. Stakeholders communicated their appreciation for the ISO development of the roadmap and emphasized the need for coordination with the CEC and CPUC. Several stakeholders provided additional information to improve the ISO's understanding of existing conditions and the important work that still needs to be done to create a market for DR and EE in California.

The CPUC, CEC and ISO are developing a cross-agency DR and EE work plan using this roadmap as a starting point. This effort, in collaboration with stakeholders, will create a work plan with specific activities, milestones, and coordination dependencies across state agencies. The ISO and agencies are currently tracking and managing regulatory actions pursuant to the ISO to ensure critically needed progress continues. The work plan will ultimately replace the ISO roadmap for tracking and management and will be refreshed regularly as the industry transitions to a more sustainable, reliable and green power grid.

[5] The comments to the ISO are posted at: http://www.caiso.com/informed/Pages/StakeholderProcesses/DemandResponseInitiative.aspx. The comments submitted to the CEC are available at: http://www.energy.ca.gov/2013_energypolicy/documents/2013-06-17_workshop/comments/.

The following table captures key activities by agency outlined in this roadmap to advance demand response and energy efficiency.

GOAL	ACTIVITIES	CPUC	ISO	CEC
Ensure consistent assumptions in ISO, CEC, and CPUC planning and procurement processes	Identify process interaction and dependencies	X	X	X
	Identify and implement adjustments to processes	X	X	X
Modify load shape to reduce resource procurement requirements, mitigate over-generation, and moderate ramp	Create targeted EE programs and incentives to locations and time periods	X	O	O
	Investigate and define retail rate options	X		
	Develop approach to align retail rates with grid conditions	X	X	
	Execute pilots and measure load shape impacts of above measures	X		O
	Implement effective load reshaping measures	X		
	Evaluate Flex Alert program effectiveness and transfer administration and funding	X	O	O
	Develop centralized electrical location mapping tool	O		O
Clarify ISO needs for DR and EE to be most effective in planning and operations	Capture DR resource types and operational attributes in base catalog to support ISO transmission planning process		X	
	Include DR and EE resources in selected ISO transmission planning studies		X	
	Perform study of local areas impacted by SONGS		X	
	Develop flexible RA requirements for DR and ISO must offer obligation for flexible resources	O	X	
	Develop ISO must offer obligation for use-limited local and system RA and standard capacity product for DR	O	X	
Ensure resources are procured and developing to meet capability, timing, and location needs	Develop more granular forecasts for EE	O		X
	Develop criteria for classification of demand-side programs	X	O	
	Include load-modifying DR programs in demand forecast			X
	Revise RA counting for DR programs classified as supply resources	X	O	
	Develop policy guidance for DR and EE programs targeted to meet needs	X	O	
	Develop approach to monitor progress of DR and EE program development and implementation	O		O
	Develop multi-year forward RA requirements and procurement mechanism	X	O	
	Develop market-based replacement for ISO backstop capacity (CPM replacement)	O	X	
	Develop DR auction pilot	O	X	
	Evaluate and measure DR and EE program effectiveness	X		X
Increase DR program and pilot participation in ISO market developing operations experience and providing feedback for policy refinement	Complete CPUC Rule 24	X		
	Implement ISO RDRR		X	
	Bid DR resources into ISO markets	X	X	
	Expand ISO metering and telemetry options		X	
	Refine and automate wholesale DR registration process		X	
	Execute PG&E intermittent resource pilot in ISO market	O	X	
	Modify and implement ISO NGR – PDR model		X	
	Define and execute pilot programs and assess resource flexibility capabilities	X	X	O

X = primary/lead role; O = support role

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> Visual Analysis
> Glint and Glare Analysis
> Photo Simulations
> 3D Animations
> Expert testimony
> Litigation/Expert Witness

SEMINARS

> AEP Solar Presentation 2014
> University of Idaho, Lecturer – Virtual Technology and Design, 2012
> POWER Delivery, Presenter – Visualization Technology, 2008-2011
> University of Idaho, Lecturer – Emerging Landscapes, 2011
> University of Idaho, Lecturer – Virtual Technology in the Engineering, 2011
> EUCI – Presenter, Visualization Technology, 2009,10,11
> EEI – Presenter, Visualization Technology 2008,2011
> University of Idaho, Lecturer – Landscape Architecture, 2010
> University of Idaho Advisory Board for Landscape Architeture/Virtual Technology & Design,, 2008-2012
> University of Idaho, Guest Lecturer – Landscape Architecture, 2009
> University of Idaho , Guest Lecturer – Landscape Architecture, 2008
> AIA Luncheon Series, Guest Lecturer, 2007
> Idaho Transportation Department, Presenter 2006, 2007, 2008
> Virtual Fire Training Lecturer, Long Distance Learning Center, Boise, ID 2007,08

