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California ISO

DEMAND RESPONSE AND ENERGY EFFICIENCY ROADMAP:

MAXIMIZING PREFERRED RESOURCES

DECEMBER 2013

ISO VISION

The ISO envisions demand response and energy efficiency becoming integral, dependable and predictable resources that support a reliable, environmentally sustainable electric power system.

Energy efficiency and demand response have a long history in California and are already contributing to lower costs and reduced environmental impacts. Utility demand response programs developed over a decade ago have offset the need for additional peaking generation.

Implementing new, more flexible and responsive resources will further advance California's goals of a more reliable and cleaner power system—with the added potential of replacing or deferring investments in more expensive energy infrastructure.

From an operational perspective, demand response resources will contribute to the low-carbon flexible capacity needed to maintain real-time system balance and reliability while also supporting the integration of increasing levels of renewable energy resources. As the main grid operator of a state leading the way to a greener grid and as a facilitator of the only open-market

in the western United States, the ISO is keenly involved in leveraging alternative resources to the benefit of an efficient and reliable system.

Anticipating the magnitude, type, timing and geographic distribution of these rapidly growing resources is as critical as solving the challenges of short-term and long-term forecasting of load variability as large numbers of resources inject energy into literally thousands of locations on the grid. The ISO is preparing for the challenges because the environmental and sustainability benefits are enormous. We also believe the new resources can be blended into the current grid composition without compromising reliability.

We have a lot to look forward to in terms of positive benefits to California's economy and environment as long as this historic grid transition is managed thoughtfully and proactively through the coordinated efforts of all stakeholders.

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INTRODUCTION

Energy alternatives such as demand response (DR) and energy efficiency (EE) provide tools to help the California Independent System Operator Corporation (ISO) maintain a reliable and affordable power supply while minimizing the environmental impacts of conventional electricity generation. DR and EE resources are already contributing to the reliable and efficient management of a greener electricity grid, reducing the need to rely on more polluting power supplies. Recent technology trends point to a larger reliance on DR and EE as well as other forms of distributed energy resources (DER) such as microgrids, rooftop solar, electric vehicles as well as energy and thermal storage facilities. The ISO is working with the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) to create a market for DR and EE that builds upon the innovation that has characterized the state as a national leader of clean energy technology advancement.

A greater reliance upon DR/EE brings new complexities to transmission planning and real-time grid and market operations. The ISO is committed to harmonizing the unique attributes that come from clean, green resources into its market in a way that fully optimizes the benefits of DR and EE resources.

In collaboration with state energy agencies and stakeholders, the ISO is working to advance and modernize these resources through competitive mechanisms that will lower wholesale electricity costs while creating a less carbonized power grid.

The nature of DR and EE requires the ISO to think differently about how resources are planned and accounted for, and how they can best be procured to serve both the needs of the ISO as well as market participants and consumers at large. As we move toward a more decentralized and distributed energy future, it is the job of the ISO to make sure reliability is maintained.

Reflecting cross-agency coordination throughout its development, this roadmap is comprised of four interdependent paths that run from 2013 through 2020. It also highlights specific activities essential to building new market opportunities for DR and EE to meet the needs of end-use customers and the power system as a whole. Each path shows the activities and milestones necessary to bring greater DR and EE capacity into the system over the next several years.

Based upon input received during the roadmap's stakeholder process about the need for collaboration, the ISO, CPUC, and CEC are developing a cross-agency DR and EE workplan to ensure activity alignment and track progress. This roadmap assumes a degree of adaptation by all stakeholders – including the ISO – with each stakeholder engaging in the outcome. It is through positive resolution we will find innovative ways to realize the historic transformation of the electricity system now moving from a one-way to a highly sophisticated two-way network.

PATHWAYS FOR MAXIMIZING PREFERRED RESOURCES

The Load Reshaping Path focuses on applying DR and EE resources to the demand side of the supply-demand balance equation. These resources will create a flatter load shape for the ISO system generally and, in specific geographic areas, reduce ISO operating needs and complexity.

The Resource Sufficiency Path focuses on the supply-side of the balance equation to ensure sufficient resources, with needed operational characteristics, are available in the right places and at the right times. This path includes activities that specify needed resource characteristics—as well as policy developments—to guide and facilitate DR and EE procurement and program development.

The Operations Path focuses on making the best use of any and all resources that are made available through the resource sufficiency path. This path is cast from a grid operator perspective. It involves changing some existing policies, modifying or developing new market products to expand DR market participation, and addressing relevant technical and process requirements to achieve operational excellence.

