California Energy Commission

STAFF PAPER

Customer Power

Decentralized Energy Planning and Decision-Making in the San Joaquin Valley

California Energy Commission

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ABSTRACT

There is a growing narrative that California's electricity system is on the cusp of a transformation. In this transformation, the traditional electricity sector model of building large-scale generation facilities and transmission lines is replaced with increasingly cost-effective distributed energy resources, such as rooftop solar, that benefit from favorable state and federal policies. Several initiatives and proceedings are underway at California's energy agencies examining the costs, benefits, and regulatory and market constructs to enable large-scale deployment of these resources.

Utilities in California and other states, such as New York, are starting to look at distributed energy resources as grid assets and not just regulatory and programmatic obligations. While the future of clean, local energy resources seems bright, complex issues and questions remain to be addressed prior to this transformation. The most basic question is, can distributed energy resources reliably and cost-effectively replace traditional system investments?

This staff paper builds on results from the California Energy Commission's *San Joaquin Valley Distributed Energy Resource Regional Assessment* that explored this question and found that, yes, these resources can replace traditional investments, if sufficient amounts are located in the right areas and available when needed. However, the study looked at this question only from an electric system integration perspective and did not consider the role of customers who will be relied upon to make investment decisions, which will determine the success of this transformation. This staff paper takes a step in that direction by presenting a conceptual decentralized energy planning process that puts the emphasis on California's electricity customers.

Keywords: California, Distributed Energy Resources, Energy, Electricity, Customers, Distribution, Planning, San Joaquin Valley

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EXECUTIVE SUMMARY

California sets an ambitious standard for energy and environmental policies designed to reduce greenhouse gas emissions. State goals aim to reduce emissions to year 1990 levels by 2020, 40 percent below 1990 levels by 2030, and 80 percent below 1990 levels by 2050.

The electricity sector's contribution to meeting the greenhouse gas reduction goals is primarily driven by the Renewables Portfolio Standard, which requires 33 percent of retail electricity sales in 2020 to be served by qualified renewable resources. Senate Bill 350 (De Leon, 2015) recently expanded the goal to 50 percent by 2030, and set a target to double the efficiency of electricity and natural gas end uses of retail customers by 2030.

There are several policies that specifically target California's various economic sectors. This staff paper focuses primarily on electricity use and how customers make investments in clean, local energy resources that contribute to maintaining system safety and reliability, and to meeting California's greenhouse gas reduction goals. It discusses and builds on the California Energy Commission's work studying the role of distributed energy resources (DER), such as distributed generation, small-scale energy storage, electric vehicles, energy efficiency, and demand response in California's electricity portfolio.

San Joaquin Valley Distributed Energy Resources Regional Assessment

The *San Joaquin Valley Distributed Energy Resources Regional Assessment* was completed in 2015 as part of the Energy Commission's DER assessment effort. The purpose of the study was to assess the ability of clean, local energy resources to meet the region's forecasted load growth and reliability needs, and provide insights to the following three high-level questions:

- Can DER serve as a viable alternative to meeting load growth and reliability needs in the San Joaquin Valley region?
- What are the electricity system benefits and costs of relying on DER to meet forecasted system needs in comparison to traditional system infrastructure investments?
- What are the issues, barriers, and opportunities for customers in the San Joaquin Valley region to participate and/or invest in DER opportunities?

Three high-level observations came out of the study and form part of the basis of this staff paper:

- Sufficient amounts of firm DER in the right locations can serve as viable alternatives for meeting forecasted load growth and reliability needs in the San Joaquin Valley region. However, projects must materialize within the appropriate planning timeframes and be available where and when needed.

- DER can potentially provide ratepayer benefits in comparison to traditional system infrastructure investments. In the San Joaquin Valley region, the primary benefit is transmission infrastructure deferrals with an estimated long-term ratepayer benefit over $300 million.
- Customers must have an expanded role as DER hosts and market participants for DER to serve as a viable alternative. However, they must have hosting capabilities, willingness to make DER investments, and the appropriate market/price signals.

Distributed resources, by definition, are small-scale and are typically located on customer host premises or within communities. In other words, they are projects located where people live, work, and play and to the extent possible should conform to the land use standards of the community. This point must be emphasized and incorporated into planning and policy design in order to achieve DER deployments on a scale needed to defer infrastructure projects. It's imperative that California's energy planning process incorporate local economic, environmental, and demographic information. As an example, Chapter 2 provides a summary of staff's initial assessment of the San Joaquin Valley region.

Decentralized Energy Planning and Decision-Making

Today's DER market deploys resources through random customer investment decisions that are driven by the value proposition to the customer. DER tariffs and programs generally lack location-specific incentive structures and are not coordinated with the impact they have on the system. While customer choice must be preserved, DER incentives, tariffs, and programs should be targeted to reflect the resource value to the customer as well as the operational requirements of the system to maximize overall value. The success of targeted DER deployments will require innovative customer engagement strategies that serve as an effective two-way line of communications between system planners and customers. Customers must be made aware of the potential value that their DER investment decisions have on the system, and the utility must be made aware of the capabilities of the customers in the areas where investments are needed.

Chapter 3 proposes a conceptual decentralized DER planning process that takes the discussion to the customers and informs them about DER opportunities in their area, and provides them the opportunity to provide feedback to system planners and policy-makers about their capabilities to deliver on DER investments. That feedback could then be incorporated into location-specific procurement mechanisms (solicitation, incentives, tariffs, and programs) to maximize the DER potential in the area.

CHAPTER 1: Introduction

California has set an ambitious standard for energy and environmental policies that are designed to reduce greenhouse gas emissions. In 2006, Assembly Bill 32 (Nunez, 2006) was signed into law requiring California to reduce greenhouse gas emission to 1990 levels by 2020.[1] More recently, Governor Jerry Brown signed executive order B-30-15 establishing a greenhouse gas reduction target of 40 percent below 1990 levels by 2030, which puts the state on the right trajectory to meet the 2050 goal.[2] These policies provide a clear signal that California will lead by example in its efforts to combat climate change. However, as the saying goes, "the devil is in the details" and how the state meets these greenhouse gas reduction goals isn't simple. Several policies are affecting many of the state's economic sectors that produce greenhouse gas emissions. As one of the main producers, the energy sector (electricity, natural gas, and transportation) is squarely in the policy crosshairs to make energy generation, delivery, and consumption cleaner and more efficient.