EXPERIENCE SUMMARY

Jason Pfaff is the Department Manager for POWER's Visualization and Visual Resources Department. Jason has a degree in landscape architecture and has over 20 years in planning with an emphasis in visual analysis and visualization technology. Jason got his start as an environmental planner in 1993, managing transmission, generation and distribution projects for an environmental planning firm called Dames and Moore. Specializing in visual analysis, Jason focused his career on the use and applications of visualization technology to qualify visual analysis methods and results. He found that visualization technology was one of the best tools to design, analyze and present information. In 2000, Jason took his passion for visualization technology and founded and because president/CEO of Visual Genesis, Inc. Visual Genesis was seen as leaders in visualization technology. In 2008, Visual Genesis, Inc. was acquired by POWER Engineers. Today Jason directs a creative team of Architects, Engineers, planners and graphic designers to solve some of the most complex visual challenges faced by our clients.

RECENT SOLAR GLARE PROJECT EXAMPLES:

- **Westwood Maxton, Solar Project – 2014**
- **Cabrillo Solar Project, 2014**
- **EPD Sunedison Project, 2014**
- **San Diego Ballpark Village 2013, 2014**
- **8 Minute Energy, Calexico – 2013**
- **Soitec Boulevard Project – 2013**
- **Aloha Solar Energy, Kalaeloa Solar Project – 2013**
- **Ocotillo Wells Solar, Gildred Co – 2013**
- **East Kapolei Solar Project, Aloha Solar – 2013**
- **Beechwood Builder Green Solutions, 2013**
- **Laurinburg Solar Project 2013-2014**
- **Soitec Generic Solar Project, 2013**
- **Westwood Skyfuel Project, 2013**
- **SunPower, Inc C7, Solar Study**
- **MEMC Kuala Lumpur International Airport Solar Project-2012**
- **Silverado Solar Project, 20, 200kV project Animations**
- **PaloVerde**
- **SunPower, Blythe I Solar Project (Glare Analysis), California 2011-2012**
- **Palo Verde Mesa Solar Project, RRG – 2012**
- **Blythe Mesa Solar Project, RRG 2011**

- **Calico Solar Project, Calico LLC – 2012**
- **Tessera Solar, Imperial Valley – 2011/2012**
- **Borrego Springs, 2011**
- **Desert Green Project, Soitec**

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Andy Stephens is part of POWER's Visualization and Visual Resources Department. Andy has a degree in virtual technology and design and has over 7 years of visualization experience with an emphasis in visual analysis and solar technology. Andy got his start as a designer for Hewlett Packard in 2009, developing marketing and training visuals for the small business sector. Andy was recruited by POWER in 2011 and focused his career on the use and application of visualization technology to qualify visual analysis methods and results. He found that visualization technology was one of the best tools to design, analyze and present information. While at POWER, he has tailored his skillset to the analysis and visualization of solar technologies and continues to excel at simplifying complex problems in an ever changing industry.

RECENT SOLAR GLARE PROJECT EXAMPLES:

- **Kalaeloa Solar Project – 2014**
- **Kahului Airport Project – 2014**
- **Westwood Maxton, Solar Project – 2014**
- **Cabrillo Solar Project – 2014**
- **EPD Sunedison Project – 2014**
- **Hemet Solar Project – 2014**
- **San Diego Ballpark Village 2013, 2014**
- **8 Minute Energy, Calexico – 2013**
- **Soitec Boulevard Project – 2013**
- **Aloha Solar Energy, Kalaeloa Solar Project – 2013**
- **Ocotillo Wells Solar, Gildred Co – 2013**
- **East Kapolei Solar Project, Aloha Solar – 2013**
- **Beechwood Builder Green Solutions – 2013**
- **Laurinburg Solar Project – 2013, 2014**
- **Soitec Desert Green Solar Project – 2013**
- **Westwood Skyfuel Project – 2013**
- **SunPower, Inc C7, Solar Study – 2012**
- **MEMC Kuala Lumpur International Airport Solar Project – 2012**
- **Palo Verde Mesa Solar Project, RRG – 2012**
- **Blythe Mesa Solar Project, RRG – 2011,12**
- **Calico Solar Project, Calico LLC – 2012**
- **Silverado Solar Project, 20, 200kV project Animations – 2011**