The Monitoring Path is the essential feedback loop for the other three paths. Systematic monitoring of each stage of activity will foster a deeper understanding of the operational capabilities of DR resources, the effectiveness of procurement programs in aligning with systemwide and locational needs, and the impacts of EE and other load-modifying programs in reshaping load profiles both locally and at the system level.

The LOAD RESHAPING PATH

Activities addressing the demand side of the supply-demand balance equation seek to modify the load shape by changing end-use consumption patterns, thereby reducing the need for additional and costly generation or transmission infrastructure. Such activities will both reduce overall energy consumption and alter the system or local load profile to reduce the severity of power demand peaks and valleys. Thus, the focus of this path is on EE and load-modifying DR resources; activities related to supply-side DR resources will be discussed within the resource sufficiency path.

These changes can benefit locally constrained areas as well as the overall transmission system. One strategy for this path is to provide locational and time-varying market signals to elicit demand-side responses that can respond to system conditions in a timely manner. For example, in conditions of over-generation, appropriate signals could trigger consumers to modify their consumption, such as the charging of electric vehicles or absorbing excess generation via various forms of battery energy storage.

STRATEGIC ACTIVITIES: LOAD RESHAPING

Advance energy efficiency programs and incentives

California has been a leader in establishing EE programs and incentives. An expanded emphasis on EE will take advantage of the effectiveness of these demand-side resources in reducing greenhouse gas emissions. This renewed focus on EE can also impact the overall system load shape, thereby reducing the need for new conventional generating resources or transmission upgrades. The ISO sees great potential benefits that can be realized through a proactive approach that targets EE programs by using incentives to reshape the load profile in specific geographic areas of the system. In the Los Angeles Basin and San Diego areas, for example, the retirement of the San Onofre Nuclear Generating Station presents an immediate need, and opportunity, for collaboration among the state agencies, the ISO and the southern California investor-owned utilities (IOUs) to define and implement EE programs to help address the demand formerly met by the nuclear plant. The Demand Analysis Working Group (DAWG), a CEC-led collaborative stakeholder effort that estimates EE program impacts as an input into the Integrated Energy Policy Report (IEPR) demand forecast, will play an important role in assessing the load-shape impacts of different EE programs and identifying which ones would be most effective in offsetting the need for new generating plants or transmission upgrades. The CPUC through its processes will authorize EE programs for the IOUs to implement that provide the most value.

Evolve demand forecasting

A critical need for the ISO is to account for EE and DR impacts in planning transmission upgrades and in determining future resource requirements (i.e., local capacity requirements for the resource adequacy program, and system-wide flexible capacity requirements). The state's demand forecast, developed biennially through the CEC administered IEPR process, is foundational to system planning and resource need determination. The CEC is working to increase the locational granularity of EE forecasts and will further that effort for the 2015 IEPR cycle.

Another high priority near-term activity is to develop criteria to assess DR programs as a load-modifying or a supply-side resource. Load-modifying DR should be properly accounted for in the demand forecast whereas DR supply resources should not. Each DR type or program should be classified in only one of these groups, and the classifications should be maintained consistently across the various applications of the demand forecast. This ensures that the benefits of each program are accurately captured, recognized and not double counted. Moreover, DR supply resources must be available to be called upon or dispatched when needed, and the ISO must have confidence that the response to the dispatch instruction will meet expectations with regard to response time, magnitude and duration.

Programs classified as load-modifying will then be included in the CEC IEPR while the programs classified as supply-side would be included as part of the supply-side resources available for grid planning and operations. In the recently published CEC 2013 IEPR draft, the CEC has included several existing load-modifying DR programs in its forecast.¹

The recently issued CPUC order instituting rulemaking, takes up the question of demand response resource classification and has already held workshops to gather stakeholder input. The classification effort is expected to be completed in 2014.