The electricity sector's contribution to meeting greenhouse gas reduction goals is primarily driven by the Renewable Portfolio Standard (RPS), originally established in 2002 by Senate Bill 1078 (Sher, 2002) at 20 percent of retail electricity sales in 2020 to be served by qualified renewable resources. Senate Bill 2 (Simitian, 2011) raised the target to 33 percent by 2020. Just last year, Senate Bill 350 (De Leon, 2015) expanded the RPS to 50 percent by 2030, as well as set a target to double the amount of efficiency in electricity and natural gas end uses of retail customers by 2030.[3] Other policies are specifically affecting the transportation sector, buildings and the built environment, industry, and in general, how California citizens utilize energy resources. In fact, citizens, as customers in all of these sectors, are the common denominator in California's crusade against greenhouse gas emissions. Whether it's how we travel, where we live, or how we use energy, customers, more than any other stakeholder, are the most consequential player in combating climate change.

This staff paper focuses primarily on electricity use and the role of customers in making investments in clean, local energy resources that contribute to maintaining system safety and reliability, and also to meeting California's greenhouse gas reduction goals. It

1 http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32

2 https://www.gov.ca.gov/news.php?id=18938

3 https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350

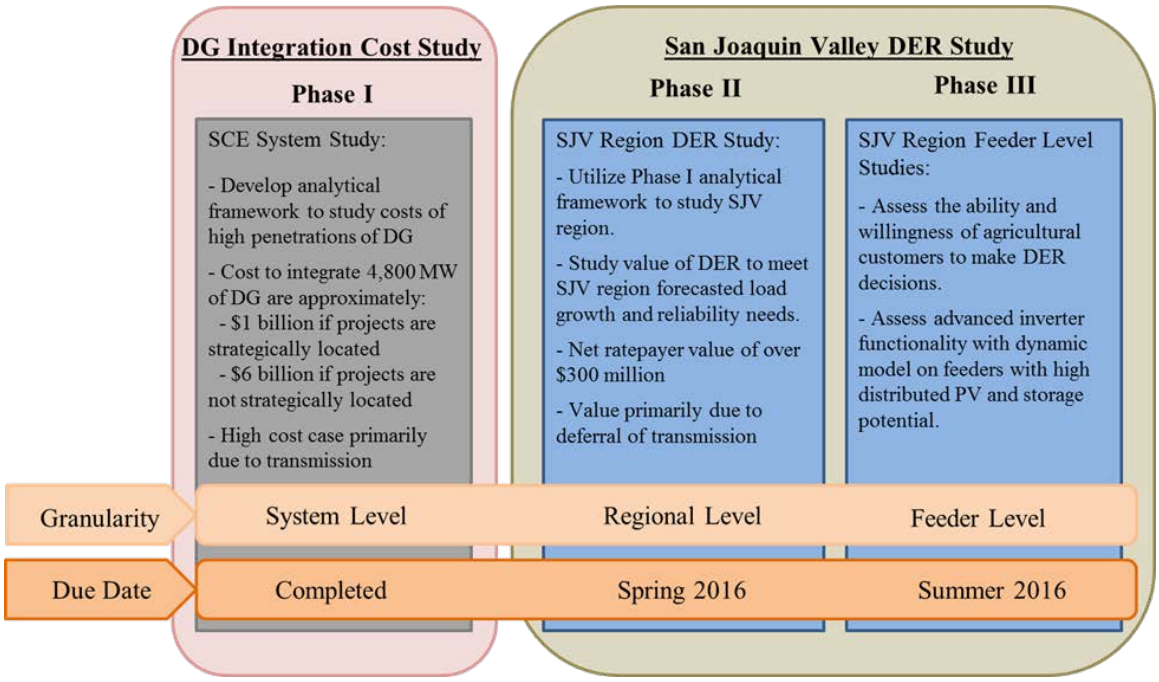
discusses and builds on the California Energy Commission's (Energy Commission) work studying the role of distributed energy resources (DER), such as distributed generation (DG), small-scale energy storage, electric vehicles, energy efficiency, and demand response in California's electricity portfolio. These resources are normally located on the premise of a customer host, with some exceptions such as larger DG projects, or small-scale storage that may be hosted by the utility or located within a community. Much of their value comes from their ability to reduce customer loads, which translates into a suite of benefits currently being discussed in relevant state energy proceedings.[4]

Energy Commission DER Assessment

The Energy Commission's ongoing DER assessment is providing valuable insights that inform its responsibility as the state's primary energy policy and planning agency. The phasing of the DER assessment is illustrated in **Figure 1** and indicates a sequence of increasing study granularity. Study results have demonstrated that DER value varies depending on several factors, in particular where the resource is located. DER tends to have location specific impacts, both positive and negative, but can potentially provide value at a regional or even system level. This can create a tension around how DER is operated, whether for the customer host's needs, the local distribution system, or at a wider system level.

4 There are several proceedings underway at multiple state agencies that will impact DER deployments. The California Public Utilities Commission is currently presiding over two related proceedings that are focused on DER planning and procurement: the Distribution Resource Plan proceeding (R.14-08-013) and the Integrated Distributed Energy Resource proceeding (R.14-10-003).

Figure 1: Energy Commission DER Assessment Phasing[5]



Credit: *Energy Commission*

The Phase I *Distributed Generation Integration Cost Study*, done in partnership with Southern California Edison (SCE), studied the impact of high penetrations of DG on SCE's system. [6] The study found that infrastructure investment costs could be over $6 billion if projects are not guided to areas of the system that are better equipped to accommodate them. **Figure 2** illustrates that transmission level upgrades make up the majority of the costs.

