CALIFORNIA ISO
DEMAND RESPONSE AND ENERGY EFFICIENCY ROADMAP:
MAKING THE MOST OF GREEN GRID RESOURCES

DRAFT – JUNE 12, 2013

Rationale for this Roadmap

The growth of demand response (DR) and energy efficiency (EE) will play a crucial role in the transition to a clean, environmentally sustainable power sector in California. DR and EE resources can contribute to the reliable, efficient management of a green electricity grid while reducing the need to rely on conventional generating resources. For this reason they have been given top priority in the state's Loading Order.[1] The ISO, as the operator of the transmission system and the wholesale spot electricity markets, is committed to facilitating the transition to preferred energy resources in a manner that fully recognizes the urgency of this transition and ensures that reliable operation and market stability are maintained along the way. To that end, the present roadmap provides the ISO's proposals for specific strategies and initiatives to help achieve these objectives through the expanded presence of DR and EE resources.[2]

A greater reliance upon DR and EE resources can offer a variety of economic and environmental benefits to California. For example, DR and EE can substitute, under circumstances to be developed through this initiative, for investments in traditional transmission and power generation infrastructure. From an operational perspective, the ISO views DR as contributing to the low-carbon flexible capacity needed on the system to maintain real-time system balance and reliability and facilitate the integration of renewable energy resources. This roadmap sets out a plan for how these and other potential benefits of DR and EE can be realized.

As the ISO's proposal, this roadmap conveys the grid operator perspective. At the same time, it lays out a strategy for coordination and collaboration among state agencies and stakeholders that will result in a staged implementation process detailing the what, why, how and who for the milestones that must be met in order to provide a reliable transition to green grid resources. The ISO's intention is to open this roadmap to broader participation in its further development. This will include the perspectives and proposed regulatory initiatives of the California Public Utilities Commission (CPUC) and California Energy Commission (CEC), which are critical to expanding the roles of DR and EE. It will also include the

[1] The state's Loading Order creates a hierarchy of preferred resource commitments that fills resource needs first with demand-side load reductions such as EE and DR, then renewable energy supply resources, and, finally advanced fossil fuel technologies to fill in the remaining electricity supply gaps.

[2] This roadmap benefited greatly from the discussions that occurred at the ISO's May 13, 2013 workshop and the written comments submitted following the workshop. A complete set of the written comments on the workshop is posted on the ISO website. http://www.caiso.com/informed/Pages/StakeholderProcesses/DemandResponseInitiative.aspx

concerns and contributions of load serving entities, consumers, third party vendors and other stakeholders. With the comments the ISO receives in response to this document, the ISO will develop and post a revised version in the third quarter of this year, which then will serve as a starting point for collaborative actions by the CPUC, CEC and ISO to develop an inter-agency DR and EE roadmap.

The collaboration between the CPUC, CEC, ISO and stakeholders will not end with the formulation of a final, detailed roadmap. Nor will these entities stop work on relevant activities while waiting for the roadmap to be completed. The specific strategies and initiatives identified within the roadmap will all be collaborative activities in one form or another, including, for example, ISO stakeholder initiatives and CPUC and CEC workshops and proceedings. Some of the activities are already in progress and will continue in parallel with finalizing the roadmap. For example, while revising this roadmap over the coming summer, the ISO will conduct a stakeholder initiative to clarify the characteristics of DR resources necessary to consider DR in the transmission planning process as a non-conventional alternative to a needed transmission upgrade. Even after the roadmap completed later this year, it will need to be refreshed regularly as the industry transition to green energy progresses.

ISO Vision for DR and EE

The ISO envisions that DR and EE will become integral, dependable and familiar resources that support a reliable transition to an environmentally sustainable electric power system that features increased penetration of new and diverse types of energy resources. The present roadmap is offered as a starting point for a statewide program to realize that vision.

The dramatic changes occurring in the electric power industry today include a clearly visible trend of rapid growth of distribution-connected resources of all types. Broadly referred to as distributed energy resources ("DER"), this diverse category includes rooftop solar systems and other local generating facilities, energy and thermal storage facilities, electric vehicles and charging stations, and micro-grids, as well as demand response resources and energy efficiency. The rapid growth of DER is driven by a combination of economics (retail rate structures and declining solar PV costs), environmental concerns, and desires of customers for more energy choices and more locally resilient power supplies. It has also been enabled by state and federal policies and rapid advances in technologies. Moreover, this growth is occurring in a context of an extensive turnover in the supply fleet connected to the ISO grid, which will result in the retirement of many of the existing conventional resources.

From the ISO's perspective as operator of the transmission system and the wholesale markets, this trend represents a host of uncertainties, including the magnitude, timing and geographic distribution of each type of DER; the challenges of short-term and long-term forecasting of net load to be served via the ISO system; and the operational complexities of having huge numbers of individually small, variable resources injecting energy into the grid. At the same time, the ISO believes that this trend is inevitable, that the challenges can be met without compromising reliability, and that the changes will bring great benefits to California if managed thoughtfully and proactively through the coordinated efforts of policy makers, the state agencies and the ISO itself.

The present DR and EE roadmap is the ISO's initial contribution to proactive, coordinated efforts, recognizing that DR and EE comprise only a portion of the full set of strategies and initiatives for the

transition to clean energy. For example, we expect that a broader roadmap that considers all the varieties of DER will be needed in the future. Nevertheless, we believe there are several good reasons for starting with a roadmap focused on DR and EE resources. First, these are resources that are first in the state's loading order and resources that have been present in the California energy landscape for decades. Academics and consultants have studied them, the state energy agencies have considerable experience with them, and there is a substantial knowledge base upon which to build effective strategies and initiatives. Second, DR and EE are the focus of ongoing, cyclical CPUC proceedings and utility programs, whose impacts are regularly quantified for inclusion in the CEC's biennial statewide energy demand forecast. Third, the ISO has already completed important initiatives and has others in progress to enhance the ability of DR resources to participate in the wholesale markets. Finally, DR and EE are effective ways to reduce environmental impacts because they reduce the need to generate electricity. Thus, DR and EE offer compelling rationales for proactive strategies to shape the pattern of their development, and to design and target them to address some of the anticipated operational challenges brought on by the turnover in the supply resource fleet and the proliferation of DER.