¹ <http://www.energy.ca.gov/2013publications/CEC-100-2013-001/CEC-100-2013-001-LCD.pdf>

Supply-side resources versus load-modifiers

Q: *What is the difference between supply-side resources and load-modifiers and why does this matter to the ISO? How does this relate to preferred resources such as DR and EE?*

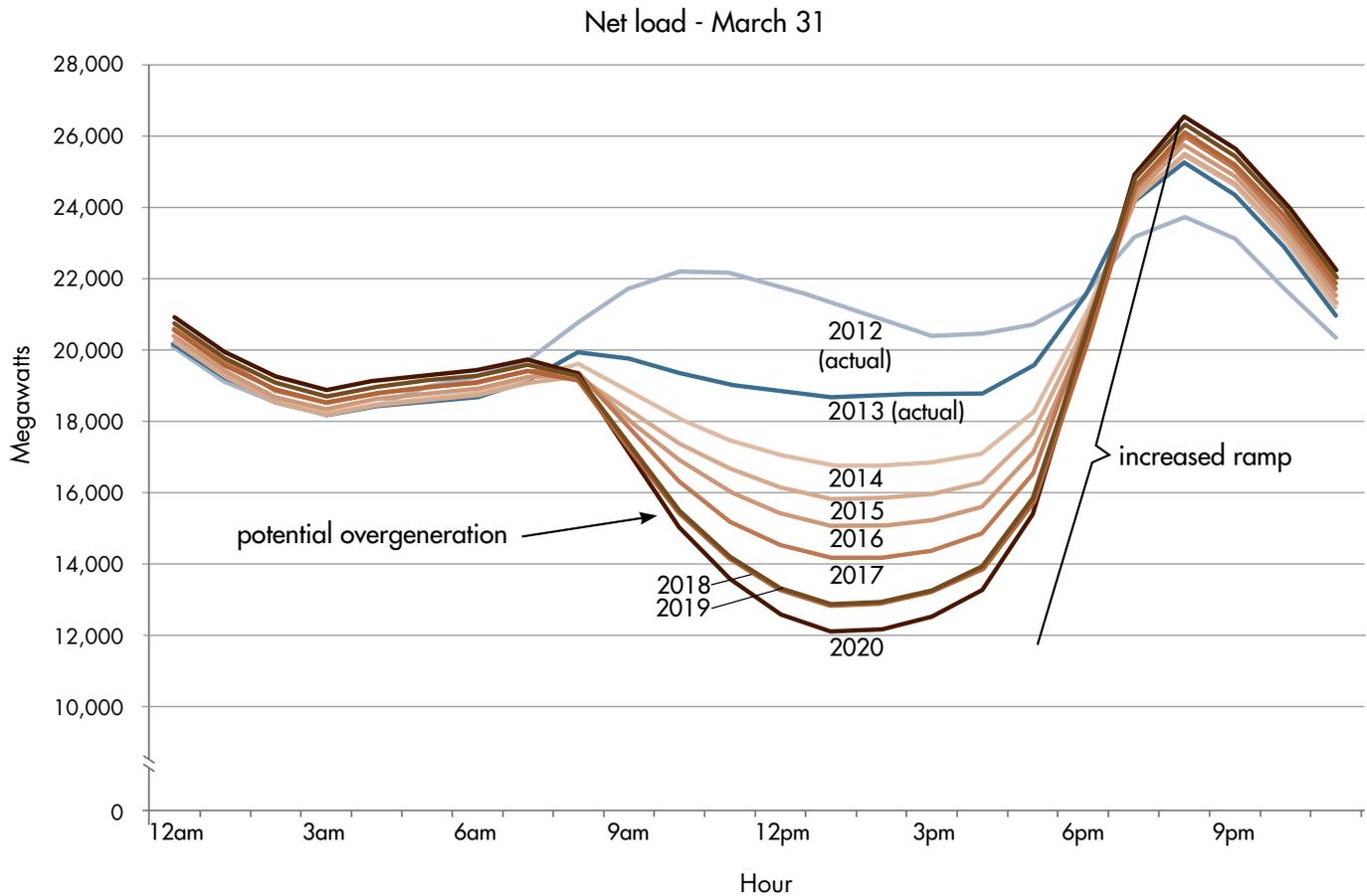
A: *The ISO's core responsibility is to maintain grid reliability, which it does by managing supply resources to match electricity demand. With increasing reliance on intermittent resources, the ISO is responsible for dispatching resources that can balance both load variability and the growing variability from non-dispatchable intermittent resources. Thus, the ISO must increasingly balance supply against a less predictable "net load," i.e., the load after subtracting the output of intermittent wind and solar resources.*

To manage the grid, each energy supplying or conserving resource and program, ranging from conventional generators to EE programs, must be consistently classified as either a supply-side resource or a load-modifier in order to be useful for the ISO management of the grid.

Supply-side resources are those energy supplies available to the ISO to balance net load. These resources can take different forms, ranging from conventional generators to demand response. Supply-side resources are used to directly balance load, manage congestion and satisfy reliability standards. Supply-side resources inject or curtail energy in specific locations, and can be modeled, optimized, and dispatched when and where needed by the ISO.