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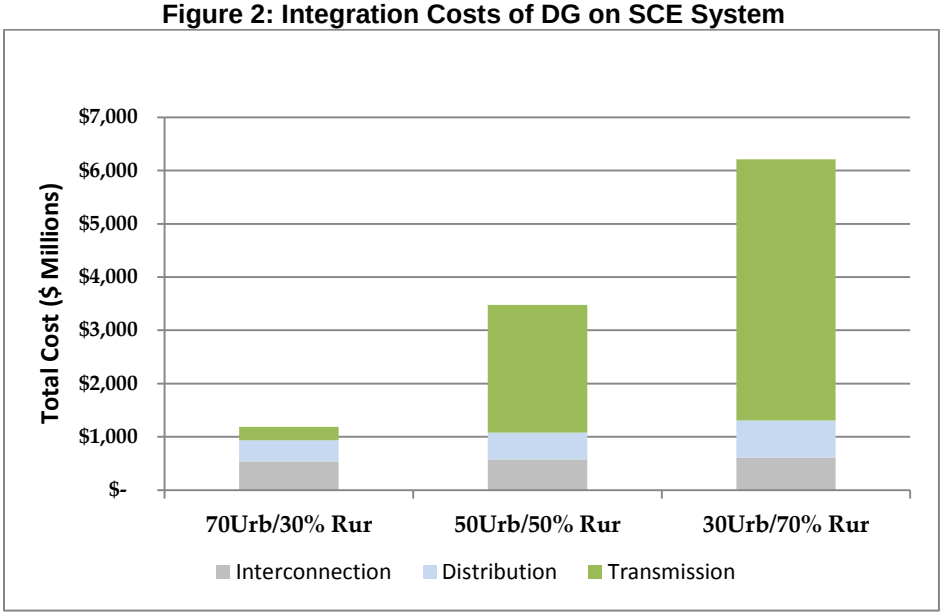
5 Reports will be published for each phase of the assessment. The Phase I report was published in 2014: http://energy.ca.gov/2013publications/CEC-200-2013-007/CEC-200-2013-007-REV.pdf. This staff paper is part of Phase II and is a companion report to the *San Joaquin Valley Region Distributed Energy Resource Regional Assessmen*t report**: INSERT REPORT LINK ONCE AVAILABLE**. Phase III reports should be published in late 2016 to early 2017.

6 http://energy.ca.gov/2013publications/CEC-200-2013-007/CEC-200-2013-007-REV.pdf. SCE estimated that 4,800 MW of DG would be their fair share of the Governor's Clean Energy Jobs Plan goal of 12,000 megawatts (MW) goal for localized energy development in California by 2020. Localized energy, or DG, is generally defined in the plan as projects sized 20 MW or fewer, interconnected on -site or close to load, that ca constructed quickly with no new transmission lines and, typically, with minimal environmental impact.

Figure 2: Integration Costs of DG on SCE System



Credit: *Navigant Consulting*

One of the study's primary finding was that a thoughtful planning approach that guides deployment of DG can mitigate system integration costs. The Phase I study's finding on DG's transmission system impact is consistent with the results of the Phase II study discussed below.

This staff paper builds on Phase II of the assessment, which is a study of the San Joaquin Valley (SJV) region of SCE's service territory.[7] The SJV region was selected because California's severe and persistent drought has created electric system reliability concerns in the region through decreased power generation from the Big Creek Hydroelectric Project (Big Creek) and from increased demand, primarily from agricultural groundwater pumping. Combined, these system conditions could require investment in new transmission infrastructure to accommodate increased power-deliveries from the south into the SJV region.

The study assesses the ability of DER to meet the region's forecasted load growth and reliability needs, in lieu of making traditional system infrastructure investments. Results indicate that if roughly 300 megawatts (MW) of firm DER can be deployed in the study area and online by 2025, DER can meet the system's forecasted needs at a net benefit of over $300 million by deferring new distribution and transmission infrastructure. However, the study was conducted from an electric system integration perspective and did not consider the role of customers that ultimately will be relied upon to make DER

7 Shlatz, Eugene, Dave Larsen, Steven Tobias, and Michael DePaolis. (Navigant Consulting), *2016. San Joaquin Valley Region Distributed Energy Resource Study: Regional Assessment.* California Energy Commission. Publication Number: CEC-200-2016 -004. (http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-200-2016-004).

investment decisions. This staff paper explores the customers' role in DER markets and system planning and makes recommendations to enable customers to become active DER planning participants.

Chapter 2: The San Joaquin Valley Distributed Energy Resource Assessment

The purpose of the SJV region study was to assess the ability of clean, local energy resources to meet the region's forecasted load growth and reliability needs.[8] Distributed resources, by definition, are small-scale and are located on customer host premises or within communities. They are projects located where people live, work, and play and, to the extent possible, should conform to the standards of the community. This point must be emphasized and incorporated into planning and policy design in order to achieve DER deployments on a scale needed to defer infrastructure projects.

This chapter provides a summary of staff's initial assessment of customers in the SJV region and a summary of the findings from the SJV region study.

The San Joaquin Valley Region

Geography and Population

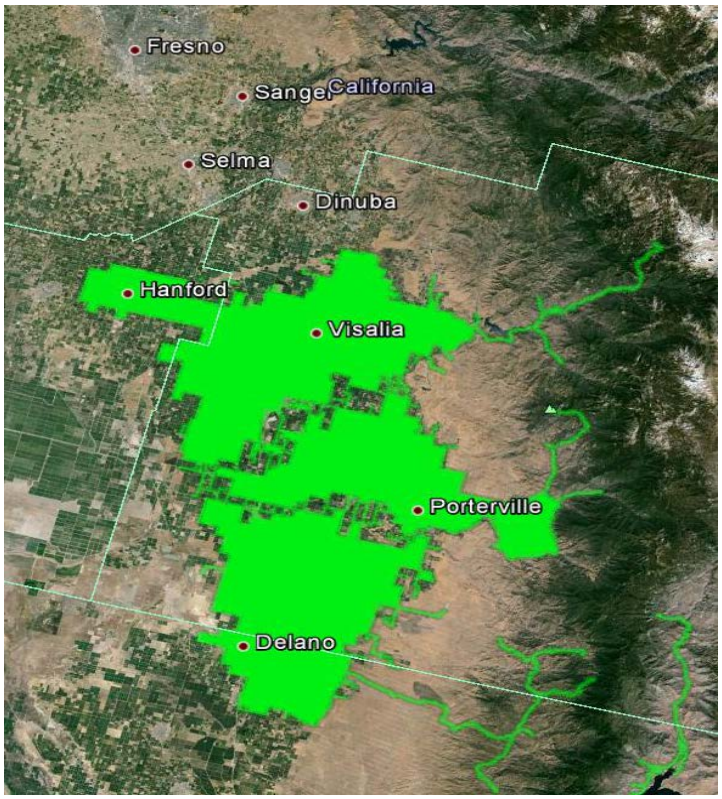
The SJV region study area is located in the southern San Joaquin Valley and primarily consists of Tulare County (460,000 population)[9], extending slightly into Kings County to the west and Kern County to the south, shown in **Figure 3.** It mostly consists of flat, rural lands with a few population centers, including the City of Visalia (130,000 population), the City of Porterville, (55,500 population), the City of Hanford (55,000 population), and the City of Delano (53,000 population).[10]

8 Shlatz, Eugene, Dave Larsen, Steven Tobias, and Michael DePaolis. (Navigant Consulting), *2016. San Joaquin Valley Region Distributed Energy Resource Study: Regional Assessment.* California Energy Commission. Publication Number: CEC-200-2016 -004. (http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-200-2016-004).