The Four Parallel Paths Forward

This DR and EE roadmap is comprised of four parallel and roughly concurrent paths or tracks of activity that run from 2013 through 2020 and are built upon inter-agency coordination throughout. The roadmap highlights specific areas where coordination and communication are necessary to build new market opportunities and other vehicles for DR and EE solutions to meet the needs of both end-use customers and the power system as a whole. The diagrams of the roadmap indicate these four primary planning and implementation paths, each showing the activities and milestones necessary to bring significant DR and EE capacity into the system over the next several years. Each of these paths recognizes the fundamental requirement of reliable power system operation that supply and demand must be balanced continuously while demand and other conditions generally outside the operator's control are continuously changing. The four paths are:

- The load reshaping path;
- The resource sufficiency path;
- The operations path; and
- The monitoring path.

The load reshaping path focuses on the demand side of the balance equation, to create a flatter system load shape that has a lower peak and is both less deep and less steep. Modifying consumption patterns to reshape system load in this favorable way can reduce costs and simplify grid operation. A lower peak load reduces the need for peaking generation capacity. A less deep load shape means less risk of over-generation and better utilization of existing resources. A less steep load shape reduces the need for fast-acting (fast starting and ramping) resources. This path therefore focuses on programs and incentive mechanisms such as retail tariff structures that change consumer behavior and favorably alter the load

shape. It also includes activities for incorporating "load-modifying" DR programs into the demand forecast, rather than including such programs on the supply side as is currently generally the case.

The resource sufficiency path focuses on the supply side of the balance equation, to ensure that sufficient resources with the needed operational characteristics are available in the right places at the right times. This path includes clear specification of needed resource characteristics as well development of policies to guide and facilitate procurement of the needed DR resources through the procedures of each relevant agency and its jurisdictional load serving entities.

The operations path takes the perspective of the grid operator responsible for continuous system balancing, and focuses on making the best use of the resources that are made available through resource sufficiency path activities. This involves changing some existing policies, modifying or developing new market products to expand market participation by DR, and addressing relevant technical and process requirements.

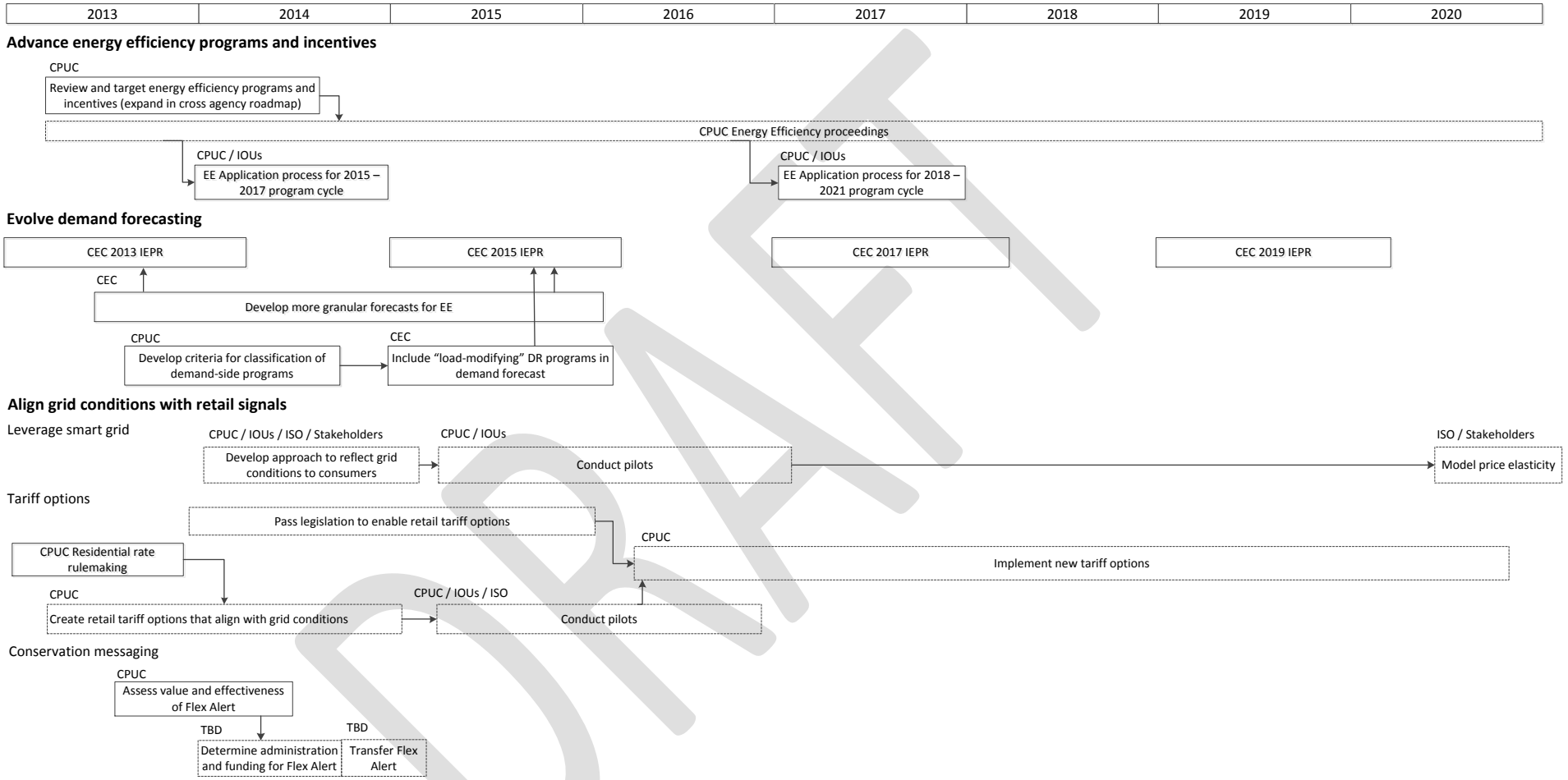
The monitoring path provides an essential feedback loop to the other three paths, so that experience with each stage of activity will foster a deeper understanding of the operational capabilities of DR resources, the effectiveness of DR and EE procurement programs in aligning with system-wide and locational needs, and the impacts of EE and other load-modifying programs to reshape the system demand curve.