Load-modifiers are those resources or programs not seen or optimized by the ISO market, but they modify the fundamental system load shape, preferably in ways that harmonize with ISO grid operations. Examples of load-modifiers are dynamic rates, and EE programs. An effective load-modifying program helps create a flatter system load profile, attenuating high energy peaks and valleys and reducing extreme upward and downward ramps. The benefit of load-modifying actions is captured in the natural load, which is incorporated into the CEC load forecast. A more favorable load profile can benefit the ISO by creating a more manageable and stable system, and it can benefit ratepayers by deferring or avoiding the need for future capacity additions and lowering resource adequacy (RA) requirements.

THE DUCK CURVE (Net load chart)



DR and EE may play a new role in the future as flexible resources to respond to new grid fluctuations brought on by added levels of wind and solar power that, by its nature, is more variable than conventional generation. The ISO has identified a growing need for operational flexibility as renewable power is added to the grid, demonstrating through its “duck curve” how the electric system is likely to evolve as more energy is produced from renewables. The chart illustrates the “net load” that shows the actual demand on the system minus variable generation production. The net load is calculated by taking the forecasted load and subtracting the forecasted electricity production from wind and solar generation resources.

These curves capture the total variability the ISO must match or follow with controllable resources. Two ways to ensure reliable grid management include applying EE and DR resources as behavior-modifying mechanisms to change the net load shape and procurement of resources in response to the grid needs. The activities discussed in the load-modifying path seek to attenuate the peaks and valleys and make the ramps less steep, while the resource sufficiency path discusses ensuring needed flexible resources, including DR, that will be included in future planning and procurement processes. Working with the industry and policymakers, the ISO is collaborating on rules and new market mechanisms that support and encourage measures to modify the net load shape and develop flexible resources to ensure a reliable future grid.

Align retail signals with grid conditions

Aligning retail signals with wholesale grid conditions is a strategy to give end-users the incentives and the capabilities to modify their energy consumption to respond quickly to the changing needs of the transmission system without requiring explicit instructions from a load serving entity, distribution utility or the ISO. The needed alignment entails at least three primary approaches: smart grid automation; retail tariff changes; and energy conservation messaging during times of extreme grid stress. The right combination of technology, policy reform and active consumer participation will be needed to elicit demand-side responsiveness to meet grid resource needs efficiently and sustainably.

In the 2014-15 timeframe, the ISO will work with stakeholders including utilities, aggregators and others, to develop practical approaches for conveying signals to customers to elicit beneficial shifts in energy consumption. During 2015-16, the ISO will actively participate in stakeholder conducted pilot programs that will provide insights into the effectiveness of these approaches in reducing load during times of high wholesale prices or contingency events. These same pilot programs can also investigate how best to increase loads under low cost or excess generation conditions. The goal is to test out and validate effective approaches and then place the fully vetted technologies in operation by 2020. When these technologies are standardized across a broad population of consumers, the ISO will be able to model the price-elasticity of this DR in its real-time market optimizations, so that the demand-side response to very high or very low prices can be predicted with a high degree of confidence.

Retail rate structures that realistically reflect the real-time cost of electricity can send a highly effective direct signal to customers to respond accordingly. As customers, aided by technology, change their consumption behavior in response to such price signals, the system load shape will have a lower peak that will also be less deep, and less steep. This, in turn, reduces the need for generating plants and transmission infrastructure. California Assembly Bill 327 recently signed by Governor Brown represents an important first step to enabling wider options for residential rate structures that can be made consistent with grid conditions.² The CPUC is conducting proceedings to gather input and decide on rate modification.

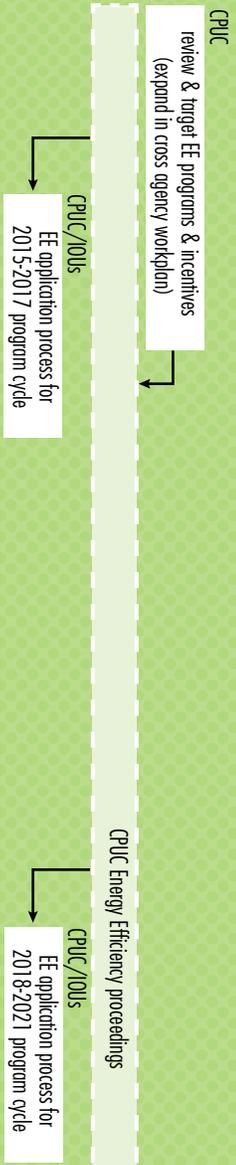
The last of the three alignment approaches involves voluntary conservation programs such as the *Flex Alert* campaign. This educational and emergency alert program was designed to develop consumer responsiveness by communicating specific actions to reduce load during tight grid conditions. Although it has proven quite useful, its voluntary nature makes its actual impact in any given hour less predictable than the impact of either technology-enabled DR or time-varying retail rates.