9 http://www.census.gov/quickfacts/table/PST045215/06107,00

10 http://www.census.gov/quickfacts/table/PST045215/00

Figure 3: SJV Region Study Area



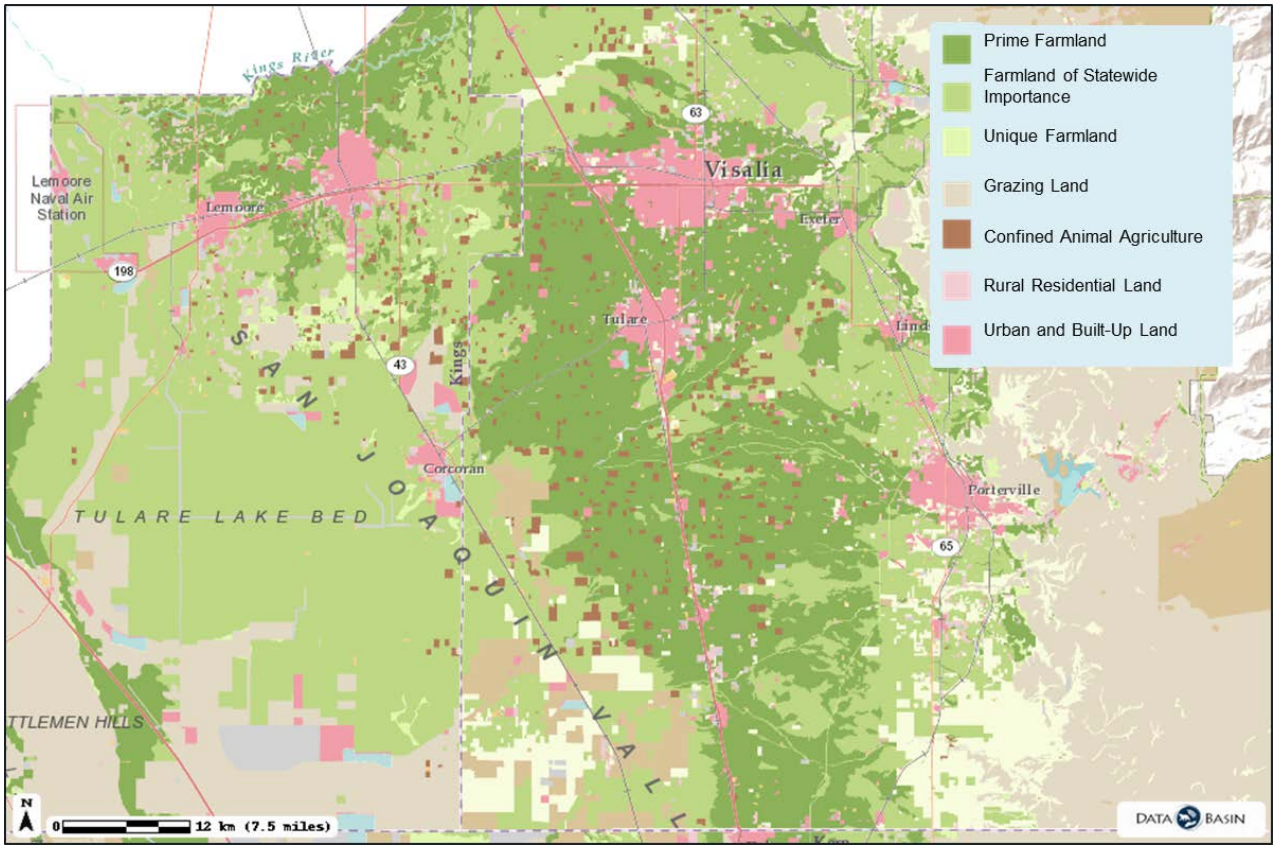
Credit: SCE's Renewable Auction Mechanism Map – Google Earth

Economy

The region is one of the most productive agricultural economies in the world. Tulare County alone contains 1.3 million acres of agricultural lands (approximately 42 percent of Tulare County), much of which has been designated by the California Department of Conservation as having varying degrees of importance.[11] Also, Tulare County is California's largest dairy and cattle producing county. **Figure 4** illustrates that the vast majority of the non-urban areas are currently designated as important farmland.

11 http://www.conservation.ca.gov/dlrp/fmmp; and http://www.tulcofb.org/index.php?page=agfacts

Figure 4: SJV Region – Important Farmland



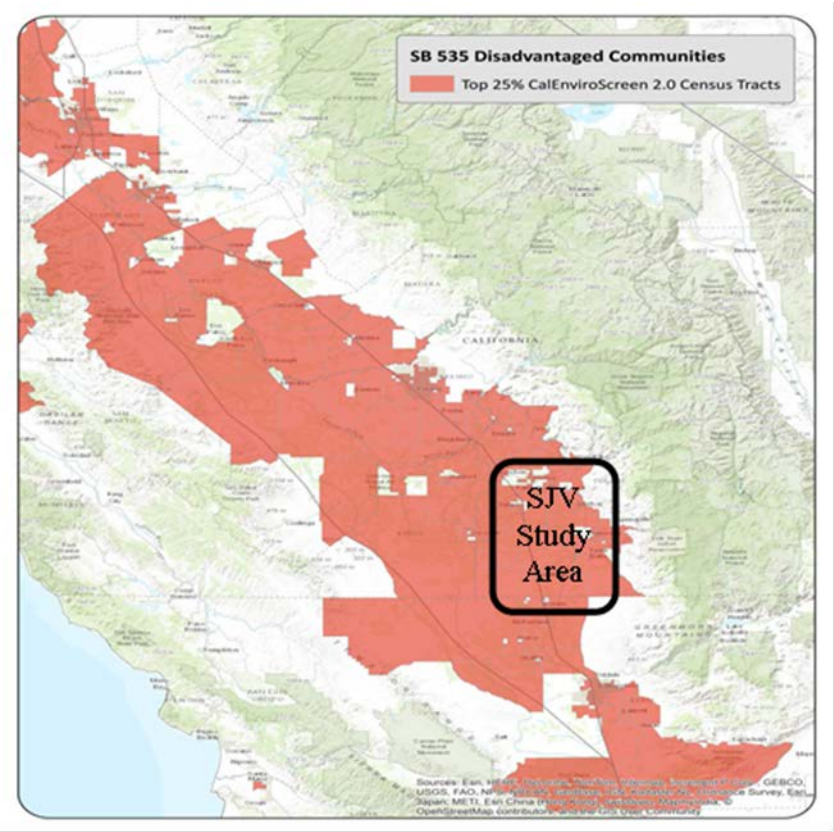
Credit: Energy Commission staff analysis of the Conservation Biology Institute's Data Basin mapping tool