The next four subsections treat the four paths in more detail, providing a graphic timeline for each one showing the main activity areas within each path, followed by brief descriptions of some of the individual activities within each area.

1. The Load Reshaping Path

In the demand and supply balancing equation, activities addressing the demand side seek to modify the load shape by changing consumer consumption patterns, thereby reducing the need for additional generation or transmission infrastructure. Such activities will both reduce overall energy consumption and alter the system load profile to reduce the magnitude and severity of peaks. These changes can be beneficial both in locally constrained high-load areas and on a system-wide basis. One strategy for this path, discussed further below, is to provide locational and time-varying market signals to elicit demand-side responses that align with system conditions. For example, in conditions of over-generation, appropriate signals could trigger increased consumption by consumers able to able to modify their consumption.

Load Reshaping Path



The solid lined boxes indicate planned activities while the dotted line boxes are not scheduled or planned

Load Reshaping – Strategic Activities

Advance energy efficiency programs and incentives

California has been an early leader and innovator in establishing EE programs and incentives. An expanded emphasis on EE will take advantage of its effectiveness in reducing greenhouse gas emissions and its potential to be targeted to load shape impacts that can reduce the need for new conventional generating resources. The ISO sees great potential benefits to be realized through a proactive approach that geographically targets EE programs and incentives to reshape the load profile in specific areas of the system. In the Los Angeles Basin and San Diego areas, for example, the recently-announced retirement of the San Onofre Generating Station offers an immediate need and opportunity for collaboration among the state agencies, the ISO and the southern IOUs to define and implement EE programs to help address the needs formerly supplied by the nuclear plant. The Demand Analysis Working Group (DAWG), a CEC-led collaborative stakeholder effort that estimates EE program impacts for 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 to be most effective in offsetting the need for new generating plants.

Evolve demand forecasting

A critical need for the ISO is to accurately account for EE 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 for the 2013 forecast that will be finalized later this year, and will further that effort for the 2015 IEPR cycle. Much of this effort will occur in the context of the DAWG, mentioned above.

Another high priority near-term activity is to clarify the classification of each of the various DR programs as either a load modifier or a supply resource. Load modifying DR should be properly accounted for in the demand forecast, whereas DR supply resources should not. Each DR 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 and 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 and magnitude. The ISO is working with the CEC, CPUC and IOUs in the context of the Demand Response Measurement and Evaluation Committee (DRMEC) to clarify and standardize the terminology for classifying DR programs and resources (e.g., load modifier versus resource; event-driven or non-event-driven; dispatchable or non-dispatchable). All existing DR programs will then be classified for purposes of the IEPR demand forecast, which is used as the basis of the state's cyclical processes to plan transmission, assess future resource needs, and procure resources. We expect this to be taken up in the CPUC DR or RA proceeding. The timing for completing this activity depends on CPUC proceeding scoping and timelines.

Resources versus Load Modifiers

What is the difference between resources and load modifiers and why does this matter to the ISO? How does this relate to preferred resources such as DR and EE?

The ISO's core responsibility is to maintain grid reliability and it does so by managing supply resources to match electric 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, energy supplying or conserving resources and programs, ranging from conventional generators to EE programs, must be either a resource or a load modifier to be used and useful for managing the grid.

Resources are those energy supplies available to the ISO to balance net load. These "energy supply" resources can take different forms, ranging from conventional generators to DR. Resources are used to directly balance load, manage congestion, and satisfy reliability standards. Resources inject or curtail energy in specific locations, which can be modeled, optimized, and or dispatched when and where needed by the ISO. If resources cannot be "seen" and optimized by the ISO, then they must be a load modifier.

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, behind the meter distributed generation, 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's 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 lower resource adequacy requirements.

Align retail signals with grid conditions

Aligning retail signals with grid conditions is a strategy to give end-users both the incentives and the capabilities to modify their energy consumption to respond quickly and directly to changing system needs, without requiring an explicit instruction from an intermediary such as the 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.

The smart grid technologies that enable DR include programmable thermostats, controls, and communication channels for grid information to quickly reach end-use customers. In the 2014-15 timeframe, the ISO will work with stakeholders to develop practical approaches for conveying signals to customers to elicit shifts in energy consumption. During 2015-16, the ISO plans to conduct pilot programs that will provide insights into the effectiveness of these approaches in reducing load during times of high wholesale prices or contingency events, and in increasing load under low cost or excess generation conditions. The goal is to have effective approaches and the required 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 time-varying cost of electricity may be the most effective direct signals to consumers. As consumers, aided by technology, change their consumption behavior in response to such price signals, the system load shape has a lower peak, is less deep, and less steep, reducing needs for generating plants and transmission infrastructure. Such reforms to retail rates will require state legislation by 2015-16, in time to align with CPUC approval of new rate structures. The CPUC already has some rate structure changes underway, including the implementation of mandatory time-of-use (TOU) rates, and a phase-in of default critical peak pricing (CPP) rates for non-residential customers. These programs are designed to incentivize end users to reduce consumption under peak load conditions.

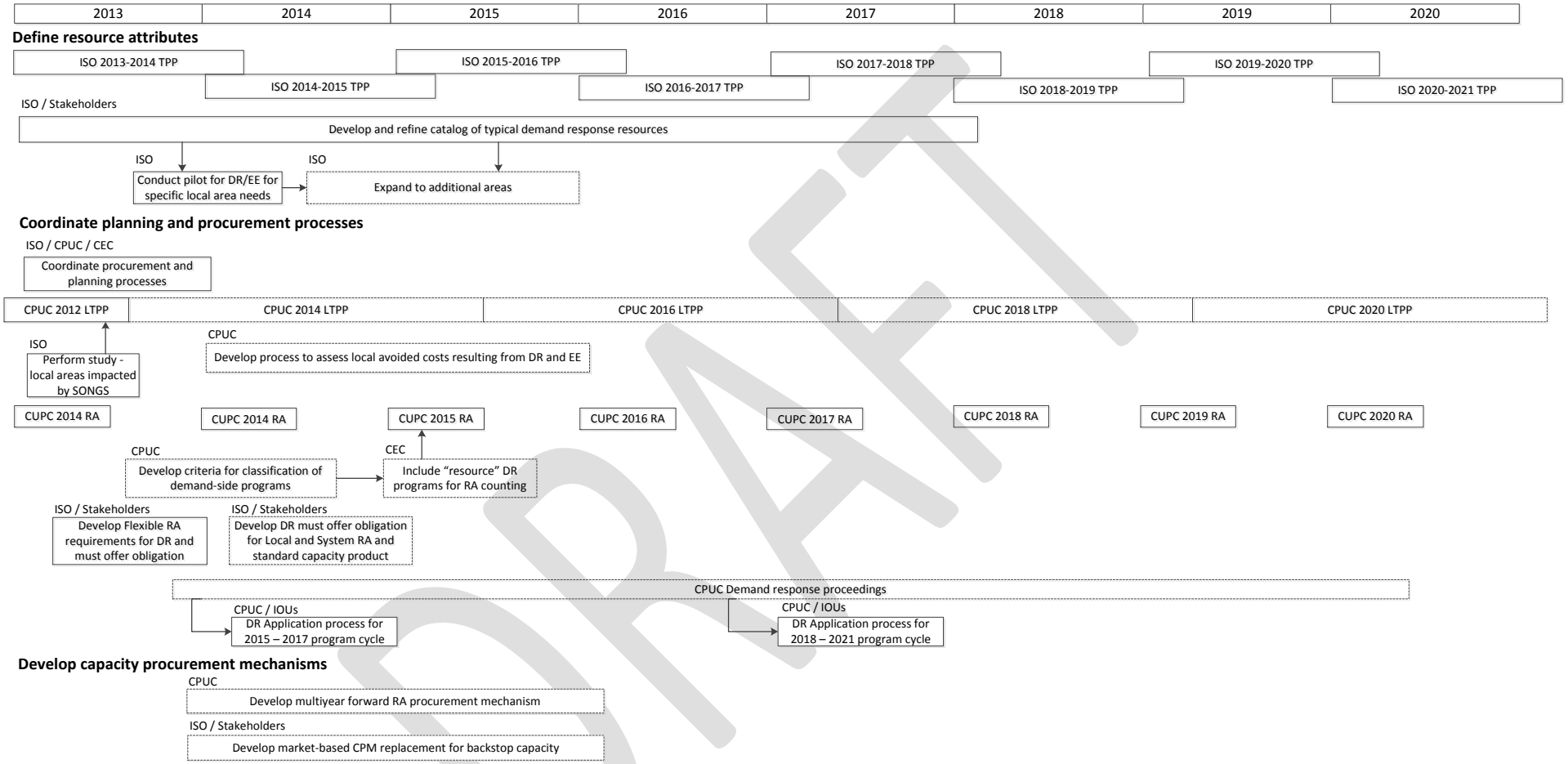
The last of the three alignment approaches involves voluntary conservation programs such as Flex Alert. This educational campaign was designed to develop consumer responsiveness by communicating specific actions they can take to reduce load during emergency conditions. The CPUC has authorized funding of the Flex Alert program through 2014, and will re-assess its value after the coming summer. A decision about where to transfer administration of the Flex Alert program must be made by the third quarter of 2014 to ensure continuity of funding and messaging into 2015.

2. The Resource Sufficiency Path

The supply side of the balance equation identifies a portfolio of resources in specific locations that will provide the performance capabilities necessary to reliably meet system needs during normal and emergency conditions. Resource sufficiency must be assessed in light of the physical transmission system and the supply resources that are expected to be in service for the various years of the planning period. This path focuses on clarifying the needed resource types and locational attributes, the planning and study processes that will quantify resource requirements, and the procurement processes that ensure the needed resources will be available when needed.

On this path the primary need for greater coordination among California's regulatory agencies and the ISO is to align the processes upon which resource sufficiency depends. The forecasting, planning and procurement processes of the CEC, ISO and CPUC must be aligned in terms of timing, so that common assumptions can be agreed upon for projected amounts of DR and EE, supported by analysis using agreed-upon methodologies. To this end the agencies also must agree on performance verification methodologies for DR, EE and other non-conventional resource types. Such coordination on verification methodologies and planning assumptions, leading to inter-agency agreement on and acceptance of the quantitative results, will enable the private sector to offer innovative and viable business models for DR, EE and other forms of distribution-side resources.

Resource Sufficiency Path



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Resource Sufficiency – Strategic Activities

Define DR resource attributes

Traditionally, needs for transmission upgrades and generating capacity have been determined through engineering studies focused on meeting the highest reasonable system stress conditions, based on the assumption that the procured generating resources either ran continuously as base load or could be controlled to operate as needed to meet load and other system conditions. With increased variability and reduced controllability resulting from the greater presence of variable renewable generation like wind and solar, plus the increased and variable load impacts of load-modifying DER, the operating needs of the grid cannot be adequately assessed by looking at only system peak or traditional contingency conditions. The ISO's efforts to date to study the operational requirements of integrating renewable resources have led to the formulation of certain generator performance characteristics generally referred to as "flexibility," and the associated quantification of needs for "flexible capacity" to be available to manage the expected system load shape during both peak and off-peak seasons and conditions. As the ISO further assesses the possibilities of DR as a supply resource, it must also consider flexibility requirements and the capability of different DR resource types to provide needed flexibility.

The ISO's input into the CPUC's Long-Term Procurement Plan (LTPP) proceeding offers an informative illustration. The ISO determines needs for generating capacity in specific local capacity areas throughout California on an annual basis. In the 2011-2012 planning process, the ISO considered local capacity needs over a ten-year planning horizon to reflect the retirement or repowering of generators subject to the state's once-through-cooling requirements. These study results were presented in Track 1 of the CPUC's current LTPP proceeding (R.12-03-014). Parties to the proceeding asked the Commission to consider EE, DR and other resources as alternatives to the local resource needs determined in the ISO studies. The ISO, in its testimony, generally described the performance characteristics that would be required to qualify as a local capacity resource, and explained that existing demand response programs did not meet these performance requirements. The ISO also expressed concern with the uncertainty involved with using EE forecasts beyond the levels embedded in the IEPR load forecast used in the studies. In the Track 1 decision, D.13-02-015, the Commission asked the ISO to work with SCE to further develop preferred resource characteristics to use in its procurement plan.

Building on the direction of the LTPP Track 1 decision and the ISO's involvement with SCE procurement activities, this roadmap includes an initiative to develop a catalog of DR resource types with descriptions of their operational attributes. This fall as part of the 2013-2014 transmission planning cycle, the ISO will study two or three local areas to consider DR or targeted EE as candidate alternatives to a local transmission upgrade or a conventional generator. By the end of 2013, the ISO intends to have the first draft of a DR catalog that includes typical DR capabilities and offers initial indications of which configurations could effectively offset or at least defer the need for a transmission upgrade. This information will inform the 2013-2014 planning cycle and could also provide study support for local resource procurement decisions in the 2014 LTPP proceeding. It will also form the basis for further ISO, CPUC and CEC coordinated efforts to arrive at consistent DR and EE assumptions to be used in future TPP cycles.

What is Flexible Capability?

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

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

A resource's degree of flexibility is largely qualitative; a resource's flexibility at any particular time can vary depending on the status of that resource (e.g., on-line or off-line) or other operating parameters (current MW output or consumption, operating range, etc.). Given the essential, yet qualitative nature of flexibility, the ISO describes three unique operational attributes that reasonably capture the ISO's needs for flexible capability. The three types of flexible capability, and their definition and benefits, are as illustrated below.

Maximum Continuous Ramping	Load Following	Regulation
Definition The MW amount the net load[1] is expected to change in either an upward or a downward direction continuously in a given month.	**Definition** The maximum MW the net load is expected to change in either an upward or a downward direction in a given hour of a month	**Definition** The amount of regulation service needed to maintain standard frequency in accordance with established reliability criteria
Benefit Ensures that there is sufficient ramping capacity to meet the ISO's largest continuous net load ramp for a particular month. Maximum continuous ramping capacity is expressed in megawatts	**Benefit** Ensures that there is enough unloaded capacity with a defined ramping capability is available to be dispatched on a five-minute basis through the ISO real-time dispatch market application	**Benefit** Ensures the ability to balance net loads and maintain system frequency within the 5-minute real-time market dispatch interval

Coordinate procurement and planning processes

Four major CPUC proceedings implement state policy for resource planning and procurement:

- The biennial long-term procurement proceeding (LTPP), which authorizes the IOUs to procure certain amounts of resources to meet forecasted system and local needs over the next 10 years;
- The annual Resource Adequacy (RA) proceeding, which establishes resource counting rules and sets capacity procurement requirements for IOUs and other CPUC jurisdictional LSEs, to ensure both local and system needs will be met in each month of the upcoming year;
- Triennial DR proceedings that set policy for the application of DR programs as well as DR procurement as part of LTPP or to meet RA requirements; and
- Triennial EE proceedings that set policy for approving and funding utility EE programs for the next 2-3 year cycle.

ISO studies are important inputs to both the LTPP and the RA proceedings, specifically for setting procurement requirements. This year the ISO will perform additional studies for the LTPP of the local capacity areas impacted by the retirement of the San Onofre Generating Station, specifically the Los Angeles Basin and San Diego area. Significantly, these studies will have to use the CEC's update to the 2011 IEPR demand forecast, because they must be initiated before the 2013 IEPR demand forecast is available.

This roadmap also identifies a 2014 CPUC assessment of avoided cost benefits resulting from DR and EE applied as alternatives to transmission upgrades and conventional generation in local areas. As the ISO develops its approaches for considering DR and EE alternatives in transmission planning and finds such alternative to be acceptable, a tighter linkage with the CPUC procurement proceedings will be needed to track the development of these resources to ensure their availability by the time the transmission upgrade would have been needed.

As mentioned earlier, the CPUC, CEC and ISO must establish a clear classification of each of the various DR program types as either a load modifier or a supply resource. Once a DR program or resource is classified as a supply resource, it should not be counted as a reduction in the demand forecast in order to avoid double counting. As a supply-side resource, DR programs must be available to be called upon or dispatched when needed and must meet reasonable and reliable performance requirements.

For purposes of counting DR resources towards the RA requirements of load serving entities, this roadmap identifies a need to revise the current CPUC practice of deducting expected DR capacity plus the planning reserve margin from the RA requirements, which effectively treats all DR programs as load modifiers. The roadmap proposes that the CPUC address this matter either during the 2014 RA proceeding or the new DR proceeding expected to begin later this year. Counting DR as a resource would allow aggregators to create programs that both qualify as RA capacity and can participate in the ISO market.

Develop multiyear for RA and ISO backstop procurement mechanisms

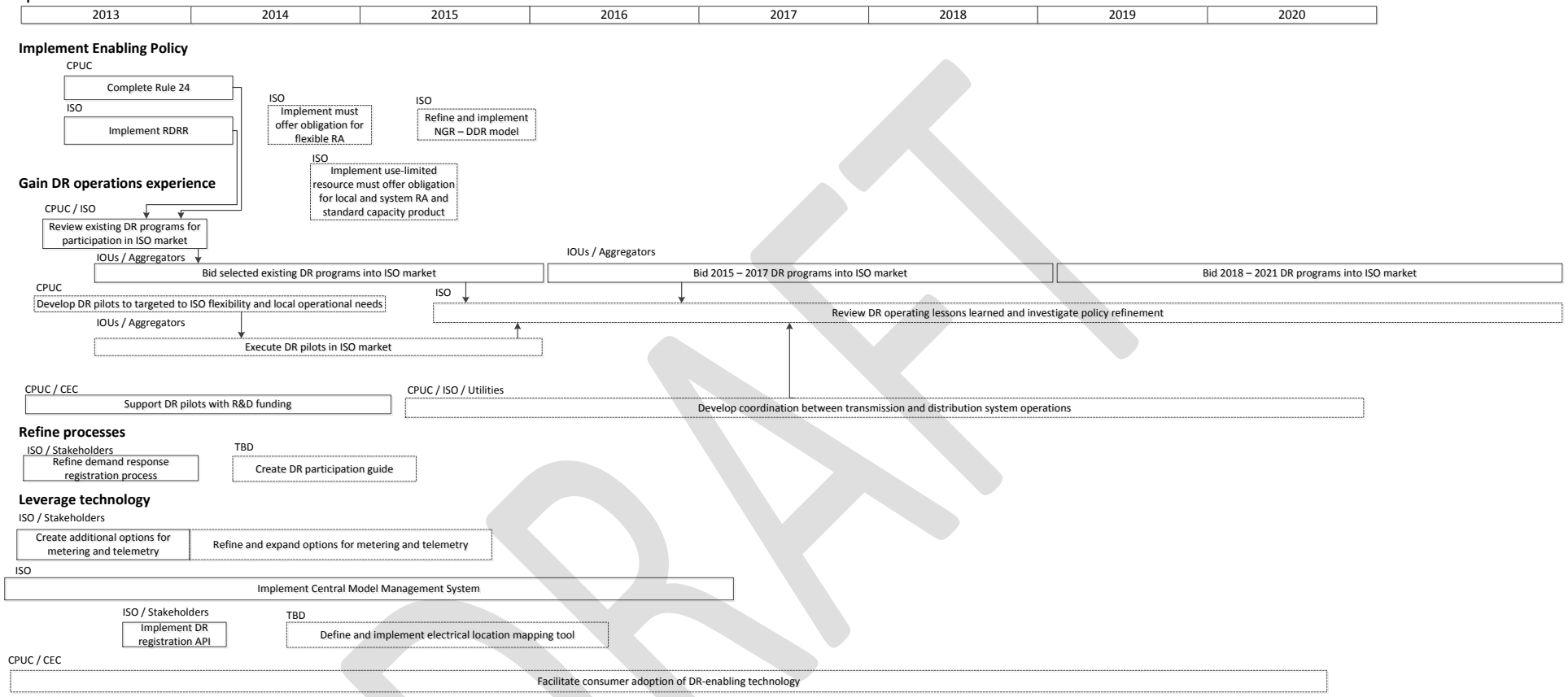
The ISO and CPUC are currently in discussions to facilitate DR capability by providing a multiyear forward RA procurement framework that would provide revenue certainty and price transparency for fast developing resources as well as support investments in upgrades to existing resources.

Additionally, the FERC has directed the ISO to replace the existing backstop procurement mechanism known as Capacity Payment Mechanism (CPM) that expires on March 31, 2015 with a market-based mechanism. The ISO will develop policy to guide these determinations through a stakeholder process. The timing for this initiative is currently under review but is expected to begin later in 2013 or early 2014.

3. The Operations Path

To maximize the value of the DR that is classified as a resource on the supply side of the balancing equation, these resources should participate in the ISO market optimization and provide balancing energy or ancillary service capacity. At the same time, as many stakeholders have pointed out, DR resources are not exactly the same as conventional generators, and these differences must be recognized and accepted so that the ISO operators and the providers of the DR resources can proceed with common expectations about the resource performance. The operations path of the roadmap focuses on addressing the key aspects of DR resources that distinguish them from generators, to remove barriers to DR and to implement policy and process changes supporting direct participation of DR in the ISO market.

Operations Path



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Strategic Activities – Operations

Implement enabling policy

There are several CPUC and FERC policies enabling DR participation in the ISO market. The ISO's market policies and models are also important for enabling participation.

In 2012, the CPUC issued a decision directing the implementation of Rule 24 that sets rules for retail compensation to enable direct participation in the ISO wholesale market. The implementation of this rule is on track for completion in 2013 or early 2014. When finalized, Rule 24 will enable existing utility DR programs as well as third-party aggregators to fully participate in the ISO's wholesale market.

In 2013, the ISO plans to re-file with FERC the Reliability DR Resource (RDRR) tariff amendment consistent with FERC's Order 745. The ISO RDRR model is required for emergency DR (also known as utility reliability programs) to bid and be dispatch through the ISO wholesale market. If approved by the FERC and feasible, the ISO target for implementation is in the Spring 2014 release. SCE has indicated that with the implementation of Rule 24 and the RDRR model, it should be able to bring 1,100 MW of DR capacity into the ISO market in the summer of 2014.

Another route for DR to gain access to the ISO's wholesale market is the participating load model. Under this model, demand-side resources can participate in ISO markets by increasing and decreasing consumption. Currently, the model only supports bidding into the market on the positive or "generation side," operating region of the resource. The ISO implemented a non-generating resource (NGR) model last year to enable energy storage participation through such positive and negative operating ranges. This model can be adapted through a stakeholder process to enable participating load to be a dispatchable demand resource (DDR) to support the ability of participants to more fully reflect operating capabilities to the ISO market. The timing of this stakeholder initiative will depend on the annual prioritization with other stakeholder catalog items.

DR classified as a resource that receives a value and counts for CPUC RA will have a must offer obligation to submit economic bids into the ISO day-ahead and real-time markets. The must offer obligation ensures the ISO can access these resources for normal or emergency operations. A stakeholder process to define the must offer obligation for flexible resources including use-limited resources will begin in 2013 to support the recent CPUC decision for the IOUs to report RA showing for 2015 compliance. The ISO will initiative a subsequent stakeholder effort to address the must-offer obligation for all use-limited resources for local and system RA.

The ISO will undertake an initiative to define standard capacity product for demand response. The standard capacity product provides a mechanism that offers an incentive or disincentive to a resource based on resource availability, reflecting whether it is providing the capacity value that it was procured for. The timing for this definition is being discussed.

Once the ISO gains experience with DR operating in its wholesale market, the ISO will review lessons learned and investigate needed changes to market policy and adjustments to DR models and baseline calculations. This effort will result in proposed ISO initiatives to be prioritized through the stakeholder initiative catalog process.

Gain DR operations experience

Working with the CPUC and the IOUs, the ISO intends to review existing CPUC-approved DR programs and integrate as many of these programs as possible into the ISO market by 2014. The ISO will work 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 programs effectiveness for different needs (local, system, flexible), and how well our policies support different DR resources.

ISO operators must coordinate with distribution system operators to ensure that central dispatch of DR resources does not inadvertently result in a local distribution system problem. The timing for this coordination will be driven by the inclusion of DR programs in the ISO market and identification by distribution system operators of potential operational concerns.

Review and refine DR participation processes

The ISO's current DR resource registration process is time-consuming and prevents participation by DR programs with large numbers of participating customers. At a high-level, this process requires DR providers to manually register all individual end user accounts associated with an aggregated dispatchable demand resource. This process is necessary to provide the ISO with information about each underlying account for audit purposes and to facilitate the review by various stakeholders to ensure appropriate participation in DR programs. Additionally, DR 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 intends to streamline the current process for assigning resource IDs as well as registering the individual customer accounts. The process streamline will provide the basis to define requirements and develop an automated interface for supplying registration data to the ISO. This effort, scheduled to be completed in 2014, is expected to reduce the time needed to initially register the aggregate resource and support future changes.

The roadmap also proposes the creation of a DR market participation guide, in cooperation with the CPUC and stakeholders, which will include ISO participation steps for DR aggregators who intend to get RA credit and therefore must participate in the ISO market. This guide should point potential DR aggregators to the ISO, CPUC, and other entities' processes, procedures, rules, and tariff sections specifically applicable to them to facilitate their qualification for RA and participation in the ISO market. The timing for this guide depends on CPUC and ISO priorities with stakeholders and is currently not scheduled.

Leverage new enabling technology

Smart grid technologies offer key capabilities including two-way communication and devices for dispatch and performance measurement, enabling DR participation in the ISO market. These technologies also provide consumers the ability to configure devices to respond to signals. During the next DR and EE cycles, the ISO will support CPUC and IOU programs that facilitate and encourage consumer adoption of enabling technology, providing the foundation for pilots and longer-term capabilities for ISO market participation or device response that favorably shapes load.

As more DR resources are configured to participate as ISO grid resources, new business scenarios will emerge to optimize data aggregation models and data provision by third parties. The current ISO requirements for metering and telemetry stipulate direct telemetry and direct ISO metering of individual resources. The ISO recognizes that these requirements have not leveraged the capabilities and new models that new technology enables at a much lower cost than the traditional approach. In 2013, the ISO began a stakeholder process to evaluate the expansion of metering and telemetry options to support emerging business models and to find lower cost solution alternatives. This effort will focus on alternative architectures that will provide comparable, secure, and reliable data acquisition, communication,

and response from DR dispatchable resources. Changes will be implemented in phases starting in 2013 and continuing through 2014 and possibly 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. This schedule does not support the timing for the creation to participation of a demand response resource. The ISO has taken steps to reduce this time for DR providers who model their resources using a pre-defined proxy demand resource (PDR), but further improvements are necessary to support resources that would like to leverage other ISO models or wish to customize their PDR. 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 mapping customer service account locations to ISO pricing nodes to support registration for ISO market participation. It is the responsibility of the DR provider to perform this mapping prior to registering with the ISO. DR 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. This tool will also be critical for consumer devices that do not participate in the ISO market, but respond to locational signals to map to the correct price signal. 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.

Wholesale Demand Response Models vs. Demand Response Programs and Products

In the wholesale market, there is often confusion regarding DR models and DR products or programs. The ISO operates a wholesale electricity spot market that clears scheduled supply and demand bids and procures sufficient resources and services to reliably serve the balancing area and satisfy applicable NERC and WECC reliability criteria. The ISO does not operate or offer programs, but has market systems, tools and market 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, DR, whether referred to as participating load, proxy demand resource, or non-generator resource, is loosely referred to both within the ISO and externally as a "programs" or "products." The different wholesale DR opportunities listed in the table below are more properly characterized as models or market mechanisms 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.[1]

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	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	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	To be re-filed at FERC	Day-ahead and Real-time Energy	DRP can be a separate entity than the LSE

**Once WECC Standard BAL-002-WECC-2 — Contingency Reserve standard is approved by FERC*

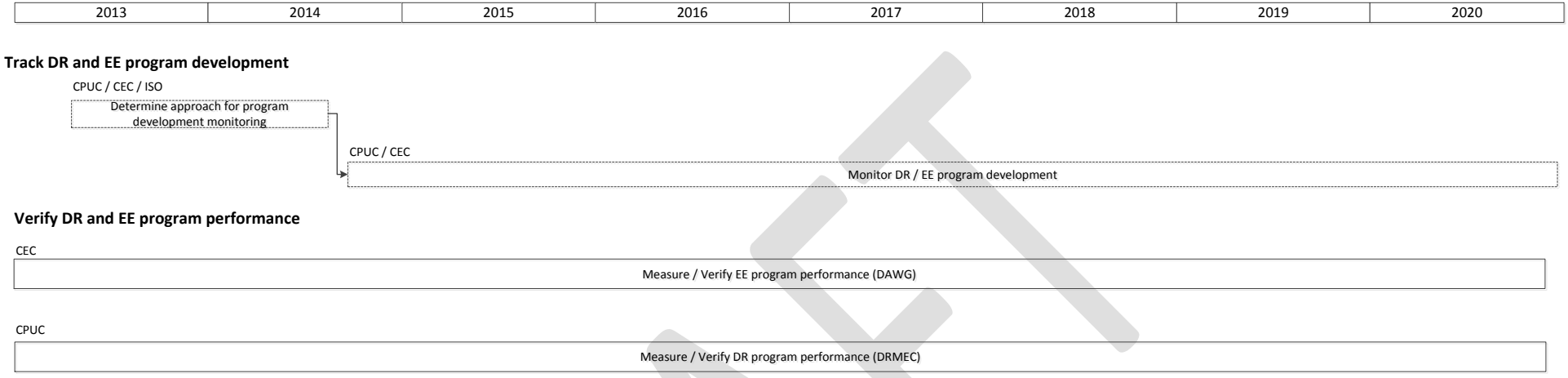
4. The Monitoring Path

In order 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 in, from the beginning, mechanisms for monitoring progress and outcomes and providing 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:

- Are committed DR and EE programs and resources being developed on schedule, to be in service and available by the time they will be needed?
- 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?
- What avoided cost benefits can be quantified for DR and EE programs and resources that offset the need for transmission upgrades or new generation investment?

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, perhaps in some cases, develop alternative approaches to better achieve the desired results.

Monitoring Path



The solid lined boxes indicate planned activities while the dotted line boxes are not scheduled or planned

Strategic Activities – Monitoring

Track DR and EE program development

The roadmap targets 2014 as the year 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 planning process to ensure that DR and EE resources will be in service as alternatives to transmission upgrades. 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 time and, if it appears they will not, to determine an alternative course of action for meeting the need for the upgrade.

Verify DR and EE program performance

Performance verification is essential for at least two main purposes. First, it provides the needed feedback 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 impacts.

With regard to the first point, this roadmap envisions a collaborative stakeholder process to assess the resource performance needs of the ISO system (response time, speed and duration of response, location, etc.) in concert with the needs of consumers that will provide DR resources (operational limitations and expectations, adequate compensation for value provided, etc.) and cooperatively develop EE and DR programs and incentives that meet both sets of needs. Performance verification will subsequently be needed to assess whether what was designed is achieving the objectives, or needs to be modified.

Currently, two working groups – the Demand Analysis Working Group (DAWG) and the DR Measurement and 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. This evaluation, measurement, and verification provide valuable feedback to assess the effectiveness of the programs for future program development and for any needed adjustments in forecasting the impacts of these programs.

A Call to Action

California, already a leader in establishing policies and initiatives to facilitate a green and sustainable grid, is at a key implementation point in achieving the economic, environmental and operational benefits of DR and EE resources. The realization of these benefits demands active engagement and participation by many parties, including the CPUC and CEC, load serving entities, consumers, and stakeholders across the industry and relevant advocacy communities. It is the ISO's intention that the strategic activities contained in the Demand Response and Energy Efficiency Roadmap will form the core of an ongoing dialogue and collaboration that will result in the optimal availability of these resources to help shape load, bolster resource sufficiency and facilitate efficient and economical grid operations.

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

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		
	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	Develop DR resource catalog to support ISO transmission planning process		x	
	Conduct pilot assessing effectiveness of DR and EE resources in selected ISO transmission planning local areas		x	
	Perform study of local areas impacted by SONGS		x	
	Develop flexible RA requirements for DR and ISO must offer obligation		x	
	Develop ISO must offer obligation for local and system RA and standard capacity product for DR		x	
Ensure resources are procured and developing to meet capability, timing, and location needs	Develop more granular forecasts for EE			x
	Develop criteria for classification of demand-side programs	x		
	Include load-modifying programs in demand forecast			x
	Revise RA counting for DR programs classified as resources	x		
	Develop policy guidance for DR and EE programs targeted to meet needs	x		
	Develop approach to monitor progress of DR and EE program development and implementation	o		o
	Develop multi-year forward RA procurement mechanism	x		
	Develop market-based replacement for ISO backstop capacity (CPM replacement)		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 – DDR		x	
	Define and execute pilot programs and assess resource flexibility capabilities	x	x	o

Primary or lead role is indicated by “x”, while “o” indicates support role.

The ISO is committed to the vision contained in this document and looks forward to working cooperatively to accomplish the full benefits of these resources.