² http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB327

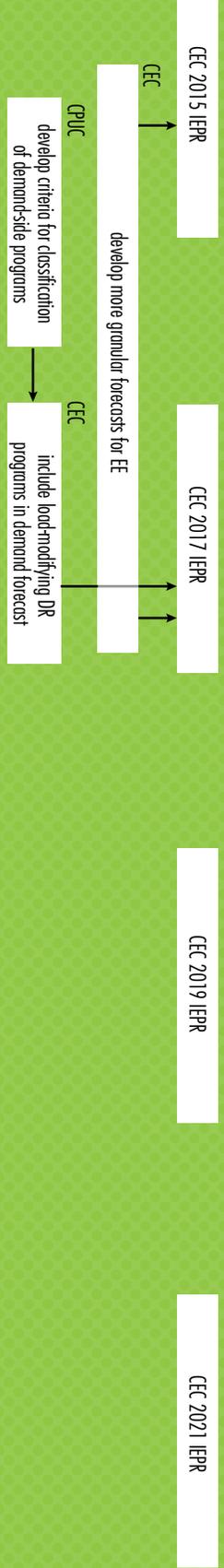
LOAD RESHAPING

2013 2014 2015 2016 2017 2018 2019 2020

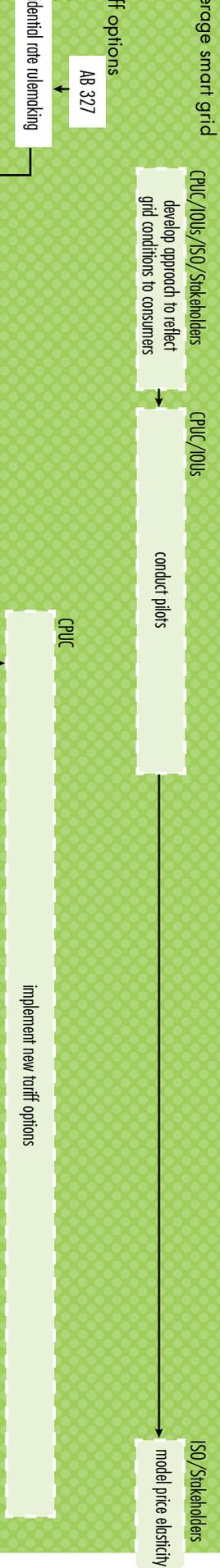
Advance energy efficiency programs & incentives



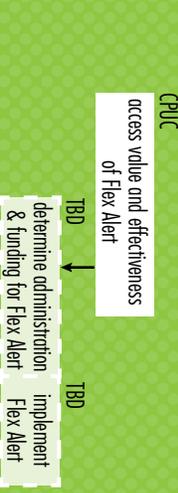
Evolve demand forecasting



Align with grid conditions



Conservation messaging



The RESOURCE SUFFICIENCY PATH

The supply side of the supply-demand equation identifies a portfolio of resources in specific locations that will provide the operational capabilities necessary to reliably operate during both normal and emergency power grid conditions. Resource sufficiency must be assessed in light of grid physics and the portfolio of supply-side resources that are

expected to be in service over the course of the planning period. This path focuses on clarifying resource types and locational attributes and the planning and study processes that will quantify resource requirements. It also examines the procurement processes that ensure the resources will be available when needed.

STRATEGIC ACTIVITIES: RESOURCE SUFFICIENCY

Define DR resource attributes

Traditionally, transmission upgrades and generating capacity additions have been determined through engineering studies focused on meeting stressed system conditions such as extreme spikes in demand and contingencies. The ability to reliably operate the grid during stressed conditions assumes that the procured generating resources either run continuously as base load resources or can be controlled to operate as needed. With reduced controllability resulting from the greater presence of variable renewable generation such as wind and solar, plus the increased and fluctuating load impacts of load-modifying distributed energy resources, grid operating needs can no longer be adequately assessed by looking at only system peak or traditional contingency conditions.

The ISO's efforts to study the operational requirements of integrating renewable resources have led to the formulation of certain resource performance characteristics. This new category of necessary resources is generally referred to as "flexible capability."

This unique operating resource is required to manage the expected system load shape during both peak and off-peak seasons and during contingency conditions, which is one of the primary challenges facing the ISO today. As the ISO further assesses the possibilities of DR as a supply-side resource, it must also consider flexibility requirements and the capability of different DR resource types to meet the operational needs created by the frequency and voltage swells and sags associated with variable resources.

To support inclusion of DR and EE in transmission planning studies, the ISO is capturing DR resource types with descriptions of their operational attributes in a base catalog. As part of the 2013-2014 transmission planning cycle, the ISO is working with stakeholders to develop methodologies and procedures for considering DR and targeted EE as candidate alternatives to a local transmission upgrade or constructing a conventional generator. This information will inform the 2013-2014 planning cycle and could also provide study support for local resource procurement decisions in future long-term procurement planning proceedings.

The ISO, CEC and CPUC released a Preliminary Reliability Plan for LA Basin and San Diego that recommends a blend of options for maintaining local reliability following the shutdown of the San Onofre Nuclear Generating Station and meet compliance dates for the once-through-cooling water regulation. The plan includes a goal to meet the incremental need of 2,800 MW through the use of renewables, storage technologies, and "preferred resources" including local energy efficiency, and demand response. Regulatory proceedings are underway or planned to determine the procurement authorization that will meet the identified needs.



Q: What is Flexible Capability?

A: A resource's flexibility can be described as the ability to respond to ISO dispatch instructions. The "flexibility" or "dispatchability" of a resource is determined by the following:

- How fast can the resource ramp up or down?
- How long can the resource sustain an upward or downward ramp?
- How quickly can the resource change its ramp direction?
- How far can the resource reduce output and not encounter emission limitations?
- How quickly can the resource start?
- How frequently can the resource be cycled on and off?

A resource's flexibility at any particular time can vary depending on the resource status (e.g., on-line or off-line) and other operating parameters (current megawatt) output or consumption level, operating range, etc.). To simplify the assessment of a resource's flexibility, the ISO describes three unique operational attributes that reasonably capture its needs for flexible capability. These attributes are derived from three types of operational needs the ISO expects to manage: 1) steep, system ramps in either upward or downward direction, which may vary by month or season and occurs multiple times a day; 2) severe intra-hour system variability in either the upward or downward direction, which may vary by month or season; and 3) second-to-second regulation service to maintain standard frequency in accordance with established reliability requirements. Based on these needs, the three types of flexible capability and their definition and benefits are as illustrated below.

OPERATIONAL NEEDS	DEFINITION	BENEFIT
Continuous ramping	ability to sustain continuous upward or downward ramps	ensures that there is sufficient ramping capacity to meet the ISO's largest continuous ramp and multiple ramp conditions throughout the operating day
Load following	respond to ISO 5-minute dispatch and meet expected operating levels within an hour	ensures there is enough capacity with a defined ramping capability available to be dispatched on a five-minute basis through the ISO real-time dispatch market application
Regulation	follow 4-second ISO control signals and meet performance expectations	ensures the ability to balance net loads and maintain system frequency on a continuous basis, in accordance with established reliability criteria

As a first step toward ensuring the system has these three operational capabilities, the CPUC released a proposed decision in its resource adequacy proceeding, which would add a mechanism that establishes a flexible capacity procurement obligation.³ In coordination with this procurement obligation, the ISO is conducting a stakeholder process to establish must offer obligations for these resources to participate in the ISO markets. In both of these efforts, flexibility is defined as the greatest three-hour continuous amount of ramping power needed in each month by the ISO to manage grid reliability. Resources that can sustain or increase output when flexibility is needed will be considered flexible capacity. In the future, these interim solutions will be replaced with a more holistic solution to address the system's specific needs for each type of flexible capability.

Coordinate procurement and planning processes

This path includes a strategic activity to align the processes that support resource sufficiency. Stakeholders agree this is a high priority. On January 30, 2013, California state senators Alex Padilla and Jean Fuller issued a letter to the ISO and the state's energy agencies as a follow-up to an informational hearing on EE. It asked for changes that would advance the goal for the state's energy efficiency investments to reduce the need for new power plants. Key to realizing this goal are process improvements that include common assumptions and a single consistent forecast for planning and procurement. These pivotal processes include the ISO's annual transmission plan that incorporates associated studies to estimate future resource requirements, the CPUC's long-term procurement process and RA proceedings, and the CEC's IEPR, which includes the biennial statewide demand forecast.

As the ISO develops its approaches for considering DR and EE alternatives in transmission planning, a much tighter linkage with the relevant procurement activities by the CPUC and CEC will be needed. Tracking the development of these DR and EE resources is essential to ensure their availability by the time the transmission upgrade is needed.

The CPUC, CEC and ISO must establish a clear classification of each DR program types as either a load-modifier or a supply-side resource. This ensures that the resource is accounted for either as 1) a reduction in the demand forecast or 2) as a supply resource eligible to provide RA capacity. Once a DR program or resource is classified as a supply-side resource, it can no longer be counted as a reduction in the demand forecast or it will result in double counting. As a supply-side

resource, a DR program must be available to be called upon or dispatched when and where needed and must meet reasonable and reliable performance requirements. The recently issued CPUC DR OIR, takes up the question of demand response resource classification and has already held workshops to gather stakeholder input. The classification effort is expected to be completed in 2014.

Develop and refine procurement mechanisms

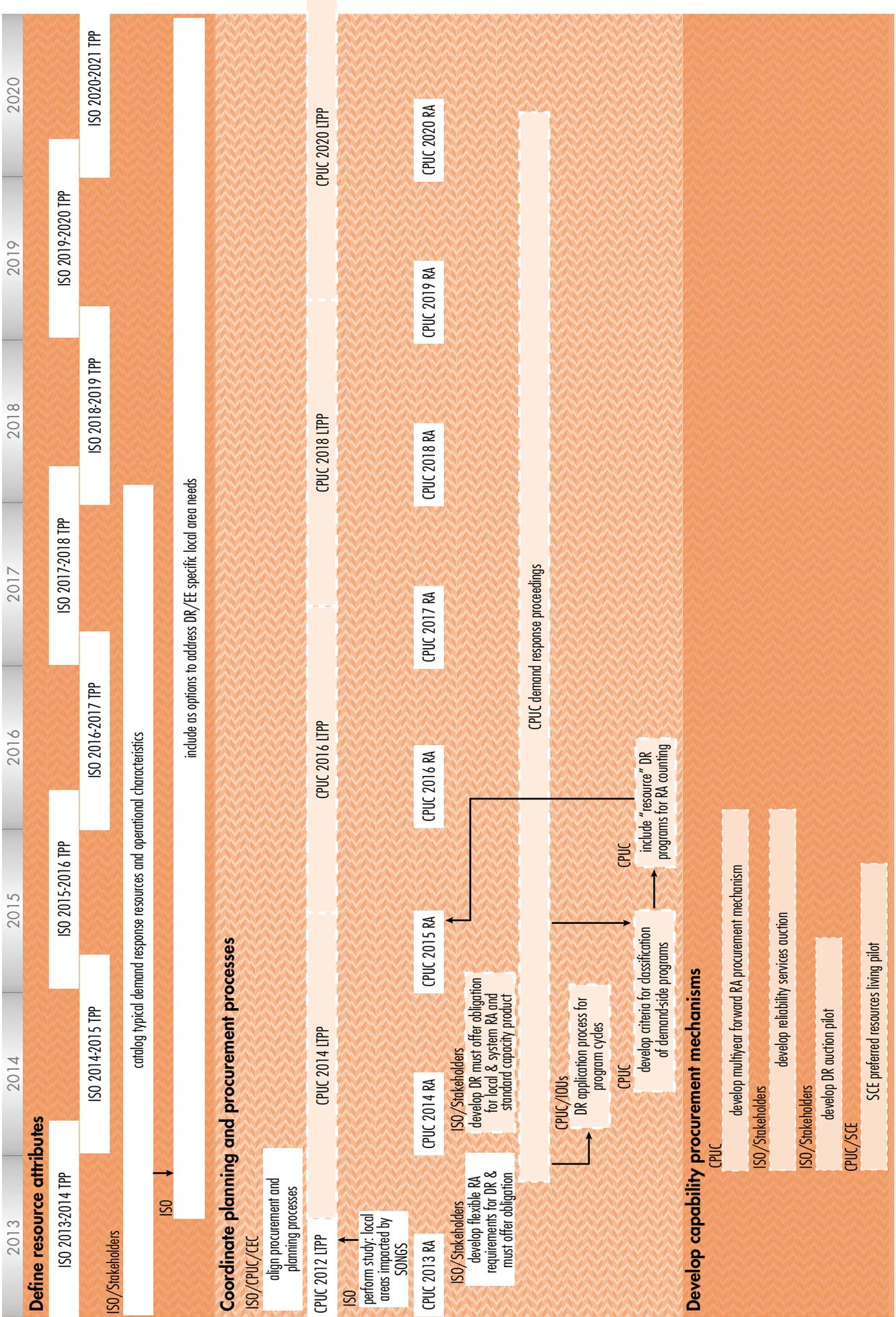
The ISO and CPUC are working on a multi-year joint reliability framework that would combine multi-year resource adequacy obligations for load serving entities (LSEs) with a multi-year, market-based ISO backstop capacity procurement mechanism. The three elements of the proposed framework include a 3-year resource adequacy (RA) program and a Reliability Services Auction (RSA) that provides a backstop procurement mechanism, combined with a long-term planning assessment of years 4-10. This provides a continuous review of resource procurement until implementation of a long-term procurement plan (LTPP) that assesses needs 10-years forward.

In response to the recommendation provided by the draft 2013 CEC IEPR that the ISO implement a multi-year forward DR auction in the region impacted by San Onofre and to further understand the availability of DR that could satisfy grid needs, the ISO recently proposed a pilot DR auction. This auction is envisioned to be a voluntary pilot that complements the joint reliability framework. This pilot auction seeks to enable the procurement of preferred resources to satisfy local resource adequacy procurement while serving ISO local reliability capacity needs. The DR auction pilot is currently under discussion.

An additional opportunity to procure demand response tailored for grid needs is through the SCE "living pilot" filed pursuant to a CPUC decision in the current LTPP proceeding. It contemplates competitive procurement of preferred resources and energy storage. The living pilot will specify performance attributes to support reliability needs, measurement and evaluation protocols to report efficacy of the portfolio of resources and methods for applying lessons learned for improvement. The ISO is actively engaged in CPUC workshops and SCE activities to support procurement and pilots that include demand response.

³ CPUC's RA Proposed Decision: <http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=70423172>

RESOURCE SUFFICIENCY



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 vice 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



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.

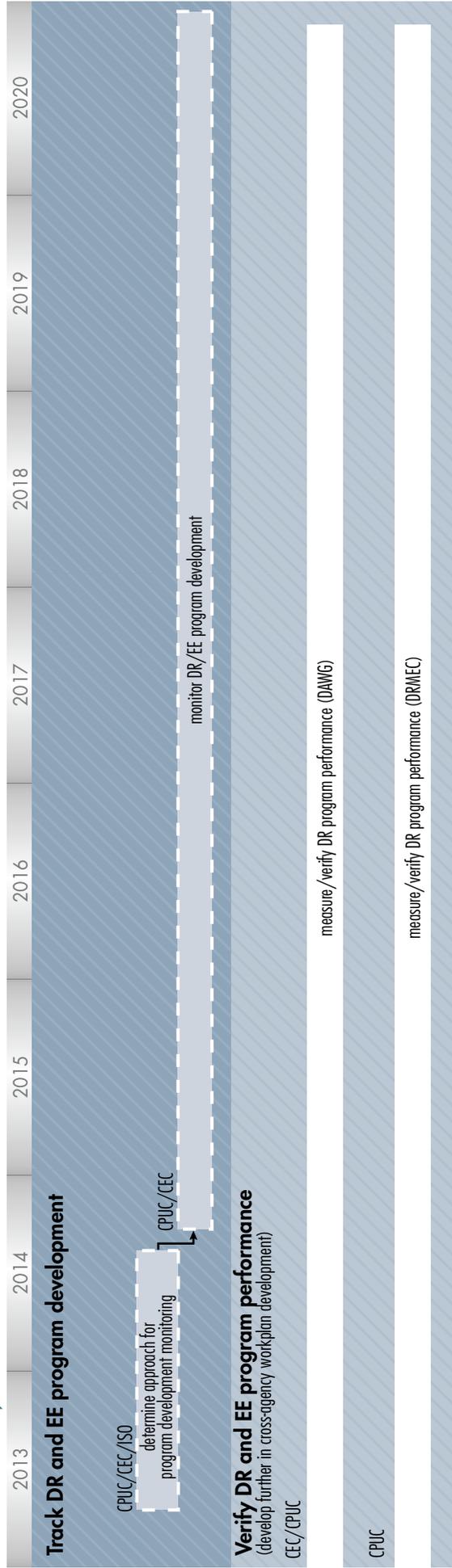
Verify DR and EE program performance

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.



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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