Disadvantaged Communities

The region has been identified by the California Environmental Protection Agency's CalEviroScreen tool as having populations that suffer from high-risk environmental exposure.[12] The tool uses 19 indicators to assess whether a community is disadvantaged, including pollution exposure, environmental conditions, socio-economics, and population characteristics. **Figure 5** shows the San Joaquin Valley and the study area with an overlay of the CalEnviroScreen tool areas designated as disadvantaged.

12 http://oehha.ca.gov/calenviroscreen/report/calenviroscreen-version-20

Figure 5: San Joaquin Valley Disadvantaged Communities

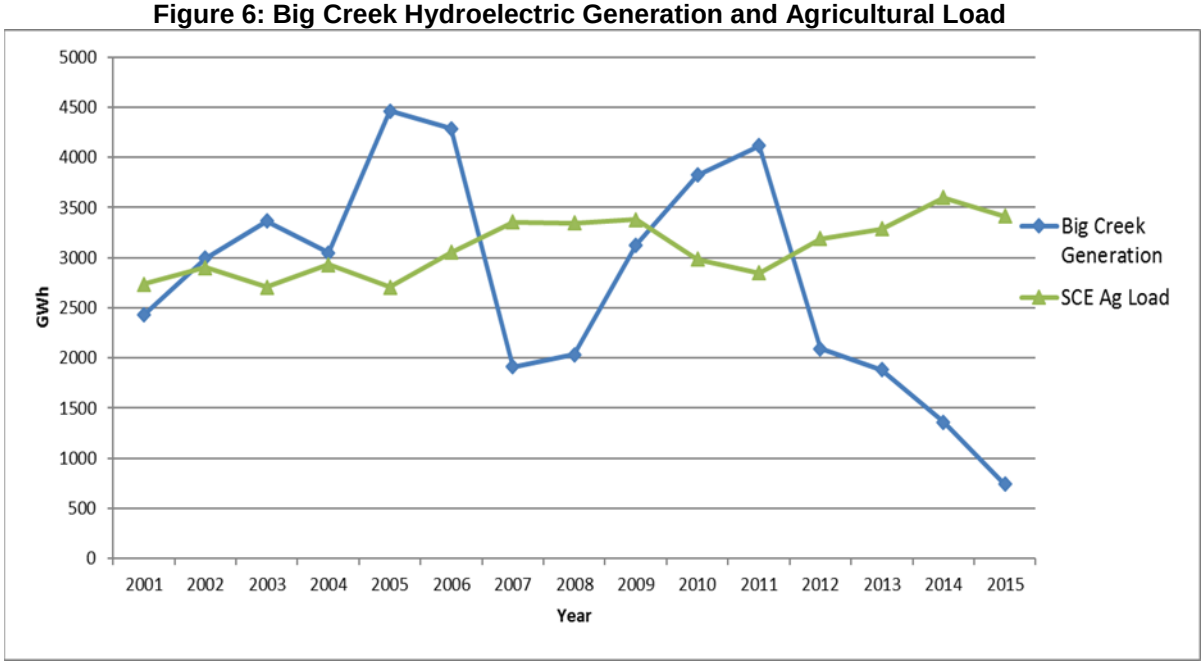


Credit: California Environmental Protection Agency – CalEnvrioScreen 2.0

Electricity System

The drought has challenged the region's electricity system, primarily from lowering hydroelectric generation from the Big Creek Hydroelectric Project. Additionally, the region's agricultural sector's electricity demand has a strong correlation to drought conditions, suspected to be tied to increased groundwater pumping from deeper wells. Should the drought persist, reduced hydroelectric generation coupled with regional demand increase will require system investments to serve the area. **Figure 6** illustrates that since severe drought conditions began in 2011, Big Creek hydroelectric generation has decreased while agricultural load has steadily increased with the exception of 2015. The SJV region study identified new transmission infrastructure to import power from south to north that would be required to mitigate drought year hydroelectric output levels.

Figure 6: Big Creek Hydroelectric Generation and Agricultural Load



Credit: Energy Commission

Current DER Deployments

Data on current DER deployments in California varies by resources. Some sources, such as the California Solar Initiative (CSI) database, are robust and transparent. However, there is no single DER data source and the sources that do exist vary in levels of quality and consistency. What is clear is that the DER market in the SJV region is active and that the potential is significant. The DER deployment numbers below are staff's best effort to catalog existing resources in the SJV region.

Distributed Generation

The SJV region study area includes most of Tulare County, the 93230 zip code (primarily City of Hanford) of Kings County, and 93215 (primarily City of Delano) and 93250 (primarily City of McFarland) zip codes of Kern County. **Table 1** shows there are currently 9,452 interconnected solar photovoltaic net energy metering (NEM) projects with a combined 128 MW of nameplate capacity.

Table 1: Net Energy Metering – Solar in the SJV Region

Sector	Number of Projects	kW AC Nameplate
Residential	9,001	51,428
Commercial	367	45,634
Industrial	76	26,536
Government	6	4,272
Non-Profit	2	97
Total	9,452	127,967

Credit: Energy Commission staff analysis of California Solar Initiative database.

Tulare County is the fifth highest ranking county in state in terms of NEM solar photovoltaic (PV) installations with nearly 125 MW of capacity installed.[13] Four of the top eleven cities with NEM solar photovoltaic installations are within the SJV study area: City of Tulare, Visalia, Delano, and Hanford.[14] The top five zip codes in the state for NEM solar photovoltaic installations are within the SJV study area: 93274 (City of Tulare) 32.3 MW, 93215 (City of Delano) 19.3 MW, 93230 (City of Hanford) 17.9 MW, 93272 (City of Tipton) 15.5 MW, and 93257 (City of Porterville) 15.4 MW.

Community-scale renewables (generally defined as projects up to 20 MW) have experienced some success in the region with four projects equaling 75 MW (nameplate) of solar capacity installed near the Vestal substation.[15]

Energy Storage

According to the Department of Energy storage database, which tracks energy storage projects worldwide, there is only one energy storage project in the SJV study area, the Big Creek Pumped Storage project.[16] There are two projects located just to the south in the Techachapi wind resource area:

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13 https://www.californiasolarstatistics.ca.gov/reports/locale_stats/

14 https://www.californiasolarstatistics.ca.gov/reports/locale_stats/

15 Renewable Auction Mechanism projects:
https://www.sce.com/wps/portal/home/procurement/solicitation/ram

16http://www.energystorageexchange.org/projects?utf8=%E2%9C%93&technology_type_sort_eqs=&technology_type_sort_eqs_category=&country_sort_eq=&state_sort_eq=California&kW=&kWh=&service_use_case_inf=&ownership_model_eq=&status_eq=&siting_eq=&order_by=&sort_order=&search_page=1&size_kw_ll=&size_kw_ul=&size_kwh_ll=&size_kwh_ul=&show_unapproved=%7B%7D

- The SCE Tehachapi Wind Energy Storage Project, an 8 MW (32 MW-hr) battery storage project.
- The SCE Tehachapi Beacon Gen 4 FESS, a 100- kw flywheel project that can discharge power for up to 15 minutes.

The California Public Utilities Commission's Self-Generation Incentive Program (SGIP) database tracks the program's project applications. It includes a significant number of energy storage installations located in the SJV region, as shown in **Table 2**.

Table 2: Self-Generation Incentive Program – Energy Storage Applications

Year	Number of Applications	Total Capacity
2013	1	5 kW
2014	13	494 kW
2015	38	2,409 kW
Total	52	2,908 kW

Credit: Energy Commission staff analysis of SGIP database

Only one of the SGIP projects in **Table 2** has an interconnection date listed database.[17] Presumably, the rest of the projects are in various stages of development and some may ultimately be cancelled.[18]

Energy Efficiency

Table 3 shows how Tulare County, which is the majority of the SJV study area, compares statewide in energy efficiency, shown in gigawatt hours (Gwh) saved during two recent reporting periods.

17 As of May 2016.

18 The Burton School District in Porterville is the recipient of at least four of the SGIP projects listed in **Table 2**, and is also receiving Proposition 39 funding that is contributing to cover the costs of the projects.[18]

Table 3: Energy Efficiency Savings by Sector (GWh)

County	Agriculture	Commercial	Industrial	Residential	Total all Sectors
Other CA Counties	35.5	622.1	152.5	280.8	1090.9
Tulare	14.6	13.4	7	6.7	41.7
Total 2010 - 2012[19]	50.1	635.4	159.5	287.5	1132.5
Other CA Counties	29.4	695.9	162.2	389	1276.5
Tulare	17.4	15.1	5.9	6.7	45.1
Total 2013 - 2015 (Q2)[20]	46.8	711	168.1	395.7	1321.6

Credit: Energy Commission staff analysis of eestats.cpuc.ca.gov

These numbers highlight the importance of the agricultural sector to the region's economy and to potential DER deployments. While Tulare County accounts for 2 to 4 percent of gigawatt-hour (GWh) savings statewide in the commercial, industrial, and residential sectors, in the agricultural sector it accounted for 29 percent during the 2010-12 reporting period, and 37 percent during 2013-15 reporting period.

Electric Vehicles

The study area does not have a significant concentration of electric vehicles. Currently, there are 116 light duty battery electric vehicles registered in the study area.[21]

Demand Response

Staff has not been able to identify demand response customer participation that is specific to the study area.

19 Net evaluated.

20 Net reported data available through 2nd quarter 2015.

21 Energy Commission & Department of Motor Vehicles data

San Joaquin Valley Regional Assessment – Results

Previous sections of this chapter highlight existing DER in the SJV region. These projects were largely deployed without consideration of the potential benefit they can provide to the area's transmission and distribution system. The SJV regional assessment examined this issue, and results tell a compelling story about the potential of sufficient amounts of DER in the right locations to meet forecasted system needs. The study set out to provide insights to the following three high-level questions:

- Is DER a viable alternative to meeting load growth and reliability needs in the San Joaquin Valley region?
- What are the electricity system benefits and costs of relying on DER to meet forecasted system needs in comparison to traditional system infrastructure investments?
- What are the issues, barriers, and opportunities for customers in the SJV region to participate and/or invest in DER opportunities?

There are three high-level observations that came out of the SJV region study:

- Sufficient amounts of firm DER in the right locations can serve as viable alternatives for meeting forecasted load growth and reliability needs in the SJV region. However, projects must materialize within the appropriate planning timeframes and be available where and when needed.
- DER can potentially provide significant electricity system benefits in comparison to traditional system infrastructure investments. In the SJV region, the value is driven by transmission deferrals with an estimated long-term ratepayer benefit over $300 million
- Customers must have an expanded role as DER hosts and market participants for DER to serve as a viable alternative. Three things customers must have are hosting capabilities, willingness to make DER investment, and the appropriate market/price signals.

Several additional findings were made, including:

- Advanced inverter functionality can mitigate almost all interconnection costs.
- Energy storage can play an important role in firming up other DER resources, specifically distributed solar, by storing and shifting generation output to match feeder or system peak.
- System upgrade costs can be reduced when the location of DER is optimized to mitigate impacts to the distribution system, which entails targeting DER to feeders that have been identified as having a relatively low cost to integrate.

Chapter 3: Customer Power

The question posed at the beginning of this paper was, can DER serve as a viable alternative to traditional utility system investments? The SJV region study provides a positive, yet incomplete answer. Deploying 300 MW of firm DER in the SJV study area can provide ratepayer benefit of over $300 million, a majority of which derives from transmission-level deferrals.[22] However, deploying 300 MW of firm DER is contingent on several factors, including study area customers making several independent decisions about modifying their energy use and making investments. Staff has few insights into their capabilities to make these commitments, which presents a challenge if system reliability is based on those decisions. Ultimately, the customer's ability, willingness, and decision-making will determine if DER can serve as a viable alternative to traditional utility infrastructure in the SJV region, or any other region.[23]

Motivating customers to make DER investment decisions requires policies and programs that realistically reflect their capabilities, and communicate a clear, location-specific value proposition based on the local system and bulk system needs. California's energy agencies are currently considering aspects of these issues within various regulatory and planning proceedings. The traditional energy regulatory process inadequately engages customers in ways that allow them to actively participate in system planning. Sufficient DER deployment in locations that can defer infrastructure investments will require new ways to engage customers and incorporate their feedback into incentive, tariff, and program designs.

Decentralized DER Planning and Decision-Making

Today's DER market deploys resources through independent, random customer investment decisions that are driven by the value proposition to the customer. DER tariffs and programs generally lack location-specific incentive structures and are in many ways disconnected from the impact they have on the system. While customer choice must be preserved, DER incentives, tariffs, and programs should be targeted to reflect the resource value to the customer as well as the operational requirements of the system to maximize overall value. The success of targeted DER deployments will require innovative customer engagement strategies that serve as an effective two-way line of communication between system planners and customers. Customers must be made

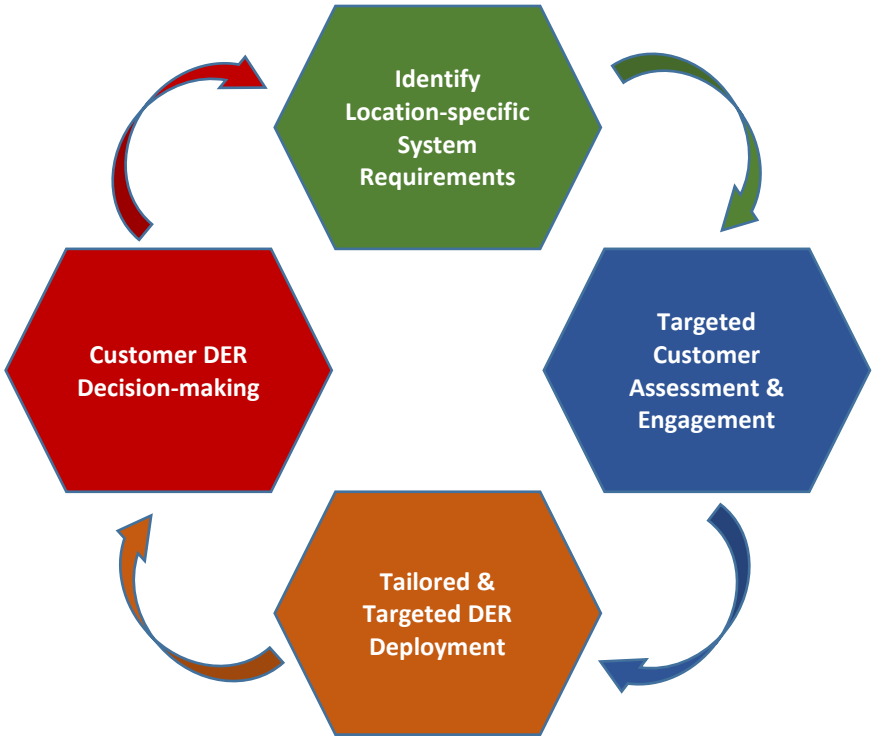
22 Staff recognizes that other DER derived benefits are currently being discussed by stakeholders. For the purposes of this paper, the focus is on the technology and infrastructure costs and benefits.

23 This assumes that utilities themselves are precluded from making significant investments in strategically located DER.

aware of the potential value that their DER investment decisions have on the system, and the utility must be made aware of the customer's capabilities in the areas where investments are needed.

This chapter proposes the development of a decentralized DER planning process that takes the discussion to the customers and informs them about DER opportunities in their area, and provides them the opportunity to provide feedback to system planners and policy-makers about their capabilities to deliver on DER investments. That feedback should be incorporated into location-specific procurement mechanisms (solicitation, incentives, tariffs, and programs) to maximize the DER potential in the area.

Figure 7: Conceptual Decentralized DER Planning Process



Credit: Energy Commission

Figure 7 illustrates the DER planning process as a feedback loop that starts with system planners identifying required investments within a specific geographical area, such as a city, county, region, or some other rationale boundary. That area would then be targeted for two-step customer engagement process:

1. Customer DER potential assessment that identifies the types of customers in the area and their DER investment capabilities.
2. Customer engagement, education, and outreach efforts to communicate potential DER opportunities, values, and applicable timeframes.

Customer engagement must go beyond traditional forms of communications, such as mailers, on-bill notifications, and website postings. Community meetings should be held within the area to discuss DER opportunities and to solicit feedback from customers about their capabilities to participate in DER programs and make DER investments. That feedback should be incorporated into location-specific solicitations, tariffs, programs, and incentives to maximize the potential for DER investments within the area. The customer response to the targeted procurement should be evaluated and lessons-learned should be utilized as another customer feedback source to inform the next wave of targeted procurement efforts in the area and in other areas. This approach should provide value to customers through a more hands-on, engaging approach to system planning, and should provide value to system planners through development of more effective procurement mechanisms and data collection on customer DER adoption trends that can be utilized in investment planning.

Staff proposes that the SJV region be utilized as a "pilot" location for a decentralized DER planning process, since the first step (identifying system requirements) is complete. While the "pilot" would be framed within the context of deploying 300 MW of firm DER in the SJV region, staff believes the study will inform discussions happening in related proceedings and would be applicable to other regions in the state. **Table 4** identifies the steps that should be utilized to conduct the pilot.

Table 4: Steps for Pilot Decentralized DER Planning Process

STEP	ACTION
1	Assess and engage customers through innovative outreach strategies, such as targeted community meetings, to communicate DER opportunities within the region, and to solicit feedback on customer DER hosting capabilities.
2	Develop pilot DER procurement mechanisms that reflect customer feedback (Step 1) and are aligned with location specific grid needs.
3	Pilot tailored and targeted DER procurement mechanisms developed in Step 2.
4	Assess the customer response to the tailored and targeted DER procurement mechanisms and incorporate the lessons learned into subsequent efforts.
5	Incorporate lessons learned into DER forecasting techniques since these assumptions may influence system investment decisions.[24]

Credit: Energy Commission

Assessment and Outreach to SJV Region Customers

As part of the Energy Commission's DER planning initiative outlined in **Figure 1**, staff has started to explore approaches to the "Target Customer Assessment and Outreach" step of the conceptual decentralized planning process shown in **Figure 7**. Chapter 2 serves as a summary of staff's initial assessment of the SJV region's customers, economy, and existing DER deployments. Staff will continue to refine their customer assessment efforts and build on the findings from SJV region study with a focus on three relevant subjects in the region:

1. Disadvantaged Communities
2. Agricultural Customers
3. Advance Inverter Deployment

Disadvantaged Communities

Energy policies often target disadvantaged communities with funding and opportunities for investing in clean, local resources that provide economic development and environmental benefits. For example, Senate Bill 535 (De Leon, 2012) directs 25 percent

24 Random DER deployments and limited understanding of how DER will augment customer load makes location-specific forecasting difficult. DER adoption trends need to be better understood to refine DER forecasts for planning and investment purposes.

of revenue generated by cap-and-trade to projects that benefit disadvantaged communities,[25] which for fiscal years 2014/15 and 2015/16 means a few hundred million dollars are available for energy related projects (generation, efficiency, transportation, water, and built environment).[26] Funding and existing programs, such as the Single-family Affordable Solar Homes (SASH) program[27], the Senate Bill 43 green shared renewable tariff[28], and enhanced incentives for electric vehicles provide opportunities for low-income households to make DER investment decisions. These opportunities need to be communicated and leveraged, particularly in the San Joaquin Valley, which has large concentrations of disadvantaged communities. The value does not have to be limited to the customer, however, and should be coordinated with system planning to deploy DER in locations where needed. The SJV study area provides a real opportunity to leverage existing funding and programs targeted at disadvantaged communities to reduce their energy bills, improve local economic and environmental conditions, and play a critical role in deploying 300 MW of firm DER.

Action Item 1: Evaluate the success and challenges of energy policies targeted at disadvantaged communities in the SJV study area.

Energy Commission staff will conduct an outreach effort to evaluate current DER participation in disadvantaged communities and inform them about potential DER opportunities.

Action Item 2: Evaluate how DER opportunities for disadvantaged communities in the SJV study area can be coordinated with system planning.

Energy Commission staff will evaluate energy policies that target disadvantaged communities within the context of system planning. By design, these policies guide DER deployments to specific locations, providing potential for multi-benefit DER deployments.[29]

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25 The California Environmental Protection Agency (CalEPA) has the authority to identify disadvantaged communities and developed the California Communities Environmental Health Screening Tool (CalEnviroScreen). The top 25 percent of census tracks in California based on the CalEnviroScreen tool are eligible for cap-and-trade funds.

26 Greenhouse Gas Reduction Funds Programs – Appropriations as of September 2015: www.arb.ca.gov/cc/capandtrade/auctionproceeds/summaryproceedsappropriations.pdf

27 The most recent SASH program report identifies gaps in funding as a real obstacle to low-income families to invest in clean, local resources. Single-family Affordable Homes Program: Semi-annual Program Status Report (January 2016), p. 7. gridalternatives.org/sites/default/files/Semi_annual_SASH_Program_Status_Report_January%202016.pdf

28 http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140SB43

29 Program, such as the SB 43 Green Shared Renewables Tariff, are capable of targeting DER deployments to specific locations.

Agricultural Customers

The agricultural sector is a major driver of the SJV region's economy, making agricultural customers a potentially important stakeholder in DER deployments. They can be active participants in deploying behind-the-meter and wholesale projects given their wide-ranging operations and suitable land for larger DG projects. Existing procurement mechanisms may under-utilize their potential, and a better understanding of their DER investment capabilities is needed to develop targeted DER opportunities.

Action Item 3: Engage SJV region agricultural customers to assess their DER hosting capabilities.

Energy Commission staff will conduct a study of the capabilities of SJV region agricultural customers to make DER investment decisions, including opportunities for modifying their operations to shape their load, and for developing on-site generation.[30] The study will include assess potential incentive structures and tariffs that motivate customers, and the barriers that impact DER investment decisions.

Advanced Inverter Deployment

Chapter 2 of this staff paper highlights that the SJV region has experienced some the state's highest penetration levels of distributed PV. While that success is impressive, it can present system operations issues that can require traditional utility investments, such as capacitors or new conductors, to mitigate potential overloads and voltage issues. The Energy Commission's Phase II SJV region study demonstrates that advanced inverter functionality can mitigate many system issues created by distributed PV.[31] However, the impact of integrating multiple devices with advanced inverter functionality along a single feeder has not been thoroughly assessed, nor have the associated costs of the needed communications and controls to manage these resources. These unknowns must be assessed and incorporated into DER valuation, and ultimately into tariffs and programs.

Action Item 4: Assess the ability of advanced inverter functionality to increase DER penetrations and provide distribution system level services.

Energy Commission staff has initiated a study to evaluate advanced inverter functionality on specific SJV region feeders utilizing a dynamic distribution system model. The analysis will utilize the Smart Inverter Working Group Phase 3

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30 This may include evaluating the impact of the recent NEM successor tariff decision to allow participation of projects over 1 MW.

31 Shlatz, Eugene, Dave Larsen, Steven Tobias, and Michael DePaolis. (Navigant Consulting), *2016. San Joaquin Valley Region Distributed Energy Resource Study: Regional Assessment.* California Energy Commission. Publication Number: CEC-200-2016 -004.
(http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-200-2016-004).

recommendations, providing valuable insights into the recommendations' operational impacts and value.[32]

Conclusion

Moving California from the traditional electricity sector model to one that relies on increasingly cost-effective clean, local resources requires extensive examination of the costs, benefits, and needed regulatory and market constructs to enable large-scale deployment of these resources. Fortunately, several initiatives and proceedings are currently underway at California's energy agencies, as well as other states, such as New York's *Reforming the Energy Vision* initiative.[33] While the future of clean, local energy resources seems bright, there are complex issues and questions that need to be addressed, including how to improve customer participation in energy planning processes, and incorporating their capabilities into procurement mechanisms. This staff paper takes a step in that direction by presenting a conceptual decentralized energy planning process that takes the discussion to California's electricity customers.

32 http://www.energy.ca.gov/electricity_analysis/rule21/

33 http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument