The City of Hermosa Beach: Assessing Community Choice Aggregation

Jessi Hampton, Jonathan Ho, Jessica Leigh, David Limjoco, Steven Odom, Francis Villanueva, Adrian Salazar
Advisor: Juan Matute
June 2014
UCLA Environment 180 Senior Practicum 2013-2014
UCLA Institute of the Environment and Sustainability

Acknowledgements:

We would like to recognize and extend our gratitude to the individuals and organizations who have made this report and study possible.

Special thanks to our Project Advisor, Juan Matute, for his expertise, guidance and continuous support throughout the project.

Additional acknowledgements to Pamela Townsend, the City of Hermosa Beach, the City of Hermosa Beach City Council, Professor Travis Longcore and the UCLA Institute of the Environment.

Who Are We?

We are comprised of seven graduating seniors from the UCLA Institute of the Environment and Sustainability. The goal of this research, performed over the course of the past six months, has been to examine methods of procuring decarbonized electricity for the City of Hermosa Beach. With the careful guidance under our advisor Juan Matute, we have produced a report that outlines the recommended next steps toward attaining carbon neutral electricity for the City of Hermosa Beach.

List of Acronyms

CAISO	California Independent System Operator
CCA	Community Choice Aggregation
CEC	California Energy Commission
CEJA	California Environmental Justice Alliance
CES	Community Energy Storage
CPUC	California Public Utilities Commission
CRS	Cost Responsibility Surcharge
FERC	Federal Energy Regulatory Commission
FHFA	Federal Housing Finance Agency
FIT	Feed-in Tariff
GHG	Greenhouse Gas
GTSR	Green Tariff Shared Renewables
HDPA	High Desert Power Authority
HERO	Home Energy Renovation Opportunity
IOU	Investor Owned Utility
IPP	Independent Power Producer
IRB	Institutional Review Board
IREC	Interstate Renewable Energy Council
JPA	Joint Powers Authority
LCCA	Lancaster Community Choice Aggregation
LMUD	Lassen Municipal Utility District

LPA	Lancaster Power Authority
MCE	Marin Clean Energy
MUD	Municipal Utility District
PACE	Property Assessed Clean Energy
PG&E	Pacific Gas and Electric
PPA	Power Purchase Agreement
REC	Renewable Energy Certificate
RPS	Renewable Portfolio Standard
SCE	Southern California Edison
SCP	Sonoma Clean Power
SDG&E	San Diego Gas and Electric
SJVPA	San Joaquin Valley Power Authority
SMUD	Sacramento Municipal Utility District

Table of Contents

Chapter 1: Introduction

The City of Hermosa Beach aspires to be distinguished as the 'leader in sustainability' by becoming 'a more livable and sustainable beach city'. Residents already know the City of Hermosa Beach as the "best little beach city" in the South Bay, but with progressive goals in sustainability, they are striving for more. The 1.43 square miles which comprises the city is home to nearly 20,000 residents with a median household income of $100,696.[1] Together they consume approximately 78 GWh of electricity per year served by Southern California Edison (SCE), an investor owned utility (IOU).[2] Over the past few years, the city has sought to integrate sustainability into its municipal operations and community as a whole. They have already led several successful sustainability ventures in order to reach their ultimate goal of becoming a carbon neutral municipality. This goal was set in 2010 by the City of Hermosa Beach to source all municipal and community operations from renewable sources. Other notable achievements in sustainability include becoming the first South Bay City to join the 'Cool Cities' Initiative, completing a municipal greenhouse gases (GHG) inventory, creating The Green Task Force, and many more (see below).

Table 1.1. A Timeline of the City of Hermosa Beach's Notable Sustainability Achievements[3]

Year	Accomplishment
2006	The City of Hermosa Beach was the first South Bay city to join the 'Cool Cities' initiative and endorsed the 'U.S. Mayors Climate Protection Agreement'.
2007	The Green Building Committee puts green issues on City's agenda.
2009	The Green Task Force was appointed by the City Council to advise on green initiatives and prepare a sustainability/ climate action plan.
2009/2010	Greenhouse gas emissions inventories were prepared
2010	**The City Council supports the carbon neutral initiative**
2011	A sustainability/climate action plan is presented by The Green Task Force

[1] (The U.S. Census Bureau, 2012)

[2] (ICF International, 2012)

[3] (The City of Hermosa Beach, 2011a)

Table 1.2. The City of Hermosa Beach's Environmental Sustainability Strides[4]

Sector	Accomplishment
Water Conservation & Landscaping	· Uses recycled water for 75% of parks, greenbelt & medians
	· 1st in L.A. County to initiate Clean Beach Restaurant Program
	· Storm water infiltration system runs along Strand & Pier Avenue
	· Adopted water conservation & landscape ordinances
	· Ocean Friendly Garden demo project at 22nd St./The Strand
Waste Reduction	· Sponsors an annual beach clean-up day
	· City offers compost and worm bins at discounted prices
	· City cleaning supplies are environmentally friendly
	· Instituted Special Events sustainability requirements
	· Recycles all green waste (grass & tree trimmings) from city facilities
Energy & Building	· Converted all traffic signals to LED
	· Waives fees on solar energy system plan checks
	· Installed solar powered flashing red lights at 8 locations
	· Amended zoning code to allow small wind energy systems
	· Adopting sustainability measures in new CalGreen Building Code
	· Improved Pier Avenue to create vibrant pedestrian environment
	· Adopted form-based pedestrian oriented zoning for Pier Avenue
	· Initiated city program to replace gas vehicles with alternate fuels
	· Placed 'Sharrow' (share the lane) markings on Hermosa Avenue
	· Local Use Vehicle (electric vehicle) Program participant
	· Offers free metered parking to all electric vehicles
Transportation	· Improved Pier Avenue to create vibrant pedestrian environment
	· Adopted form-based pedestrian oriented zoning for Pier Avenue
	· Initiated city program to replace gas vehicles with alternate fuels
	· Placed 'Sharrow' (share the lane) markings on Hermosa Avenue
	· Local Use Vehicle (electric vehicle) Program participant
	· Offers free metered parking to all electric vehicles

[4] Ibid

Sector	Accomplishment
Notable Contributions by Hermosa Beach's Green Task Force	· Adopted water conservation and drought management ordinance
(2010-2011)[iii]	· Adopted water efficient landscape ordinance that exceeds state regulations
	· Adopted water efficient landscape ordinance that exceeds state regulations
	· Adopted water efficient landscape ordinance that exceeds state regulations
	· City distributes recycling guide to every house and business
	· Instituted Special Events sustainability requirements
	· Recommends ban on polystyrene take-out food containers (est. Completion June 2011)
	· Prepared Sustainability Plan

Figure 1.1. A picture of the City of Hermosa Beach's Strategic Plan

In 2013, a group of seven graduating students from UCLA's Institute of the Environment and Sustainability produced a carbon neutral scoping plan for the City of Hermosa Beach. The UCLA Practicum team in conjunction with the City of Hermosa Beach initiated a project which counted all GHG emissions associated with water, energy, and materials consumption and acquisition. From analysis of this data, they identified the sources and quantities of GHG emissions in the city. Using this information, three scenarios for reduction of total GHG emissions were produced, spanning a timeframe from 2015-2075. These models varied in intensity, with the final recommendation that the City of Hermosa Beach pursue most aggressively, a combination of energy efficiency, implementing electricity from renewable energy sources, and purchasing carbon offsets.[5]

This year, the team, comprised of a new set of seven graduating seniors, continued research from the previous year's conclusions. We focused centrally on electricity generation. This year's report sets out to explain various avenues of attaining carbon neutral electricity and provide a final recommendation tapered to the specific needs of the City of Hermosa Beach. In order to provide the most sufficient and suitable recommendation, these two main topics of research were analyzed by financial cost and technical feasibility. The result of this research is a comprehensive recommendation for the City of Hermosa Beach to achieve carbon neutral electricity generation.

First, we started by considering the efforts of energy efficiency to address the specific constraints electricity supply. Next, the goal was to increase the amount of renewable resources to the grid. Consequently, we set out to investigate methods of delivery and distribution of electricity from renewable sources. The bulk of the research is examining and determining the feasibility of two different energy policy options, a Community Choice Aggregation (CCA) and SCE's version of a Green Tariff Shared Renewables (GTSR) program. A CCA is a system in which residents of a community can unite their demand for electricity and interactively decide from whom they purchase their power. Most importantly, residents, along with their local governing boards, have influence over the selection of the energy sources providing their electricity with this program. Secondly, the newly created GTSR program offered by SCE, allows ratepayers access to a higher portfolio of renewable energy procured by the utility for a premium price. With each respective energy policy, the advantages/disadvantages and technical requirements were carefully analyzed to ensure a suitable fit for the City of Hermosa Beach.

[5] (Dickinson, Fan, Goh, Maki, Savarani, Shabnoor, & Trans, 2013)

Methodology

To provide the City of Hermosa Beach with options and recommendations to reach carbon neutrality in its electricity production and delivery system, we first developed expertise in the following areas: methods to increase energy efficiency, technical aspects of electricity generation, transmission and consumption, CCA programs, the GTSR program, and PPAs.

We learned how the efficiency of electricity consumption can be increased in a city by reviewing literature and researching best market practices. We studied various approaches aimed to improve city-wide energy efficiency, including but not limited to, technological improvements and policies. In addition, we studied the structure and consequences of the existing Home Energy Renovation Opportunity (HERO) program. The HERO program is a policy designed to incentivize and help homeowners improve home energy efficiency by upgrading home structure and electronics.

Technical components of electricity generation such as transmission and consumption are integral parts of understanding how to achieve carbon neutrality. They were investigated by reviewing scientific literature. We explored where and how exactly the City of Hermosa Beach could potentially get renewable energy. After this research, we were able to understand the current structure of the grid, its shortcomings, the technical challenges of integrating renewable sources of energy into the grid, and possible solutions to these challenges.

We became familiar with CCA programs by reviewing literature, reviewing relevant legislations, and studying current practices. We studied the structure and operation of existing CCA programs, including examining the CCA feasibility reports of Berkeley and East Bay. We also explored the benefits of multiple municipalities forming a joint CCA program. Another option for providing carbon neutral electricity is the GTSR program. We began researching and reviewing Senate Bill 43, followed by an analysis of public comments on the legislation. Then we investigated SCE's Green Rate Proposal and opinions surrounding its submission to the California Public Utilities Commission (CPUC).

To comply with UCLA policy regarding research involving interviews, the team first had to obtain approval from the Institutional Review Board. Every group member went through the Collaborative Institutional Training Initiative. The interviewing aspect of the project was contingent on the approval of the research project by IRB.

After becoming experts in the aforementioned topics, we analyzed the feasibility and applicability of various policies for the City of Hermosa Beach. We analyzed the technical situation, geographical factors and constraints, demographic factors, and political atmosphere of the City of Hermosa Beach. With these considerations, we assessed the feasibility of various options for Hermosa Beach. We calculated the possible benefits of each option and the relative costs of each option. The costs were calculated through estimation and extrapolation of the known costs of each option. After feasibility assessments and thorough cost-benefit analyses of the options were executed, we made a policy recommendation for the City of Hermosa Beach.

Throughout the duration of the project, we worked under the guidance and supervision of our advisor Juan Matute. Our advisor acted as the intermediary between us and the client, the City of Hermosa Beach.

Chapter 2: Options to Decarbonize Electricity

This chapter presents brief overviews of what options the City of Hermosa Beach has in order to decarbonize electricity used in the city to achieve municipal carbon neutrality. The options consist of rooftop solar, SCE's GTSR program, and a CCA program.

Rooftop Solar

GIS analysis shows that if all residential units of the City of Hermosa Beach were to install rooftop solar panels, they would generate 56.8 GWh of electrical power in a year, more than two thirds of the city's annual electricity demand. If all rooftops in the city, including residential units, were covered with solar panels, they would generate a total of 76.2 GWh per year, almost the entire city's annual electricity demand.

Rooftop solar has tremendous potential to provide carbon neutral electricity for the city, but there are also technical challenges that come with heavy reliance on rooftop solar. These include, but are not limited to the following: threatening power reliability, locally jeopardizing power quality, current infrastructure not suitable for bidirectional power flow, and electricity generation only as long as sunlight is available.

Green Tariff Shared Renewables

One option for the City of Hermosa Beach to decarbonize electricity deliveries is to turn to the newly created GTSR program by SCE. The Green Rate program is a brand new addition to SCE's service plan mandated by California Senate Bill 43. As a requirement of this legislation, utilities will begin to offer programs equivalent to the Green Rate program outline. Each program offers ratepayers an opportunity to buy high-percentage renewable energy directly from their service provider. Currently, the CPUC is reviewing SCE's program proposal to see if it meets the qualifications set by SB 43.

Once approved, ratepayers in the City of Hermosa Beach can purchase fifty or one-hundred percent renewable power on the GTSR program. Demand from local residents will be filled with the 269 MW of power allocated to SCE for their service area. Enrollment in this rate begins twelve months after approval of the proposal by CPUC. Customers are free to cancel their subscription once enrolled, but must wait one year before re-enrollment. Four methods of enrollment will be provided: online web portal, SCE call center, paper form, or account manager. Customers who choose enrollment in the GTSR program are charged extra fees for electricity generation. These costs go to renewable integration, market participation, program administration, the green rate portfolio, and resource adequacy costs. Renewable Energy Certificates (REC) created from subscriptions shall be retired on behalf of the customer, which means the customer can claim the environmental benefits of renewable energy. In order to promote this new option, SCE proposes to market to households currently in Bundled Service as well as outreach to low income customers. Last, SCE intends to establish a Green Balance Account to separate extra costs incurred to the company from renewable energy procurement. Through this mechanism, SCE will determine Green Rate program prices accurately, without shifting expenditure costs onto non-participants.

Community Choice Aggregation

The City of Hermosa Beach could form a CCA program in order to take control of its power procurement decisions in support of its carbon neutrality goal. The first CCA started in Massachusetts with the Cape Light Compact in 1997 and the idea has since spread to other states, most notably Illinois, but also California. Two CCAs are currently operating in Northern California and most recently a third is forming in the County of Los Angeles.

A CCA would provide a medium for the City of Hermosa Beach to make decisions about power procurement, a function currently provided by their electric utility, SCE. SCE would continue to distribute electricity through their power lines and bill customers. Once a CCA program is established within the service territory, each customer is given an opportunity to opt out of the program and maintain service through their original electric utility. Those customers that do not opt out will become members of the CCA.

The increase in decision-making power that a CCA program offers communities would allow the City of Hermosa Beach to increase the procurement of carbon neutral power delivered to the city. In this way, the city would be able to achieve its goals of GHG emissions reductions while taking greater control of the costs of pursuing these goals.

Chapter 3: Technical Assessment

The City of Hermosa Beach's goal of obtaining carbon neutral electricity could be reached through various policies. But the entire operation of generating and transmitting electricity involves much more than just policy. This chapter serves to provide a fundamental understanding of: the process of producing electricity, the methods in which carbon neutral electricity could be generated, the basic functioning of the current electricity transmission and delivery system, and the incompatibility of distributed, incremental energy sources (including rooftop solar) with current infrastructure. The chapter ends with a brief discussion about possible solutions to mitigate technical challenges so that the City of Hermosa Beach can utilize renewable energy sources to a greater extent.

Renewable Energy Sources

Renewable energy is energy produced from a source that is either not depleted when converted to energy or can regenerate more quickly than needed to serve energy needs. Prior to industrialization and use of coal (and later oil and natural gas), most energy used was renewable. This section introduces the different types of renewable energy sources, with a focus on those available to the City of Hermosa Beach.

Solar Thermal

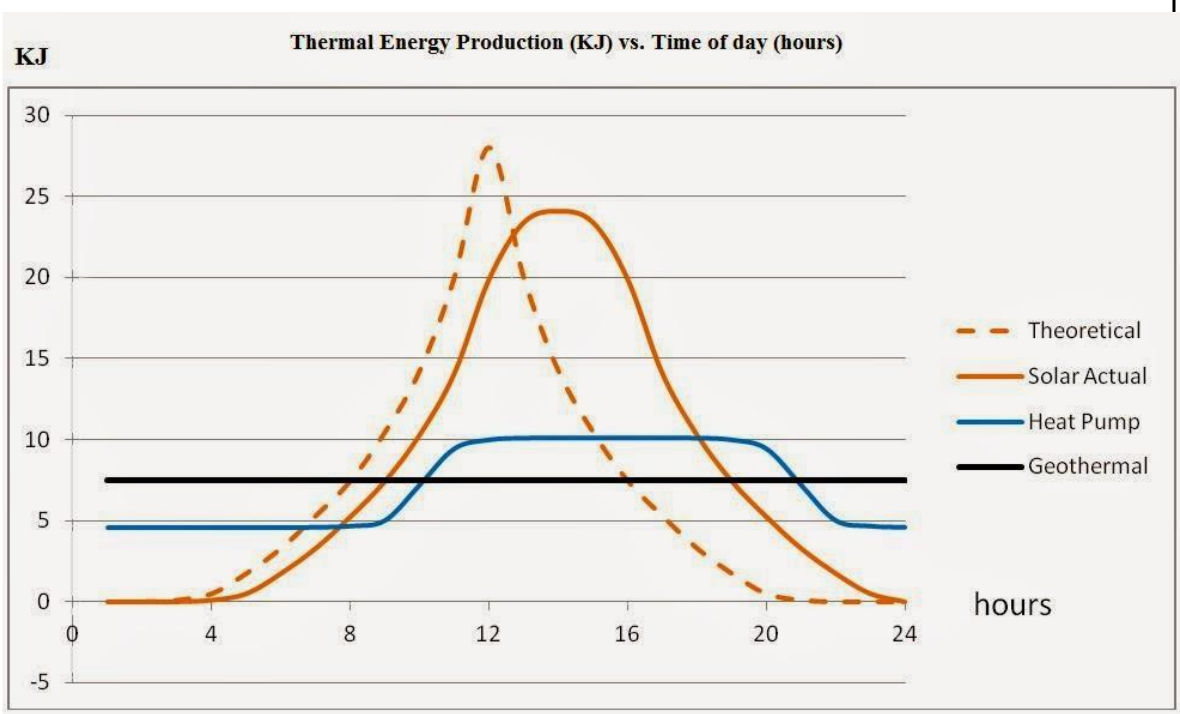
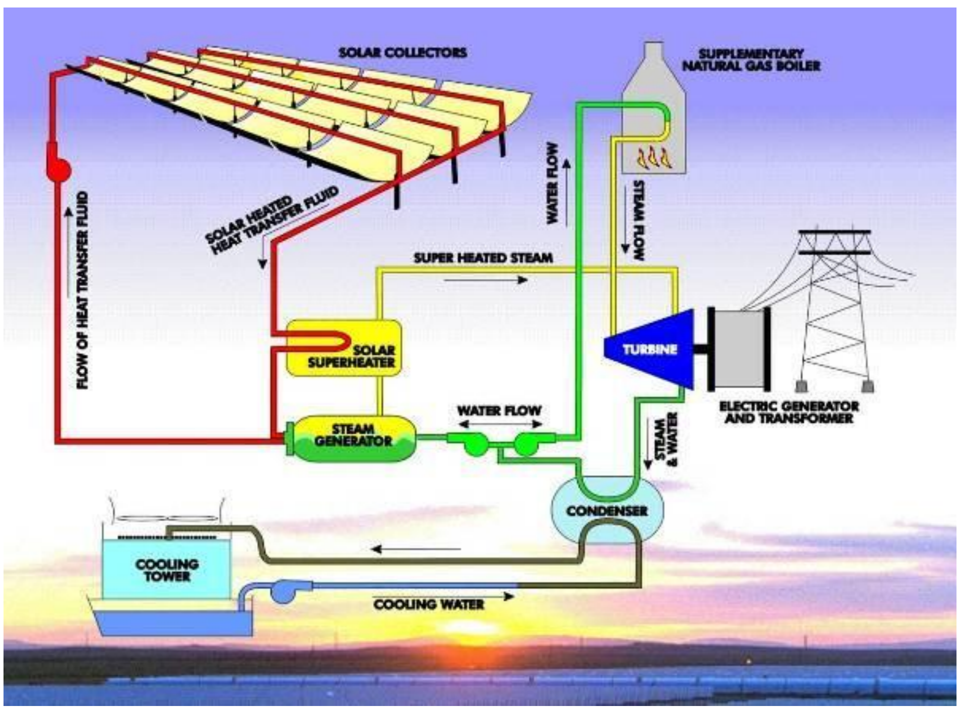


Figure 3.1. This graph compares the theoretical solar thermal energy production, with actual solar thermal energy production according to time of day.[6]

[6] (Ascent Systems, 2013)

Solar thermal systems generate electricity by utilizing thermal energy from solar radiation. Solar thermal energy collection depends solely on the heat generated by the sun, so it can still generate power on cloudy days when direct sunlight is not available.[7] The dotted line in Figure 3.1 displays the theoretical solar thermal energy production according to the time of day, but due to delayed heat loss, the actual thermal energy production is represented by the solid orange line. Hence, solar thermal facilities can continue to produce electricity for some time after the sun goes down also. Therefore, electricity production from solar thermal is less variable than solar photovoltaic.

Utility-scale solar thermal power plants, called high-temperature collectors, use mirrors or lenses to concentrate sunlight. This maximizes the amount of energy available for electricity production. Figure 3.2 illustrates how energy is produced in a parabolic trough solar thermal plant. First, collectors concentrate sunlight in order to heat a synthetic oil, which is then used to heat water and generate steam. Next, the steam is piped to an onsite turbine generator, which produces electricity to be transmitted to power lines. On days when heat from sunlight is not available, a supplementary natural gas boiler can be used in place of solar energy to produce steam.[8] Solar thermal plants of the power tower design function in a similar fashion by also producing steam to operate a turbine generator. The largest of these plants is located in Southern California in the Mojave Desert. These systems increase in efficiency as temperature increases, making desert climates ideal locations for such electricity production.



[7] (Lueken, Cohen, & Apt, 2012)

[8] (NextEra Energy Resources, 2014a)

Figure 3.2. This diagram explains how parabolic trough solar thermal plants produce electricity[9]

The Mojave Desert is a huge resource for solar energy in California and has been rapidly growing in the past years. This is assisted by funding provided by federal stimulus in order to achieve the standards set by California's Senate bill, which requires 33% of the state's energy to be provided by renewable sources by 2020. At the beginning of 2014, two solar thermal power plants began operation in the Imperial and Riverside Counties in the Mojave. Ivanpah is a solar thermal power plant of the power tower design and the largest operating solar thermal plant in the world. It produces 377 MW of energy by using over 300,000 mirrors to focus the sunlight towards three main towers that can reach up to 1,000 degrees Fahrenheit. The plant generates enough energy to provide electricity for over 100,000 homes.[10] Both Pacific Gas and Electric (PG&E) and SCE have signed contracts to purchase electricity provided by Ivanpah for twenty-five to thirty years.[11] The price that SCE will pay for the electricity it is receiving from Ivanpah is not publicly available. However, BrightSource Energy, the company that constructed the Ivanpah plant, and SCE have said that the price is competitive. Figure 3.3 is an image of the Ivanpah plant.

Figure 3.3. This is the Ivanpah solar thermal power plant in the Mojave Desert. It produces 377 MW of energy using a power tower design.[12]

The Genesis Solar Power Project is the second solar thermal power plant that began operating at the end of 2013. This project consists of two independent generating facilities each producing 125MW for a total output of 250MW of electricity. This solar thermal plant is of the parabolic trough design, consisting of

---

[9] Ibid.

[10] (BrightSource Energy Inc., 2014)

[11] (NRG Solar, 2014)

[12] (U.S. Department of the Interior, Bureau of Land Management, 2014)

troughs made of over 600,000 mirrors.[13] PG&E currently holds a power purchase agreement (PPA) with the Genesis solar plant at an undisclosed price.[14] Figure 3.4 is an image of the Genesis Solar Power Project.

Figure 3.4. This is the Genesis Solar Power Project located in Riverside County. It produces 250 MW of electricity using a parabolic trough design.[15]

While both of these power plants have been lauded for creating jobs and offsetting carbon emissions, they have received some criticism from conservationists for potentially causing fatalities in bird species. Solar thermal plants are known to burn birds that fly over the plant due to the high temperatures that they conduct.[16] Over half of the casualties caused by solar thermal plants were of water bird species typically found around ponds or streams. Biologists speculate that the birds may be mistaking the solar thermal plant's reflective surfaces for water, thus attracting them to the site.[17] While solar thermal plants can provide clean and renewable electricity, it is important to take into consideration their impact on wildlife too.

Solar Photovoltaic

Solar photovoltaic cells directly convert captured solar radiation into electricity. The cells operate at maximum efficiency at a temperature greater than 55° F, but high temperatures from extended exposure to concentrated sunlight can also decrease the efficiency of photovoltaic cells, thus sometimes requiring a cooling system. The greatest limitation of photovoltaic cells is that they only generate electricity when the sun is out. This contributes heavily to their high variability compared to both thermal solar and wind

[13] (NextEra Energy Resources, 2014b)

[14] (National Renewable Energy Laboratory, 2014)

[15] (NextEra Energy Resources, 2014b)

[16] (Hering, 2014)

[17] (Clarke, 2013)

energy.[18]

Solar photovoltaic power plants are more common than their solar thermal cousins mostly due to the declining costs of photovoltaic solar cells. Since the 1950s the price of photovoltaic cells have dropped drastically, by a factor of 100.[19] The increase in power plant size and efficiency has helped lower the costs of photovoltaics. Larger power plants are able to offset more of the base costs of construction by producing a greater profit from increased generation of electricity. Increased efficiency contributed to a decline in cost as more electricity is produced per square meter of photovoltaic material.[20]

Some solar thermal power plants have even been converted to photovoltaic power plants due to their comparative affordability[21]. An example of such a solar power plant is the Blythe Solar Power Project. Originally, the project was approved in 2010 to be a parabolic trough solar thermal plant with four adjacent plants each producing 250 MW of power for 1000 MW total. However, in 2011 it was announced that the project would use photovoltaic solar panels instead and consist of three plants producing 125 MW each and a fourth producing 110 MW for a total output of 485 MW[22]. The Blythe Project is currently in the compliance phase, producing an environmental impact statement, and construction is projected to begin by the end of 2014.[23]

Several other photovoltaic solar power plants are being constructed in the Mojave Desert with completion dates ranging from 2013 to 2015. However, all of these power plants already have PPAs arranged for when the plants are completed and ready for commercial use. One of such photovoltaic solar power plants is Desert Sunlight Solar Farm, which has an anticipated operational date of 2015. The project includes two separate phases, each backed by a PPA, the first with PG&E for 300 MW of electricity and the second with SCE for 250 MW.[24]

Though the Mojave Desert is within the SCE service territory, it is the state's most efficient solar producing region. PG&E is an especially prominent figure in the photovoltaic solar energy market in the Mojave Desert as they hold exclusive PPAs with numerous power plants, such as Antelope Valley Solar Ranch for 230 MW and California Valley Solar Ranch for 250 MW.[25] Many projects are supported by a PPA before construction even begins.

---

[18] (Lueken, Cohen, & Apt, 2012)

[19] (Nemet, 2006)

[20] Ibid.

[21] (U.S. Department of the Interior, Bureau of Land Management, 2014)

[22] (Montgomery, 2013)

[23] (California Energy Commission, 2014)

[24] (Renewable Energy World, 2011)

[25] (Leone, 2011)

Utility-Scale Wind Turbines

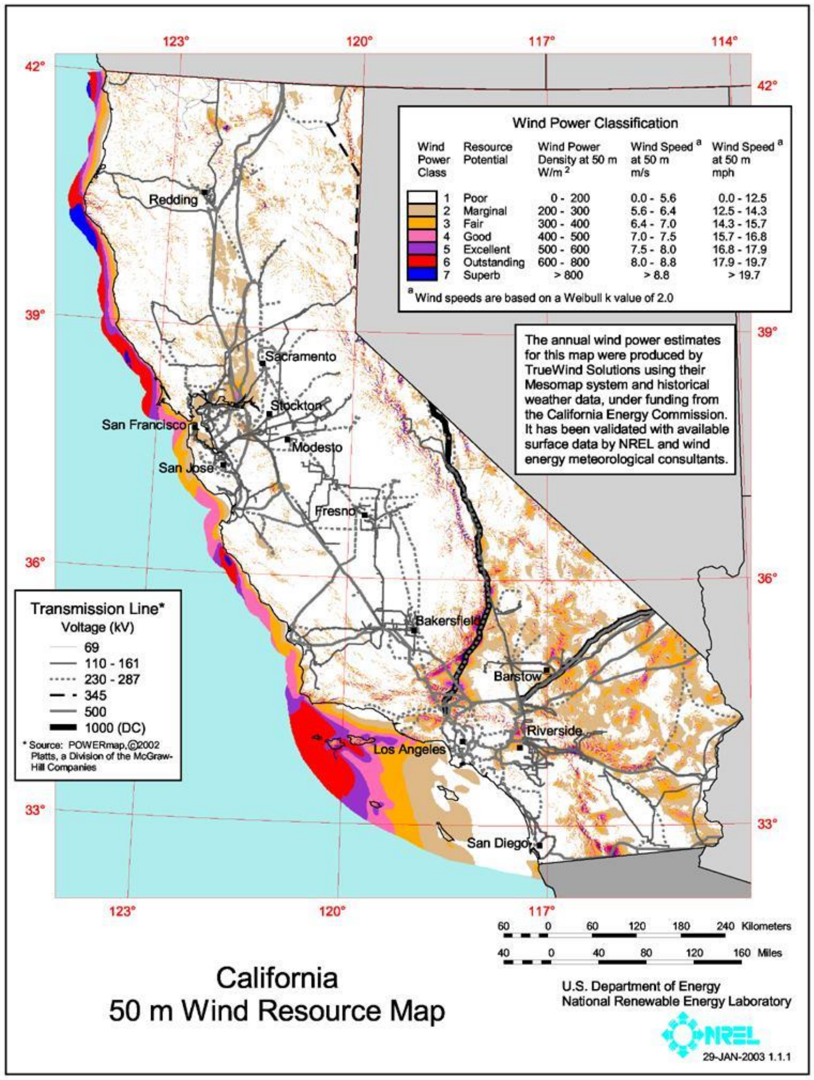


Figure 3.5. This map shows California's wind resources[26]

As of 2013, over five percent of California's total electricity is provided by wind energy, but it continues to grow as a prominent renewable energy source.[27] Figure 3.5 shows the wind potential in California. Major utility-scale wind farms in California are primarily located in three areas: Tehachapi (southeast of Bakersfield), San Gorgonio (east of Los Angeles near Palm Springs), and Altamont (east of San Francisco), as shown in Figure 3.6. These regions provide ninety-five percent of California's wind energy supply,

[26] (National Renewable Energy Laboratory, 2003)

[27] (American Wind Energy Association, 2014)

each with the capacity of producing hundreds of megawatts of energy.[28] This is convenient for Southern California and Los Angeles in particular as two of these three locations are within reasonable distance to supply electricity, allowing for a plentiful source of wind energy available to the City of Hermosa Beach. SCE currently holds over a dozen PPAs with wind energy producers in these areas; they include new projects with contracts not expiring until mid-2030, while others are due to expire within the next five years.

Figure 3.6. This map shows regions where wind power facilities are located in California[29]

The Alta Wind Energy Center is a wind farm project in Tehachapi that was recently developed, earning the distinction of the largest wind facility in the nation. The total generation of the facility is projected to be 1,548 MW provided by several individually operating wind farms. The first phase already online is generating 1,320 MW.[30] Some smaller projects in the same area that have been operating since the 1980s are due for renewal in the coming years, such as Project 251, Cameron Ridge, San Gorgonio, and more. Cameron Ridge recently underwent construction in 2013 to replace older turbines with a newer design, the Ogin Turbine, which is predicted to increase energy output by fifty percent.[31] More details regarding these and other wind farms can be found in Table 3.1.

The lifespan for wind turbines has been projected to be about twenty years, also conveniently the typical

[28] (California Energy Commission, 2014)

[29] (California Energy Commission, 2003)

[30] (California Energy Commission, 2014)

[31] (Ogin Inc., 2014)

length of a PPA. After this time, it is necessary for the turbines to be replaced. A recent study conducted in Scotland, however, suggests that this may actually be an overstatement. After ten years of operation, the average output of a wind farm had declined by one-third.[32] In this case, the actual lifespan of an average wind turbine at approximately twelve to fifteen years, and after that time, would require a reevaluation of the operation and maintenance costs associated with wind turbine development.

Offshore wind energy is also an option for the City of Hermosa Beach. Winds offshore are generally more reliable, strong and abundant than those onshore. This can be a particular advantage for California where the potential for wind power onshore is limited, but coastlines are plentiful. However, there are several complications that make offshore wind energy a less feasible option in today's energy market. Wind turbines require a certain minimum distance from shore in order to optimize the power of the wind. But the construction of undersea transmission lines is an expensive endeavor and the price increases with distance offshore.[33] Also, exposure to seawater increases the risk of corrosion to the wind turbines. Thus the offshore wind turbines must be designed more robustly to endure the conditions of the sea. They may also require additional maintenance, which is more expensive than traditional turbines as this requires transporting crews out into the ocean.[34] Technology has been improving to make offshore wind more practical.

Architectural Wind

Figure 3.7. These are Aerovironment's AVX400 architectural wind turbines[35]

Architectural wind turbines are small modular systems that can be constructed on existing buildings. AeroVironment's architectural wind turbines take advantage of the natural acceleration of wind that

[32] (Hughes, 2012)

[33] (Dvorak, Archer, & Jacobson, 2009)

[34] (Beaudry-Losique, Boling, Brown-Saracino, et al., 2011)

[35] (Aerovironment, Inc., 2014)

results from a building's aerodynamics using specific positioning and design. While architectural wind provides benefits that traditional turbines are lacking, there are drawbacks to this technology as well. Since the release of Aerovironment's AVX400 turbines (as pictured in figure 3.7), energy production has not met the company's original expectations.[36] This is mostly due to the low energy output produced at slower wind speeds. While the turbine has the capacity to produce up to 400 W of energy, it usually operates at lower wind speeds and does not reach this potential. This reduces the cost effectiveness of these architectural wind designs compared to larger wind turbines. Aerovironment has since released a newer model of its architectural wind turbine, AVX1000, which has a capacity of 1,000 W. However, like the AVX400, reaching this rate of energy production requires wind speed of nearly 30 mph. At wind speeds of 10 mph or lower, the turbines will likely produce less than 50 W.[37] Technologies surrounding architectural wind are still developing and improving, so this form of energy production may gain momentum in the future. However, it does not currently seem viable as a form of cost effective energy production.

Geothermal

California is unique in its bountiful reservoir of geothermal energy as it contains the second largest supply in the world.[38] The untapped geothermal energy available in California could supply enough electricity to power the entire state's needs. Geothermal energy is consistently available at all times because the Earth is constantly releasing heat. Therefore variability is not an issue as it is for some other renewable energy sources.

The Salton Sea is the nearest geothermal extraction site to the City of Hermosa Beach located in the Imperial Valley. There are several geothermal power plants currently in operation serving areas of Los Angeles, San Diego and Tempe, Arizona. Eight of these plants are currently under a thirty-year PPA with SCE.[39] This means that the infrastructure necessary to transport geothermal energy from the Imperial Valley to the City of Hermosa Beach is already existing. Each of the eight power plants providing energy for SCE have individual contracts with a range of expiration dates and rates. One of such contracts expires as soon as 2016, with all but one following through 2020.[40] As recently as 2012, development of an additional geothermal plant was approved in the Salton Sea area for 49.9 MW of energy. It was already under contract with the Salt River Project from Arizona when production was halted due to an anticipated output that fell short of initial predictions.[41] Besides this attempt, only one geothermal plant has been constructed in the last twenty years in the Imperial Valley and there are no current plans for any additional power plants.

[36] (Wilson, 2009)

[37] (Aerovironment, Inc., 2008)

[38] (Glassley, 2011)

[39] (CalEnergy Generation, 2014).

[40] (CCE Generation, LLC, 2005)

[41] (Abou-Diwan, 2014)

Table 3.1. This graph shows operating solar, wind, and geothermal power plants in California that have either recently come online or have existing contracts that will expire in the next ten years.

Generation Technology	Name	Location	Owner(s)	Completion Date	Nameplate Capacity (MW)	Contract Information
Solar thermal - power tower	Ivanpah	San Bernadino County	NRG Energy, BrightSource Energy, & Google	14-Feb	377	25 - 30 yr PPAs with SCE & PG&E
Solar thermal - parabolic trough	Genesis Solar	Riverside County	NextEra Energy Resources	14-Mar	250	PPA with PG&E
Photovoltaic solar	Blythe Solar	Riverside County	NextEra Energy Resources	N/A - construction to begin 2014	485	N/A
Photovoltaic solar	Desert Sunlight	Riverside County	First Solar	2015	550	PPA with SCE for 250 MW and PG&E for 300 MW
Photovoltaic	Antelope Valley Solar Ranch	Antelope Valley	Exelon	Anticipated in 2015	230	PPA with PG&E for 230 MW
Photovoltaic	California Valley Solar Ranch	Carrizo Plain	NRG Solar	13-Oct	250	PPA with PG&E for 250 MW
Wind	Alta Wind Energy Center	Tehachapi	Terra-Gen Power, MidAmerican Energy, Ever Power, & Brookfield Renewable Energy Partners	2013	1,548	Multiple PPAs with SCE for 720 MW expiring between 2035 - 2038
Wind	Project 251	Tehachapi	Terra-Gen Power	1987	16	4 PPAs with SCE for $79.14/MWh expiring in 2016 and 2017
Wind	Cameron Ridge	Tehachapi	Terra-Gen Power	1999	60	2 PPAs with SCE expiring in November 2014 and December 2015
Wind	TG Mojave 16/17/18	Tehachapi	Terra-Gen Power	1989	85	PPA with SCE expiring in 2019
Wind	TG Mojave Victory Garden	Tehachapi	Terra-Gen Power	1990	21	PPA with SCE expiring in 2020
Wind	San Gorgonio	Palm Springs	Terra-Gen Power	1985	43	PPA with SCE expiring in 2015
Geothermal	Vulcan	Calipatria	CalEnergy Generation	1986	34	30 yr PPA with SCE for 29.5 MW at $5.5 M/year expiring in 2016
Geothermal	Salton Sea I	Calipatria	CalEnergy Generation	1982	10	30 yr PPA with SCE for 10 MW expiring in 2017
Geothermal	Elmore	Calipatria	CalEnergy Generation	1989	38	30 yr PPA with SCE for 34 MW at $7.9 M/year expiring in 2018
Geothermal	Salton Sea III	Calipatria	CalEnergy Generation	1989	50	30 yr PPA with SCE for 49.8 MW at $9.7 M/year expiring in 2019
Geothermal	Leathers	Calipatria	CalEnergy Generation	1990	38	30 yr PPA with SCE for 34 MW at $7.5 M/year expiring in 2019
Geothermal	Del Ranch	Calipatria	CalEnergy Generation	1989	38	30 yr PPA with SCE for 34 MW for $7.9 M/year expiring in 2019
Geothermal	Salton Sea II	Calipatria	CalEnergy Generation	1990	21	30 yr PPA with SCE for 15 MW at $3.3 M/year expiring in 2020

Hydropower

In 2007, hydropower in California produced 43,625 GWh of electricity, 14.5% of the state's total system power, making it one of the most utilized forms of renewable energy. [42] California's has 400 hydro plants located in the eastern mountain ranges with a total capacity of 14,000 MW.

Hydropower harnesses energy from water flowing into a turbine from a higher potential to a lower potential. It is important to note that hydropower is only renewable as long as water is available. Additionally, hydropower has significant impacts on the local environment. "The construction of hydropower plants can alter sizable portions of land" by "caus[ing] erosion along the riverbed upstream and downstream."[43] Also, since hydropower is highly dependent on rainfall, the amount of hydroelectricity may vary year to year.[44]

The closest hydro plants are small conduit plants approximately 50 miles east of the City of Hermosa Beach. Conduit plants are man-made structures such as existing canals, pipelines, and aqueducts fitted with electric generating equipment.[45] Conduits are considered "small hydro, and are able to extract power from water without the need for a large dam or reservoir." These include the Mojave Siphon Hydroelectric Facility and the Devil Canyon Hydroelectric Facility. Both of these conduit plants are part of the State Water Project, which transports water from Northern to Southern California through the California Aqueduct, and are operated by the California Department of Water Resources. The Mojave Siphon Hydroelectric facility features three turbines producing up to a total of 29.4 MW. The Devil's Canyon Hydroelectric Facility is one of the larger facilities with four turbines producing a total of up to 276 MW. According to the U.S. Energy Information Administration, the cost of a hydro plant entering service in 2019 would be $84.50 per MWh which includes levelized capital cost, fixed operation and maintenance, variable operation and maintenance, including fuel, and transmission investment.[46] Figure 3.8 and 3.9 are maps that display the location of hydroelectric facilities.

---

[42] (California Energy Commision)

[43] (U.S. Environmental Protection Agency)

[44] (Califonria Energy Almanac)

[45] (National Hydropower Association)

[46] (U.S. Energy Information Administration, 2014)

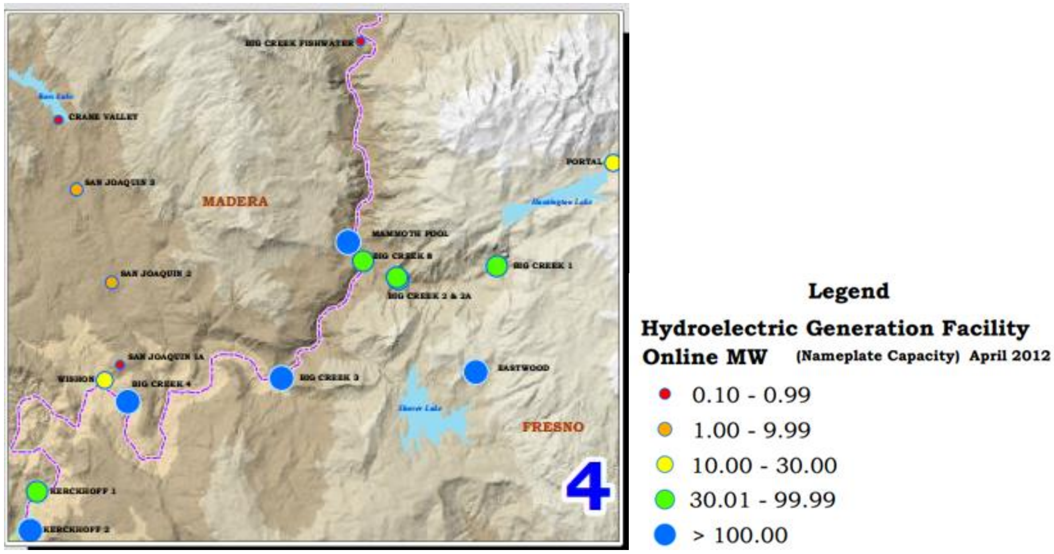


Figure 3.8. This map shows the location of hydroelectric facilities.[47]

Figure 3.9. This map shows the location of hydroelectric facilities.[48]

---

[47] (California Energy Almanac, 2012)

[48] Ibid.

Biomethane & Biomass

According to the California Energy Commission (CEC), biomass produced over 6,236 GWh of electricity in 2007.[49] Biomass plants generate energy from the burning of forest, agricultural, and urban organic matter. Figure 3.10 displays the various biomass fuels that can be used for electricity generation. Electricity production from burning biomass is considered carbon neutral because the carbon associated with the biomass fuel is regarded as part of the natural carbon cycle, as opposed to the combustion of fossil fuels.

The City of Hermosa Beach is in close proximity to two natural gas power plants in El Segundo and Redondo Beach. The El Segundo Natural Gas Power Plant is owned and managed by NRG Energy Inc, and it has a generating capacity of up to "550 MW, enough to supply over 400,000 homes."[50] The Redondo Beach Natural Gas Power Plant operated by AES California is currently being renovated to be more efficient and to comply with regulations prohibiting once through cooling. Advanced technology has allowed natural gas plants the ability to utilize biomethane as their fuel. Biomethane is a biogas that is removed of its contaminants, and is conditioned to pipeline quality natural gas. Some European countries such as Ireland have already considered upgrading their natural gas plants to biomethane.[51] If the City of Hermosa Beach decides to have their own generating facility, upgrading the El Segundo and Redondo Beach plants may be possible.

The largest constraints of upgrading natural gas plants to biomethane plants is the high cost of acquiring a power plant that serves many times more than the load demand of the City of Hermosa Beach and sourcing sufficient quantities of renewable biogas to make the energy renewable and with zero GHG emissions. The City of Hermosa Beach is in the proximity of the Desert View Power Plant, one of the largest biomass plants in California located in Riverside County in the town of Mecca. The Desert View Power Plant produces up to 47 MW of electricity and currently sells this renewable energy to SCE. The average levelized cost of biomass energy is $102.60 per MWh.[52]

---

[49] (California Energy Commision)

[50] (NRG Energy Inc.)

[51] (Sustainable Energy Authority of Ireland)

[52] (U.S. Energy Information Administration, 2014)

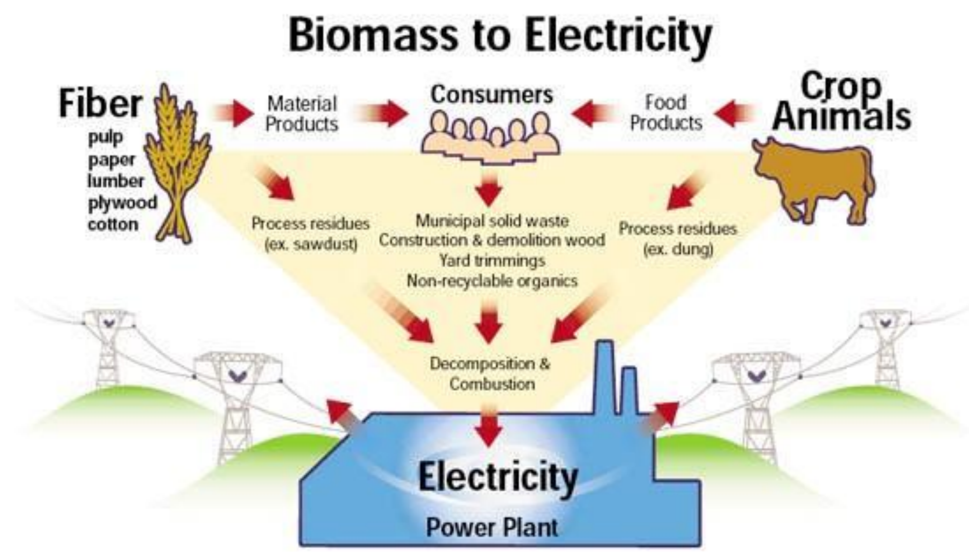


Figure 3.10. This figure shows the different types of biomass that can be used as fuel for electricity production. [53]

Hydrogen

Since molecular hydrogen (H_2) is highly flammable, it is uncommon in nature. 95% of hydrogen used as energy is produced through industrial processes.[54]

The most common technology of producing hydrogen is through electrolytic processes which utilizes an electrolyzer to split water into hydrogen and oxygen. Alternately, photolytic technology, which is still in its research and development stage, utilizes sunlight to split water into hydrogen and oxygen. Photolytic technology is predicted to exhibit significant potential for sustainable hydrogen production with very little environmental impact.

A hydrogen fuel cell works by harnessing the chemical energy from compressed hydrogen to generate electricity through a chemical reaction. When operating, hydrogen fuel cells emit only water vapor, warm air and hydrogen, making it a zero tailpipe emissions generation energy source.

Hydrogen can be sustainably produced if the process is fueled by renewable energy. According to the National Renewable Energy Laboratory, "results have verified that there is abundant solar and wind

[53] Ibid.

[54](U.S. Department of Energy, 2006)

energy resources to meet hydrogen transportation fuel for the entire country."[55]

California is one of the few major hydrogen producing states in the nation along with Louisiana and Texas[56]. Hydrogen Energy California is planning to establish a low carbon power plant for baseload requirements for SCE. This plant would produce 400MW of electricity, using hydrogen as fuel. The plant is expected to recapture 90% of its CO_2 emissions.[57] The state has 13 research hydrogen fueling stations, 9 public stations, and 18 expected for future development.[58] Currently, hydrogen fuel cells are being utilized primarily as a means to power vehicles in California.

Due to the high energy content of hydrogen by weight but very low energy by volume, storing hydrogen is very challenging.[59] Despite of this limitation, hydrogen can still be used as a means of storing energy. Currently, hydrogen can only be stored in high pressure tanks, and physical storage of cryogenic hydrogen (hydrogen cooled at -235 Celsius at pressures of 6-350 barr) in insulated tanks.[60]

Although hydrogen can be produced sustainably from renewable sources, the question remains as to why a city would use electricity to produce hydrogen, and in doing so experience energy loss, as opposed to using the electricity directly.

New fuel cell innovations have brought about the creation of the Bloom Box or the Bloom Energy Server created by Northern California based startup company by the name of Bloom Energy. The Bloom Box serves to convert natural gas or biogas into electricity by using a "direct electrochemical reaction rather than combustion."[61] The fuel cell works with three pieces of equipment consisting of the anode and a cathode made of special ink with a solid oxide ceramic plate (the electrolyte) placed in between. The mechanism works by fuel passing over the anode and air passing the cathode which leads to the oxygen ions reacting with the fuel to create energy. The company seeks to generate energy on site by installing its fuel cells enclosed in a weatherproof shell at the customer site to ensure direct sustainable delivery to the customer. A Bloom Energy Server is quoted to be approximately $800,000 for the Bloom Box ES-5000 in 2010.[62] Each Bloom Energy server provides about 100 kW and is set to take up as much space as a parking spot with the ability to power a 30,000 square foot office building or 100 average U.S. homes.[63] Bloom Energy Servers are natural gas based systems that emit 773 lbs/MWh of carbon dioxide on average whereas a natural gas turbine powered by combustion releases about 1,314 lbs/MWh on average.[64] The current constraints of the Bloom Box is that it is relatively new and that the solid oxide ceramic plates

---

[55] Ibid

[56] (U.S. Department of Energy)

[57] (Hydrogen Energy California, 2010)

[58] (California Environmental Protection Agency: California Air Resources Board)

[59] (U.S. Department of Energy, 2011)

[60] Ibid

[61] (Bloom Energy, 2014)

[62] (Seattle City Light, 2010)

[63] (Bloom Energy, 2014)

[64] Ibid

require temperatures up to $1,800^{\circ}$ Fahrenheit for the chemical reaction to occur, which may reduce the durability of the material in the long term.[65] It is estimated that current units will have a 10 year life as long as the fuel stacks are swapped out twice. Figure 3.11 describes the operation of a Bloom Box.

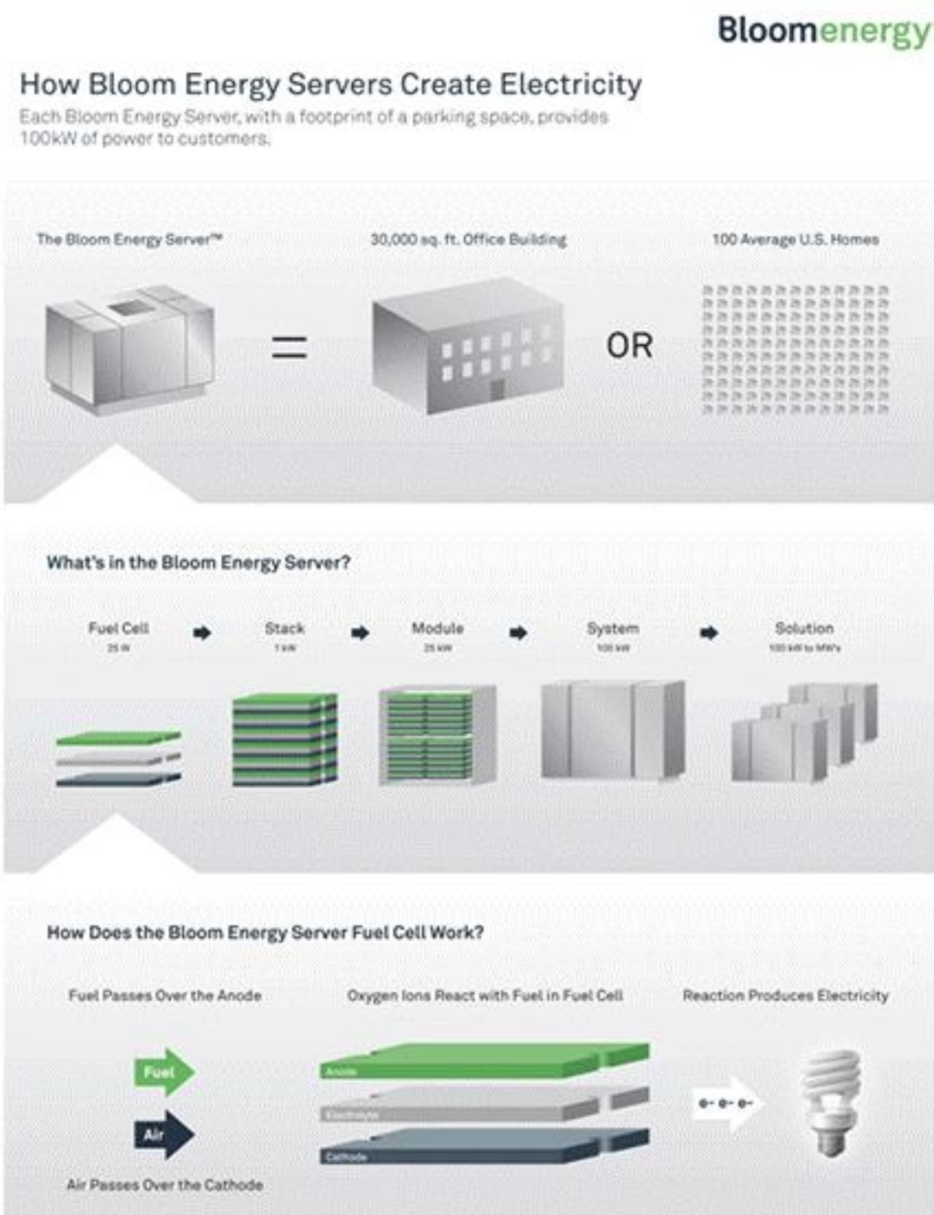


Figure 3.11. This diagram explains the functioning of Bloom Energy Servers. [66]

[65] Ibid

[66] (Schwartz, A., 2010)

Table 3.2: Range for total system levelized costs (2012 $/MWh) for plants entering service in 2019. [67]

Plant Type	Minimum	Average	Maximum
Dispatchable Technologies			
Conventional Coal	87	95.6	114.4
Natural Gas-Fired			
Conventional Combined Cycle	61.1	66.3	75.8
Conventional Combustion Turbine	106	128.4	149.4
Advanced Nuclear	92.6	96.1	102
Geothermal	46.2	47.9	50.3
Biomass	92.3	102.6	122.9
Non-Dispatchable Technologies			
Wind	71.3	80.3	90.3
Wind- Offshore	168.7	204.1	271
Solar PV	101.4	130	200.9
Solar Thermal	176.8	243.1	388
Hydro	61.6	84.5	137.7

Technical Fundamentals

For the City of Hermosa Beach to reach its goal of obtaining carbon-neutral electricity, it will have to procure electricity from the sources described above. But bringing renewable electricity into the grid is easier said than done. There are technical challenges and limitations. This section describes the fundamentals of electrical power, grid operation, and the difficulties of incorporating renewable electricity into the grid.

[67] (U.S. Energy Information Administration, 2014)

Introduction to Electrical Power

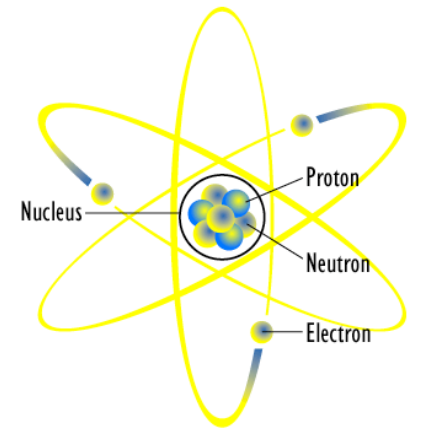


Figure 3.13. This is a diagram of an atom [68]

In order understand electricity, it is first necessary to understand atoms. Everything is made of atoms - they are the building blocks of the universe. Atoms are extremely small; millions can fit on the tip of a pin.[69] Figure 3.13 shows the basic structure of an atom. At the center of the atom is the nucleus, made up of particles called protons and neutrons. Protons are positively charged while neutrons contain no charge. Surrounding the nucleus is a cloud of negatively charged electrons. In terms of mass, electrons are approximately two thousand times lighter than protons and neutrons. Electrons spin around the nucleus in orbital paths known as shells. The opposite charges of electrons and protons attract each other, which keeps the atom and its orbiting electrons intact. The shell closest to the nucleus can hold two atoms, the next shell can hold eight, and the outer shells hold even more electrons. Electrons can be pushed out of their orbits and a force great enough can even push electrons to move to another atom. Electricity is simply the movement or flow of electrons between atoms.

Electricity is a secondary energy source, also referred to as an energy carrier.[70] This means that there is no natural source of electrical power that we can tap into. It must be generated and converted using other sources of energy, such as fossil fuels, wind and solar power. One of the greatest advantages of converting energy into electricity is that it is relatively easy to transmit and deliver.

Energy is typically measured in joules while electricity is measured in watts.[71] Since electricity is a flow of electrons, watts measures the rate of energy transfer. A Watt is defined as one joule per second. A kilowatt hour (kWh) is equal to the energy of 1,000 watts transferred over the period of one hour. The amount of electricity generated by a power plant or consumed by a customer is usually measured in kilowatt hours. For example, when a 40-watt light bulb is lit for five hours, 200 watt hours, or 0.2 kilowatt

---

[68] (Fastfission, 2005)

[69] (U.S. Energy Information Administration, 2013)

[70] Ibid.

[71] (U.S. Energy Information Administration, 2013)

hours, of electrical energy is used.[72]

Electrical power starts at the power plant, which typically consists of a spinning electrical generator. The steam turbine is the most commonly used spinning electrical generator in the United States. A turbine converts the kinetic energy of a moving liquid or gas to mechanical energy. In steam turbines powered by fossil fuels, such as coal and natural gas, the fuel is burned in a furnace to heat water in a boiler to produce steam. The steam is then forced against a series of blades mounted on a shaft, rotating the shaft connected to the generator. Generators take advantage of the relationship between magnetism and electricity to convert mechanical energy into electrical energy. Moving magnetic fields can pull and push electrons. Metals, such as copper, have electrons that are loosely held, and through the use of electromagnets and copper wires, generators create electricity.[73] Figure 3.14 shows how a steam turbine generates electricity.

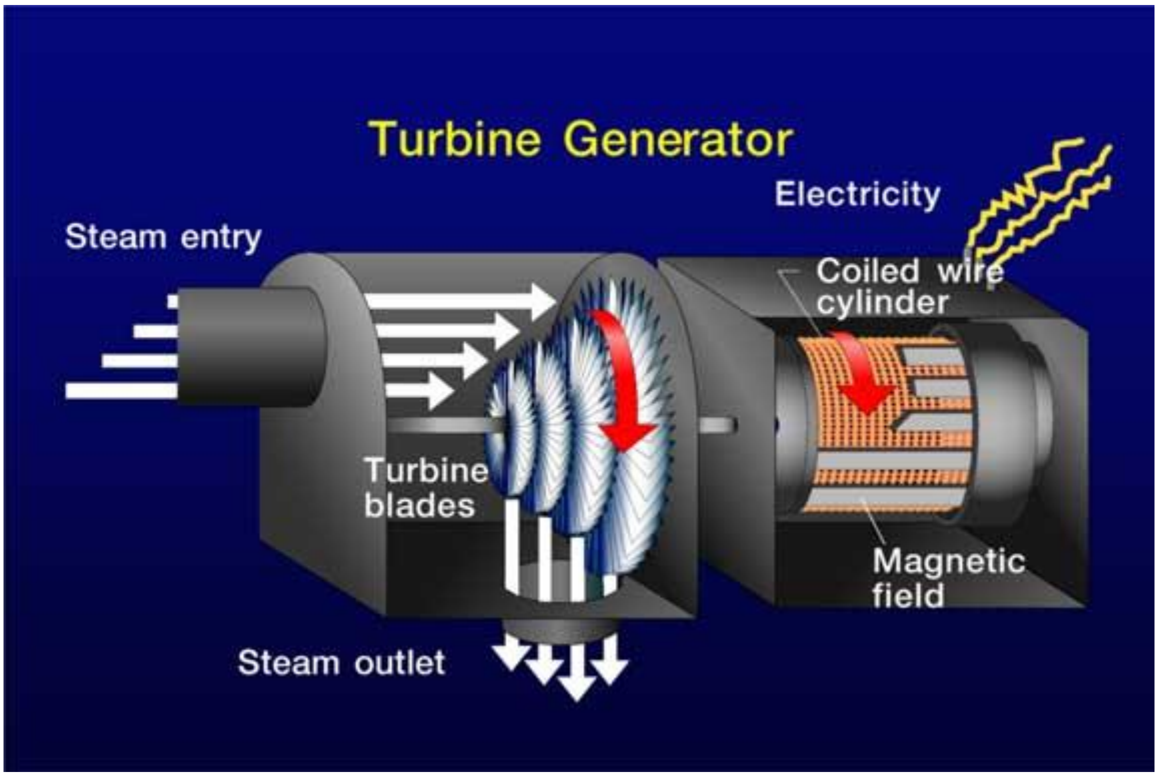


Figure 3.14. This diagram explains how a turbine generator generates electricity.[74]

Most power plants burn various types of fuels to create steam, and use steam turbines to generate electricity. However, there are three types of electricity-generating techniques that are exceptions. First,

[72] Ibid.

[73] Ibid.

[74] (Geothermal Education Office, 2000)

hydropower relies on the movement of water to directly turn the turbine, generating electricity. Windmills rely on the movement of air to turn giant blades. As they move, they also turn the turbines that are behind the blades. Finally, solar photovoltaic technology directly converts sunlight into electricity as it directly strips electrons from incoming solar radiation.

Delivery and the Grid

Electricity is delivered to consumers by the following process: electricity is generated at power plants, then a transformer steps up the voltage of the electricity for transmission. This occurs so that the transmission lines' full capacity is taken advantage of to transfer electricity more efficiently and reduce energy loss from transmission. Stepped-up electricity travels through transmission lines, which are large, high voltage power lines. In the U.S., the network of nearly 160,000 miles of these lines is known as the "grid". These transmission lines deliver electricity to local substations. When the electricity reaches a local substation, the neighborhood transformer steps down the voltage to a level that it is safe and appropriate for consumer use. Finally, this low voltage energy is distributed to households via a local system of distribution lines.

The grid is the assemblage of transmission lines over the U.S., interconnecting power plants, substations, and electricity consumers. It can be compared to a huge spider web covering the country. However, there is actually no national power grid, but there are three power grids operating in the 48 contiguous states. They are the Eastern Interconnected System for states east of the Rocky Mountains, the Western Interconnected System, from the Pacific Ocean to the Rocky Mountain states, and the Texas Interconnected System. These systems generally operate independently of each other with limited links between them.[75] Figure 3.15 displays the three power grids in the contiguous United States.

[75] (U.S. Energy Information Administration, 2012)

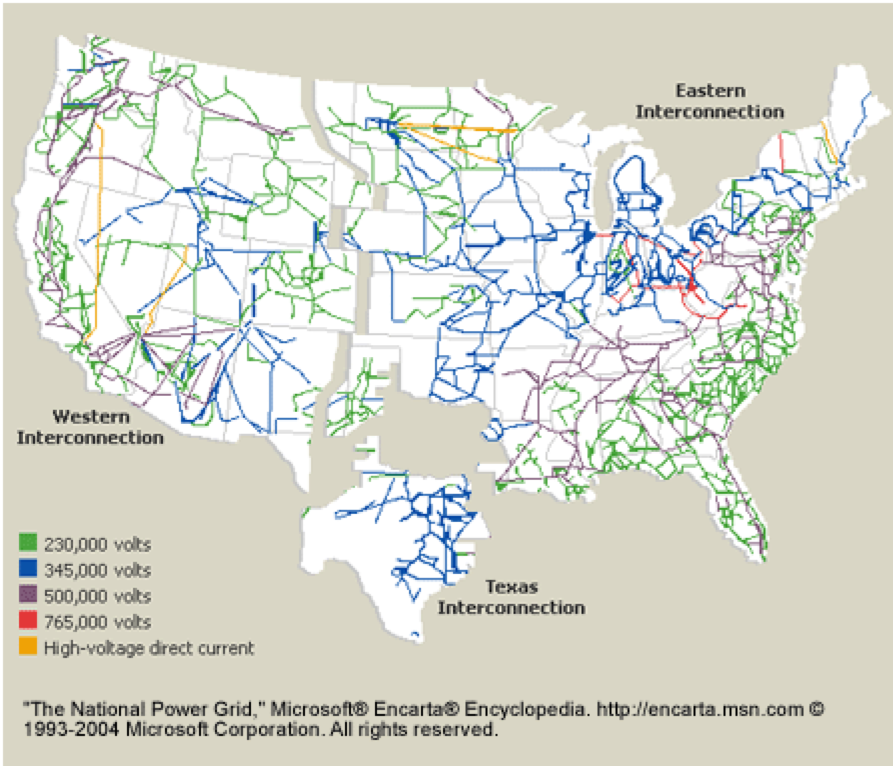


Figure 3.15. Map displaying the three power grids in the contiguous U.S.[76]

The grid did not come to exist until post-World War II era. Prior to that, at the beginning of the 20th century, there were over 4,000 individual electric utilities operating in isolation. Almost all of them served only the local customers through low-voltage connections from nearby power plants to the distribution lines. As the demand for electricity grew, particularly in the post-World War II era, electric utilities found it more efficient to interconnect their transmission systems. This way, they could build larger generators to serve the electricity demands at lower costs and could avoid building duplicate power plants. The interconnection also helped to provide more reliable service. To meet increasing demands, higher voltage interconnections were developed to transport electricity over longer distances. Over time, three large interconnected systems evolved in the United States.[77]

SCE is the largest subsidiary of Edison International. The company traces its origins to July 4th, 1886.[78] On that day, the partnership of Holt and Knupp first used a steam engine to power the lights of Visalia during its evening celebration.[79] Since then, the company was formed through mergers and acquisitions

[76] Ibid.

[77] Ibid.

[78] Edison International, 2014

[79] Ibid.

of numerous small predecessor companies, and SCE was officially incorporated in 1909.[80] SCE has grown significantly. Today, it serves over 14 million people over a service territory of 50,000 square miles.[81] It owns and maintains over 100,000 miles of power lines and over 700,000 transformers to deliver electricity to its customers.[82]

Grid Operation

Through a complex network, the grid delivers power where it is needed. Once the electricity is generated, it will flow along whatever pathway is presented to it along the grid, much like water flowing downhill. Utilities provide and maintain the infrastructure that carries electricity to end users. Utility companies own the transmission infrastructure, but the electrical power they transform and transmit is bought from private companies on the wholesale power market.[83] In California, this market is operated and managed by the California Independent System Operator (CAISO). CAISO ensures equal access to the state's power lines, forecasts electrical demand, accounts for operating reserves, and dispatches the lowest cost power plant unit to meet demand while ensuring enough transmission capacity is available to deliver the power.[84] CAISO's responsibilities can be summed up as managing the supply and demand of electrical power on the grid, known as load balancing. CAISO have a critical role in the operation of the grid and help to ensure every customer in the state receives the electrical power needed at the right time and place.

Electricity cannot be easily or efficiently stored over an extended period of time and is usually consumed momentarily after production. The real-time balancing of the supply and demand of electrical power in the grid is not an easy task.

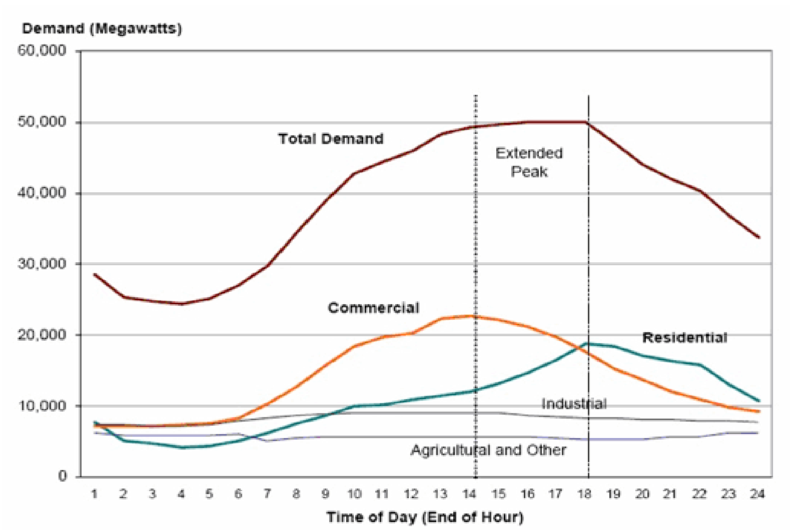


Figure 3.16. A load profile for California on a hot day in 1999 [85]

[80] Ibid.

[81] Southern California Edison, 2014

[82] Ibid.

[83] (Flex Alert, 2013)

[84] Ibid.

[85] (Lawrence Berkeley National Laboratory, 2005)

If represented graphically, the power demand over the duration of a twenty-four hour day is approximately a bell curve. Figure 3.16 is the load profile for California on a hot day in 1999. Electricity demand is relatively low during the night time, with demand peaking in the day. Hypothetically, if the load is to be supplied by a single power plant only, its capacity has to be equal to the peak load demand or more. However, such a power plant would be uneconomical since the peak load occurs only for a short duration of the day. Because of this dynamic and time-dependent demand of electrical power, it is optimal to have a mix of different power plants supplying base and peak loads. Hence, the coordination of different power stations is essential.[86]

There are three categories of power stations with differing purposes. First, base load plants provide an unvarying supply of electricity at nearly all times. Baseload electricity is the minimum amount of power that a utility must have available to customers, or the power needed to make minimum demand based on customer expectation.[87] Some characteristics of base load power plants are low operating costs, the capability to operate for long periods of time, little maintenance, and few operating personnel.[88] Nuclear power was a large fraction of SCE's baseload generation, but with the loss of the San Onofre plant, SCE is strained for baseload energy. It is predicted that combined natural gas will replace the nuclear plant's position in baseload generation. Alternately, peak load plants serve to satisfy the peak demand that is not met by the electricity produced by base load facilities. Peak load plants usually start operating quickly, synchronize quickly with the grid, and therefore have quick response to load variations. Figure 3.17 displays the generation profile of different resources.

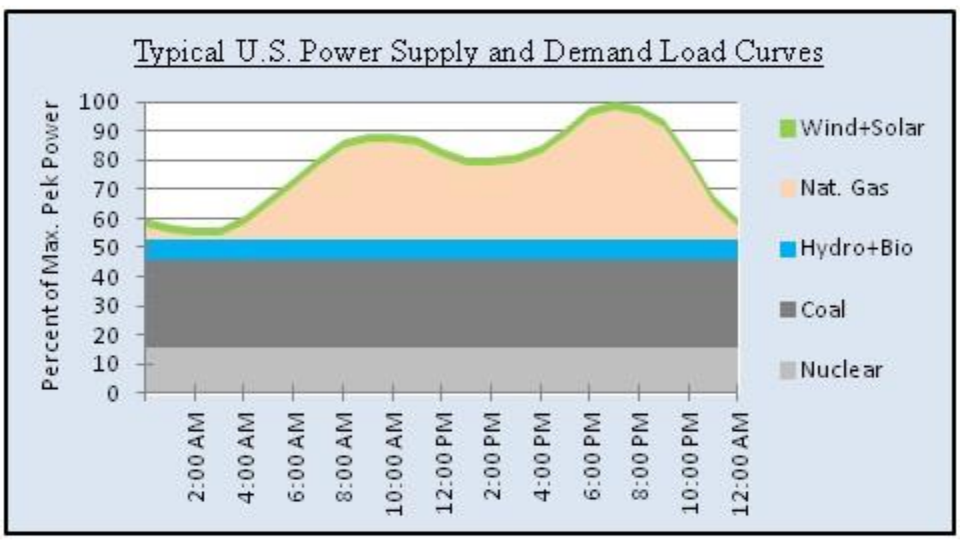


Figure 3.17. Electricity generation profile of different resources.[89]

[86] (Electrical Engineering Tutorials)

[87] (Cordaro, Matthew, 2008)

[88] Ibid.

[89] (EIA MER New England, 2013)

Grid Reliability

According to the North American Electric Reliability Council, reliability is "the degree to which the performances of the elements of the electrical system result in power being delivered to consumers within accepted standards and in the amount desired."[90] In other words, reliability refers to the ability of the power systems to deliver electricity to all points of consumption in adequate quality and quantity. Power quality is a subcategory of grid reliability, which describes the characteristics, in terms of continuity and voltage, of the electricity delivered to consumers.[91] Not surprisingly, customers depend on and demand grid reliability and power quality.

Reliability encompasses two concepts: adequacy and security.[92] Adequacy is "the ability of the system to supply the total energy requirements to all consumers at all times", which means that sufficient generation and transmission resources are available to meet needs at all times, including peak conditions, and with reserves for contingencies.[93] Security is "the ability of the system to withstand sudden disturbances", which means that the system remains intact even after outages and equipment failure. Efforts to address grid reliability must consider these two aspects.

Reliability is measured by the frequency, duration, and extent of system disturbances and outages. A disturbance is any unplanned event, including an outage that produces an abnormal system condition. An outage is described in terms of frequency, duration, the amount of load, or the number of customers affected. Voltage disturbances can take forms in overvoltage and undervoltage.[94] Overvoltage is the increase of the supply voltage by more than 10%, while undervoltage is the decrease in voltage by more than 10%. Extended periods can lead to brownouts and blackouts. A brownout occurs when the energy supplier intentionally reduces electrical voltage more than 10% for a sustained period, forcing consumers to use less power.[95] Blackouts are long periods of complete loss of electrical power.

If an area experiences a blackout, that particular area will be affected immediately, but the surrounding regions will be affected as well. A blackout, the absence of electrical power in a particular region of the grid, naturally creates a vacuum-like effect in the grid, drawing power from energy-rich regions to the energy-deficient blackout area. In addition, system operators can intentionally reduce the voltage in surrounding areas, causing a brownout, to provide at least some electricity to the blackout region. This is a typical occurrence in the event of a blackout.

There are different strategies to ensure grid reliability. Grid reliability is the most threatened when electricity demand peaks. Hence methods to ensure the grid functions properly, even at high demands, are known as peak shaving. Peak load power plants, as described previously, run only when there is a high electricity demand. They can be thought of as backup, emergency generators. They act as a buffer against blackouts in times of high electricity demand. This is a supply-side strategy to ensure grid

---

[90] (Osborn, J., & Kawann, c)

[91] Ibid.

[92] Ibid.

[93] Ibid.

[94] Ibid.

[95] Ibid.

reliability. Demand response is a broad term that describes a demand-side strategy. According to the Federal Energy Regulatory Commission (FERC), demand response is defined as "changes in electric usage by end-use customers from their normal consumption in response to the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high market wholesale prices or when system reliability is jeopardized". Demand response strategies range from having high prices of electricity at peak periods, to programs that involve certain electrical appliances being shut down to reduce peak demand. Figure 3.18 is a graphical representation of demand response's effect on the load profile.

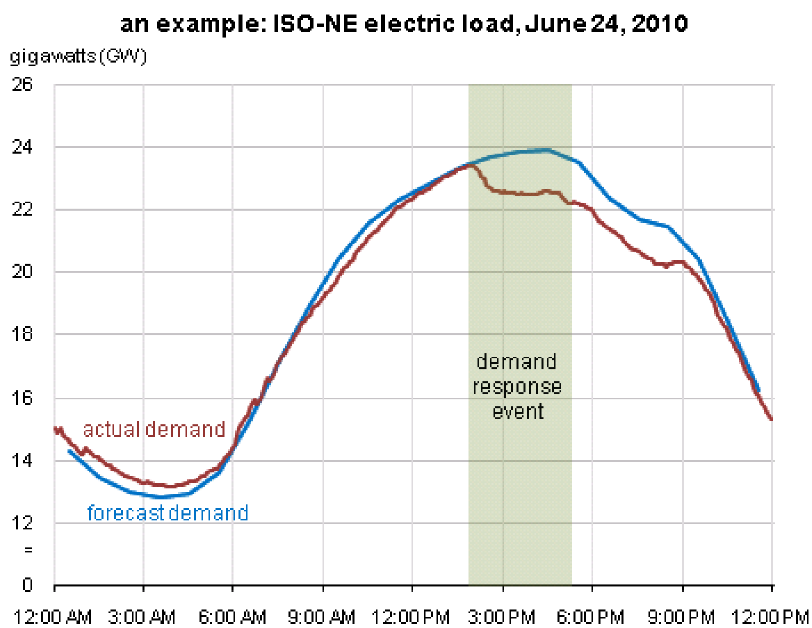


Figure 3.18. Demand response event shaves peak demand [96]

Limitations of the Grid

The grid has been revolutionary, but it is not without flaws. In 2011, an average of only about 93% of a generating station's net electricity production is actually delivered for consumer use in the United States; 7% of the energy is lost in transformers and along transmission lines.[97] There are two types of electricity loss along transmission lines: corona and ohmic. Corona loss occurs when the electric field at the surface of a bare wire becomes sufficiently large and electric charge is injected into the air near the wire. This charge moves in the electric field thereby creating a leakage current. Ohmic loss is resistive loss. It occurs because the carriers of electric charge within the conductors encounter resistance to their motion.[98] When

[96] (EIA, 2011)

[97] (Pickard, W. F., 2013)

[98] Ibid.

the energy source is close to the consumer, the loss can be tolerated, but if the energy source is located far from the consumer, the total electricity lost through transmission can be staggering.

Transmission lines also have a specific and limited capacity. Grid congestion occurs when the flow of electricity over a line or a piece of equipment is constrained below desired levels.[99] Simply put, congestion occurs when there is more electricity than certain transmission lines can carry, limiting the electricity supplied to the destination of the line. This restriction can be imposed either by physical or electrical capacity. Severe congestion conditions can impair grid reliability by reducing the diversity of electricity sources and making an area more vulnerable to unanticipated outages.[100]

The greatest limitation of the current grid is perhaps its incompatibility with renewable energy sources.

Renewable Energy Sources and Grid Reliability

When a switch is flipped to turn on the lights, it occurs instantly. This can be taken for granted as a seemingly mundane phenomenon, but in reality, many complex operations occur to make this possible. As described previously, electricity is produced and consumed virtually instantly, so at every given moment, the grid operator instantaneously matches supply and demand. As we flip on a switch, it is a signal that there is demand for electricity. The electricity is then manufactured instantly and delivered to the lights. With tedious control, just the right amount of electricity is delivered. If more than the needed electricity is delivered, the lights will burn out. If too little electricity is delivered, the lights will be dim or not turn on at all. This entire process takes only a fraction of a second. The key to making electricity available whenever and wherever it is demanded is tedious, precise control that instantly matches supply and demand.

In order to be able to control the supply of electricity precisely, grid operators mainly rely on dispatchable power. Dispatchable generation refers to electricity sources that can be turned on and off or can adjust their power output on demand.[101] Fossil fuel power plants are dispatchable power plants. The amount of power they can produce can be turned up or down and the plant itself can be turned on or shut down on demand. This is part of the reason why coal and natural gas are the most widely used sources for electricity generation. Hydropower is also dispatchable. As long as water is available, operators can decide when to let it flow to generate electricity.

The intentions of replacing fossil fuels with renewable sources of energy are honorable, but renewables are difficult to incorporate into the grid system. Most renewable energy sources are non-dispatchable. Solar farms only generate electricity during the day, and wind turbines only generate electricity when the wind blows. The amount of energy generated cannot be controlled on demand. Renewable energy sources are also intermittent and the electricity produced varies.[102] For example, cloud movements and weather affect solar radiation, while wind intensity and direction is impossible to accurately forecast. In short, the combined effects of the non-dispatchable and intermittent characteristics of renewable energy sources make them nearly impossible to control as an electricity source. With current technology and infrastructure, significant dependence on renewable sources for electricity generation could severely

[99] (U.S. Department of Energy Office of Electricity Delivery & Energy Reliability)

[100] Ibid.

[101] (Cooper, D., 2014)

[102] Ibid.

jeopardize reliability. Infrastructure upgrades will be required for substantial renewable energy sources penetration into the grid.

Battery Energy Storage System

Although high penetration of solar and wind energy threatens grid reliability, energy storage can act as a buffer between supply and demand. It can store energy when supply is greater than demand, and release energy when demand is greater than supply. Energy storage could help solve the reliability issues that renewables impose on the grid.

However, current technology still has much room for improvement. The ideal battery energy storage system should be able to hold and retain huge amounts of electrical power efficiently. It should have high energy density, meaning it can hold lots of energy with very small volume. And the storage mechanism should also be safe and not contain hazardous chemicals that many batteries have. In the case of a leakage or breakdown of a storage mechanism with toxic chemicals, noteable health risks due to the scale of the storage system could occur.

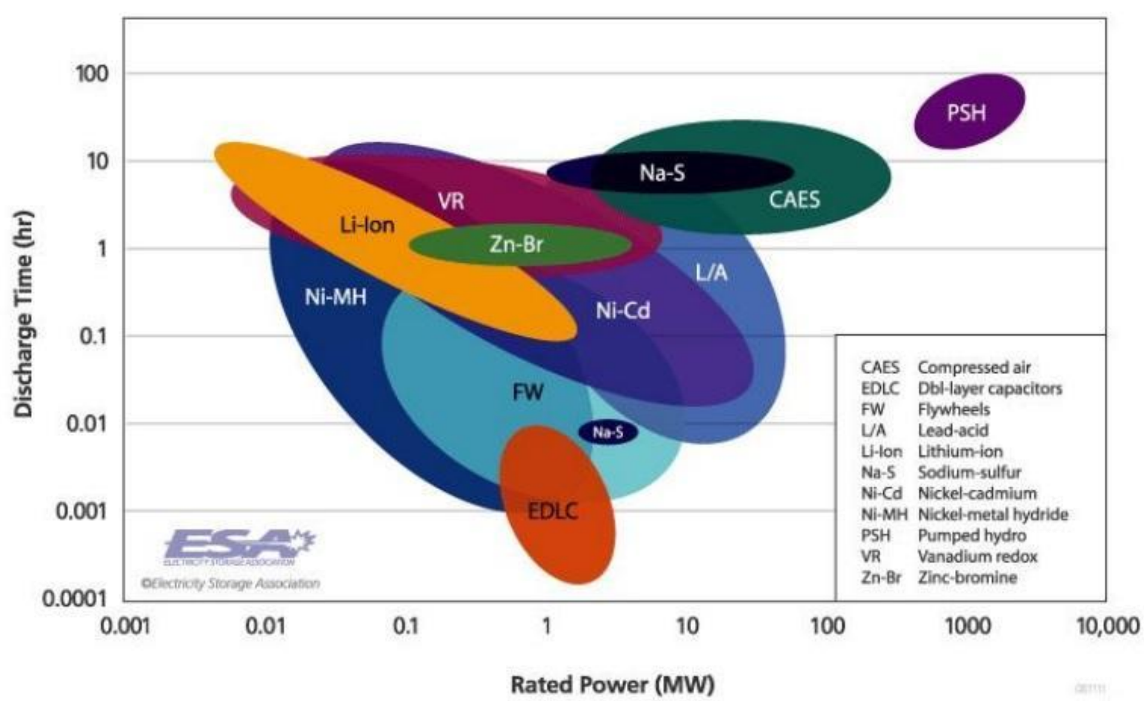


Figure 3.19. Storage ratings by technology type. [103]

[103] (KEMA, 2012a)

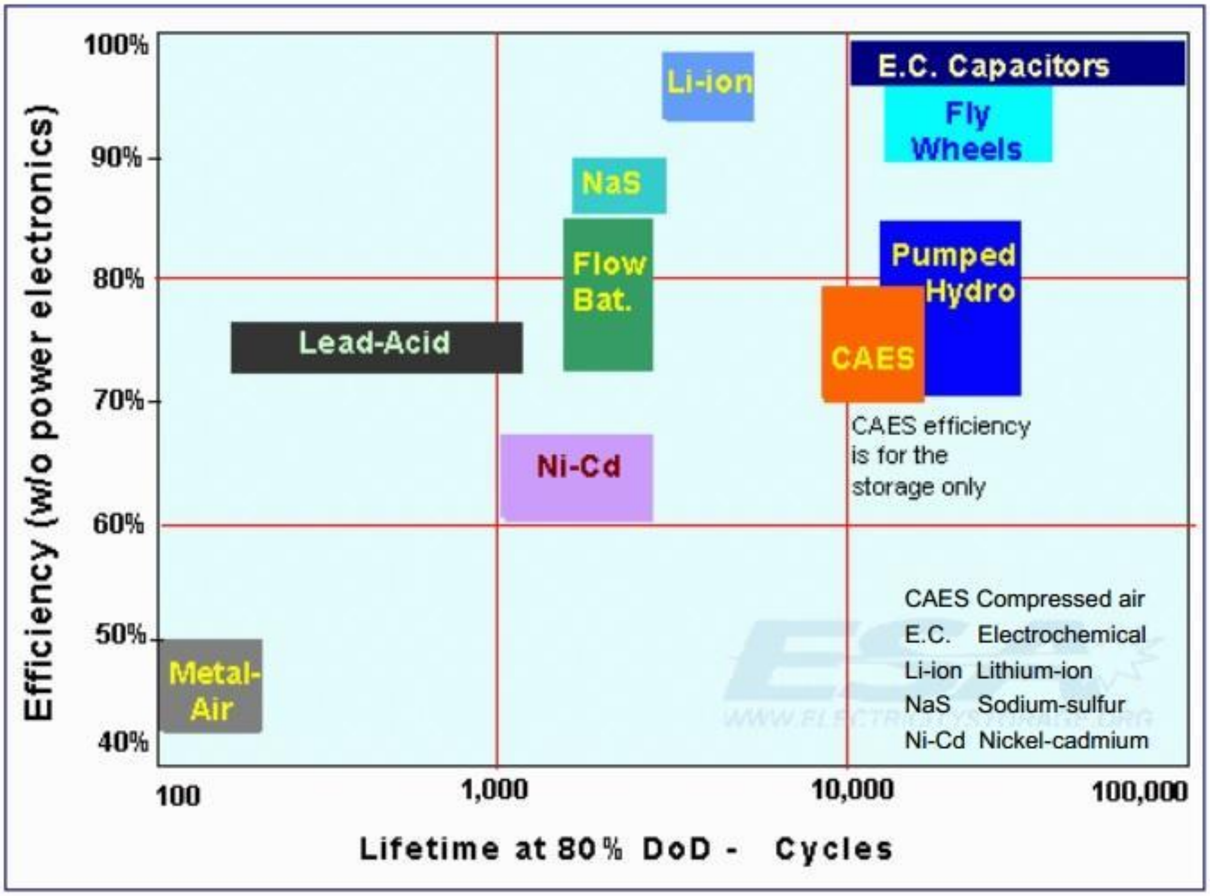


Figure 3.20. Storage efficiency and lifetime by technology type.[104]

Figure 3.19 characterizes storage technology types according to rated power, which describes how much power a storage unit can provide, and discharge duration, which describes how long it can provide power for. Figure 3.20 illustrates the efficiency and lifetime of energy storage technologies. Lithium-ion batteries are one of the best battery energy storage systems available right now.[105] These batteries have a relatively high energy density and slow discharge rate. They are commonly utilized in new models of electric vehicles. SCE's $55 million Tehachapi Wind Energy Storage Project will test the effectiveness of lithium-ion battery storage.Though promising, lithium-ion batteries do have shortcomings. These batteries pose risks of combustion and catching fire. And the largest obstacle preventing more widespread use of the battery is its cost, as shown in Figure 3.21.

Battery energy storage units are currently available. But technologically, they have much room for

[104] (KEMA, 2012b)

[105] (Kim, D., 2014)

improvement, and the hope is that they will become more cost-effective in the near future.

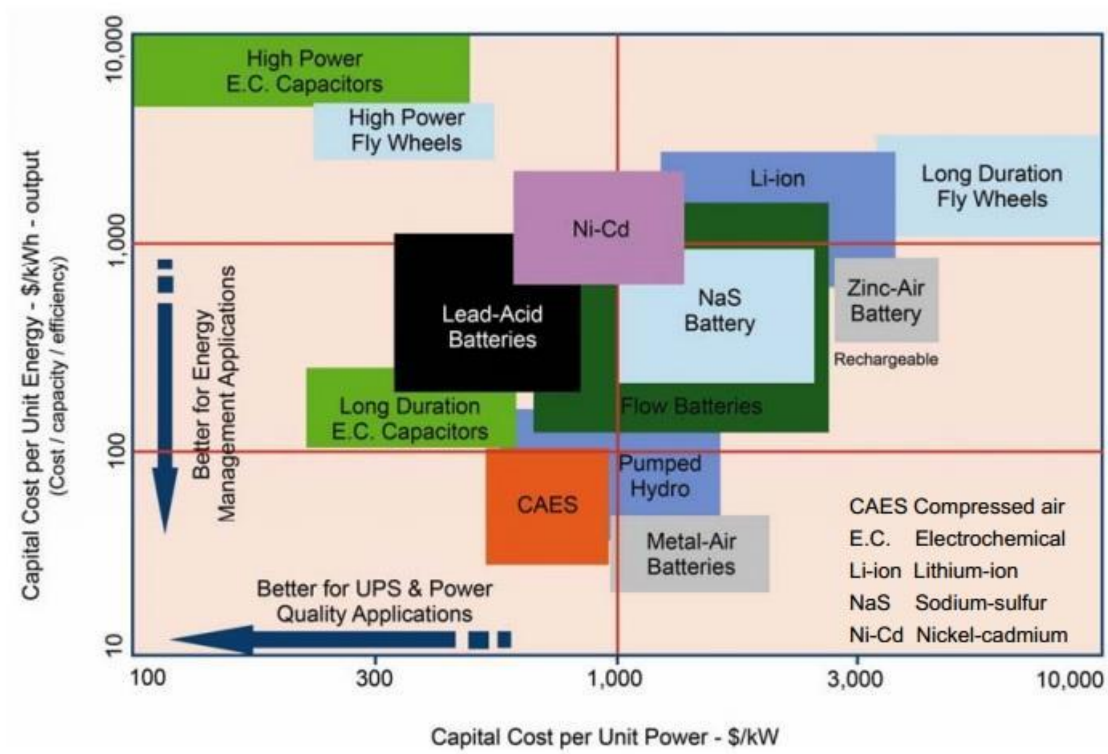


Figure 3.21. Storage capital costs by technology type.[106]

Distributed Generation

Localized energy, also known as distributed generation, is generally defined as energy-generating systems that are 20 MW or smaller, interconnected on-site or close to the electricity demand, can be constructed quickly with no new transmission lines, and typically have no environmental impact.[107] California defines distributed generation as fuels and technologies that are accepted as renewable for purposes of Renewable Portfolio Standard (RPS), 20 MW or smaller, and located within low-voltage distribution grid or supply power directly to consumer.[108] Rooftop solar panels are an example of distributed generation.

Distributed generation poses challenges to the grid as well. With significant penetration of distributed generation, the distribution network is no longer a passive circuit supplying loads but an active system with power flows and voltages determined by the generation as well as the load.[109] Because of the

[106] (KEMA, 2012c)

[107] (Shlatz, E., Buch, N., & Chan, M., 2013)

[108] (Weisenmiller, R., 2014)

[109] (Mahmud, M. A., Hossain, M. J., & Pota, H. R., 2011)

unpredictable behavior of renewable energy sources, the installation and connection of distributed generation units will affect system frequency. They will free-ride on the efforts of the grid operator to fix deviations and imbalances of electricity supply and demand.[110]

Secondly, the introduction of bidirectional power flow in distribution lines with the installation of distributed generation is another challenge. Typically, power flows unidirectionally, from higher to lower voltage levels, in other words from generation to transmissions lines then finally to distribution lines.[111] That is how the grid and all of its infrastructure is designed to operate, to supply electricity from power plants to consumers. However, distributed generation produces and exports electricity back into the grid. This scenario can be compared to introducing two-way traffic to a one-way street. The one-way street, with its traffic lights and signs, operate to coordinate one-way traffic only. The street will require modifications and improvements to safely and reliably handle two-way traffic. Similarly, the current grid system will need upgrades and modifications to reliably handle bidirectional power. For example, transformer's must have tap-changers capable of operating with reverse power flow.[112]

A third challenge is a phenomenon known as the voltage rise effect. Given that distributed generation units can export electricity back into the grid, the voltage in a network with distributed generation is directly proportional to the amount of active power supplied by the distributed generators.[113] In other words, heavy distributed generation penetration increases the voltage level in a local distribution network. This is problematic because the voltage level at each connection point of the load is very important for the electricity power quality. There is typically a defined steady-state voltage range, or a maximum permitted voltage variation in a distribution in a distribution network.[114] Hence, the voltage rise effect caused by distributed generation could jeopardize power quality locally.

The Challenge of Rooftop Solar

Southern California has plenty of sunshine and the City of Hermosa Beach is no exception, making rooftop solar a relatively popular choice for distributed generation. Solar insolation is the amount of energy received by the sun at the earth's surface. On a clear day, approximately 1,000 watts per meter squared reaches the earth's surface, perpendicular to the incoming radiation.[115] Currently, it is thermodynamically impossible for solar panels to be more than a hundred percent efficient, meaning the highest possible energy a square meter of solar panels can generate will never be greater than 1,000 watts. In reality, the most common solar panels that are compliant with California's SB1 guidelines are on average about 15% efficient.[116] This means that under ideal weather conditions, a square meter of photovoltaic panels generate only about 150 watts of electricity. Furthermore, solar panels only generate electricity during the day. With these constraints, it is nearly impossible for a home to completely rely on rooftop solar alone, unless it is paired with battery storage or remains connected to the grid.

Rooftop solar has been encouraged by SCE's Net Energy Metering program. Under this program, homes

---

[110] (Pepermans, G., Driesen, J., Haeseldonckx, D., Belmans, R., & D'haeseleer, W., 2005)

[111] Ibid.

[112] (Mahmud, M. A., Hossain, M. J., & Pota, H. R., 2011)

[113] Ibid.

[114] Ibid.

[115] (Kyle, G. A.)

[116] (Roe, S., 2014)

install rooftop solar panels while remaining connected to the grid. During the day, rooftop solar panels generate electricity for the house and any surplus electricity not consumed is sent back onto the grid. At night when solar panels no longer generate electricity, the house is provided with electricity from the grid. This can also be used for commercial buildings. Under this program, even with rooftop solar, the buildings are still dependent on grid-supplied electricity. And since the rooftop solar panels are connected to the grid, the technical problems of distributed generation described previously apply as well.

The CPUC-approved feed-in tariff program has also encouraged homeowners to install distributed generation systems. A feed-in tariff (FIT) is a program designed to accelerate the investment in renewable technologies by offering contracts to purchase electricity from renewable energy producers. A FIT program facilitates development of renewable energy sources by lowering the barriers to enter the wholesale electricity supply market by creating a price certainty, simplifying the procurement process, and expanding access to the distribution network. Small producers and non-commercial producers are able to participate in renewable resource production.

It is true that rooftop solar has tremendous potential, especially with the ample solar capacity in the City of Hermosa Beach. However, with current technology and existing infrastructure, significant integration of distributed generation into the grid could jeopardize reliability and power quality.

Technical Solutions: Smart Grid

As described in the previous section, the current grid system is not well-suited for supporting distributed generation inputs. Updates and installations will be necessary for a greater integration of renewable sources into the grid. There is a need for a better electricity distribution system - a smart grid. However, a smart grid system cannot be installed overnight. Rather, it will be realized through many incremental updates and changes. This section discusses the necessary moves toward a smarter grid system and specifically elaborates on: facilitating bidirectional power, adding energy storage components and installing microgrids.

Facilitating Bidirectional Power for Distributed Generation

Rather than continuing with the traditional "power plant to grid" approach to electricity generation and delivery, a smart grid should include infrastructure suited for distributed generation systems. Distributed generation is carbon neutral and renewable, and the decreased distance between generation and consumption of electricity reduces the amount of energy lost through transmission. Distributed generation facilities can also serve to ease the pressure on the grid in the event that a power plant goes offline.

Instituting bidirectional power would be a major step towards making the grid more suitable for distributed generation. The process is two-fold: building circuitry must support bidirectional flow of electrons and secondly, buildings will need smart meters to track outgoing and incoming electricity.

There are two types of circuits commonly used to distribute electricity from the grid to buildings. Radial circuits connect once with the grid and then carry electricity to its final socket destination where it stops. The second type of circuit is looped circuits. These circuits initially carry electricity from the grid source to the socket and back again to the grid. Both circuits have their merits. Radial circuits are good for minimizing the length of electrical wire needed, thus lowering installation cost.[117] On the other hand, looped circuits have the benefit of being able to facilitate bidirectional power.[118] The circuitry must also contain transformers with tap-changers capable of operating with reverse power flow.

Smart meters keep track of the electricity delivered by the grid and any electricity that distributed generation sources send back into the grid. Figure 3.22 is a chart from San Diego Gas and Electric (SDG&E) that compares a smart meter with an analog meter. SDG&E, along with other utility providers are incentivizing the installation of smart meters to homes in their service area.

Meter Comparison	Smart Meter	Analog meter
View daily energy use	✓	✗
Remote service capabilities	✓	✗
Remote meter reading	✓	✗
Initial fee	Free	$75.00[1]
Monthly charge	Free	$10.00[2]

Figure 3.22. Differences between a smart and analog meter.[119]

Energy Storage

Although energy storage technologies have much room for improvement, they can help solve issues that renewable or intermittent generation devices may create on the grid. This is seen in applications where

117 (Whitfield, 2008)

118 (SCE, 2010)

119 (San Diego Gas & Electric, 2013)

storage is being targeted towards increasing energy security, smoothing of renewable variability and ramp rates of renewables, and assisting with diurnal cycles of wind and solar projects.[120]

Community energy storage (CES) is an example of such applications. The concept of CES involves utility-owned storage systems that are distributed and located near consumers. Figure 3.23 is an image of a CES device.

Figure 3.23. Community Energy Storage Device [121]

The PureWave, a particular energy storage device, is produced by S&C Electric Co. and can hold between 25-75 kWh of energy.[122] It can provide a supply of power when the the grid isn't supply any electricity. Provided the average home in the U.S. uses 10,800 kWh/year, then each home could be calculated to use 3 kWh's of energy in one hour. [123] Given the device has a charge of 50 kWh, then it would be able to power 17 homes for one hour before needed to be recharged. Thus it helps increase energy reliability.

CES systems also help reduce the amount of energy used during peak periods.[124] CES devices can be charged when electricity demand is low and release energy when needed. They can also be charged when renewable energy sources are producing more electricity than can be consumed at the moment, and therefore helping solve the dilemma of power dumping. Additionally, CES systems help mitigate the voltage fluctuation problems that distributed generation sources bring. The transformer can change the voltage of incoming energy accordingly; and if more voltage is needed, it can use energy from the battery to make up for the difference.

[120] (KEMA, 2013)

[121] (Thomas, 2011.)

[122] (S&C Electric Co. 2014)

[123] (Energy Information Administration, 2012)

[124] (ESA, 2014)

Table 3.2. is a table showing the companies that are key suppliers in energy storage.[125]

[125] (KEMA, 2013)

Company	Technology	Emerging/ mature	Current penetration	Market Share
A123 Systems www.a123systems.com Currently piloting technology at AES facility in Southern California. Targeting utility-scale applications of ancillary services, renewables, nd PHEV market.	Lithium-ion battery	Emerging	Plot applications	0%
Altairnano www.altairnano.com Piloting trailer-based, transportable storage systems for frequency regulation	Lithium-ion battery	Emerging	Plot applications	0%
NGK http://www.ngk.co.jp/english/products/power/nas/index.html Considered the most advanced in commercialization of the battery manufacturers. Currently implementing a 50 MW system in Middle East	Sodium sulfur flow battery	Commercialized	Implementing commercial installation	0%
Premium Power www.premiumpower.com Piloting trailer-based transportable storage systems for long-duration applications	Zinc bromine flow battery	Commercialized for back-up power, emerging for utility scale	Piloting projects at utility scale	0%
Beacon Power www.BeaconPower.com Beacon is using their devices to participate in the ancillary services market.	Flywheel technology	Commercialized	Piloting projects at utility scale	0%
Prudent Energy www.pdenergy.com Prudent has recently acquired the assets for VRB Technology, a firm that was leading the piloting effort for utility scale storage devices.	Vanadium redox battery	Pre-commercialized	Piloting applications for utility-scale storage devices	0%
ZBB Energy Corporation www.zbbenergy.com Provides a trailer-based transportable storage device that is being targeted at multiple utility-scale applications.	Zinc-bromide	Commercialized applications being tested at uilities and national labs	Piloting applications	0%
Xtreme Power Solutions www.xtremepowersolutions.com Xtreme Power is building an advanced lead-acid battery system for utility-scale applications.	Advanced lead-acid	Commercialized applications being extended to utility scale	Piloting for utility-scale applications	0%
ICE –Energy www.ice-energy.com ICE-Energy is a provider of thermal storage devices and has the ability to aggregate systems to provide loads as a resource for ancillary services and wind integration.	Thermal storage device based on ICE generation to supplement A/C loads	Commercialized for individual applications	Piloting for aggregated services	0%
International Battery	Lithium-ion	Emerging	Pre-commercial	0%
GridStorage	Zinc-air	Emerging	Pre-commercial	0%
Eagle-Pitcher	Multiple	Emerging	Pre-commercial in utility space	0%

Microgrids

Microgrids are generally defined as low-voltage networks consisting of distributed generation sources and local storage devices.[126] They connect multiple customers to multiple distributed generation sources and storage devices.[127] Intra-system cross-supply and communal management differentiate microgrids from a group of independent but physically proximate small-scale generators.[128] The microgrid is a very versatile concept as it can accommodate various types of micro generators, such as wind turbines, photovoltaic arrays, wave generators, and diesel generators.[129] Although they operate mostly connected to the distribution network, they can also be switched to the islanded mode, which is continuing to supply electricity in an independent manner disconnected from the main grid.[130] This adds an extra measure to ensure reliability. Islanded microgrids can be later resynchronized and reconnect to the main distribution network.[131] Within the main grid, a microgrid can be regarded as a controlled entity that can be operated as a single load or generator.[132] Microgrids can function as grid support and provide ancillary service.

Higher penetration levels of distributed generation alter grid structure and jeopardize reliable grid operation.[133] The microgrid concept is introduced to manage distributed generators in small quantities so that more distributed generators can be employed in the grid and the negative effects of grid operation can be reduced.[134] As Figure 3.24 explains, microgrids help balance energy loads and manage the input of distributed generation sources.

---

[126] (Bayod-Rújula, 2009)

[127] Ibid.

[128] (Sanseverino, Luisa Di Silvestre, Giuseppe Ippolito et al., 2011)

[129] (Selim Ustun, Ozansoy, & Zayegh, 2011)

[130] (Bayod-Rújula, 2009)

[131] Ibid.

[132] Ibid.

[133] (Selim Ustun, Ozansoy, & Zayegh, 2011)

[134] Ibid.

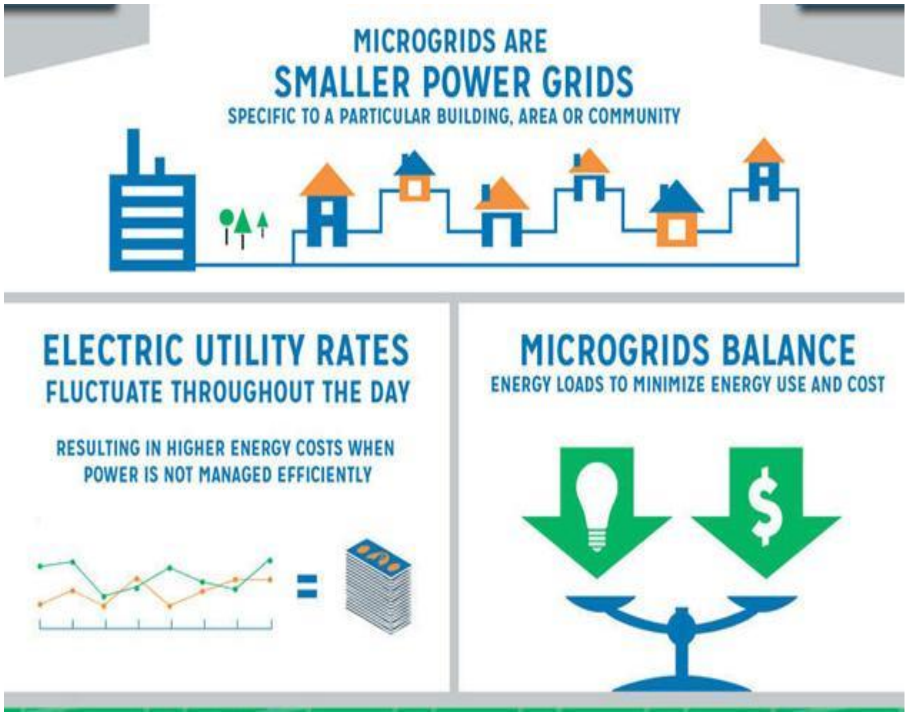


Figure 3.24. A depiction of how microgrids balance energy load and balance distributed generation. [135]

Microgrids are commonly used in areas where transmission lines cannot easily reach a specified location. In such locations it is usually economically infeasible to justify building transmission infrastructure to service a community for two reasons. First, the energy demand in that community might be very low and would not warrant building transmission lines. And secondly, geographic circumstance could make transmission line construction very expensive. Borrego Springs, California, in north east San Diego County, is one example of a community with such a small load that is serviced by a microgrid. There are only 3,429 residents, as compared Hermosa Beach's population of 19,506.[136] Also, a geographic circumstance warranting a microgrid may include servicing island communities. Catalina Island, which is just off the coast of Long Beach, is one such example of an area that is serviced by a microgrid.

[135] (Shephard News Team, 2013)

[136] (United States Census, 2010)

Chapter 4: Green Tariff Shared Renewables

This chapter introduces the GTSR program as outlined by California Senate Bill 43. This bill requires that utilities propose a plan for the implementation of off-site renewable energy generation to be available to ratepayers. In order to receive approval, these proposals must follow several specifications to ensure that consumer and environmental interests are upheld. The proposal submitted by SCE is the Green Rate program and is currently under review by the CPUC. The Green Rate program will offer SCE customers a choice of either fifty or one hundred percent renewable energy generation for a twelve-month period at an additional cost. This program would allow for energy users in Southern California to purchase renewable energy generation through the utility.

Legislative Review of Senate Bill 43

The passage of California State Bill 43 by Governor Jerry Brown in September 2013 marked an impressive new opportunity for California residents to participate in shared renewable energy generation. Outlined in this bill are guiding standards for the formation of the GTSR program. Legislators and supporters of SB 43 believe GTSR programs will lead to the expansion of renewable energy resources providing benefits to the state, local communities, and individual households. Actions taken by each utility in submitting GTSR program proposals show their restraint in meeting the full requirements of the bill, which has led to strong concerns from interest groups and a ruling by the CPUC mandating further compliance. By these regulating methods, the programs offered by each utility to their customers should mirror the legislation. After taking a look at the causes for creation of this bill and its requirements, this paper will review CPUC rulings and several perspectives of current weaknesses in each proposal. Then the current proposal submitted by SCE, which covers Hermosa Beach's energy demand, will be reviewed including most recent amendments.

The outlining legislation for the GTSR program opens with a precursor, referencing the renewable energy self-generation program. This existing law allows households to receive a bill credit on their account for self-generated electricity exported to the grid.[137] Opening the bill with this reference establishes the context and applicability for the new program, which the CPUC will govern in the same manner. The GTSR program will allow ratepayers to directly participate in eligible offsite renewable energy generation as defined by previous legislation through a program created by each utility. Each utility's program application will be reviewed by the CPUC by July 1, 2014 and approved or modified as the commission determines. If the program is deemed reasonable the commission will allow opportunity for public comment before approval. Under penalty of law, each utility must follow the stipulations of their proposal as submitted for the lifetime of this bill, which will repeal the program on January 1, 2019.[138] There will be no reimbursements to schools or local agencies for participation in this program.

The first section of SB 43 cites reasons for establishing the GTSR program. First, the creation of more renewable generating facilities is favorable to the state by providing "financial, health, environmental,

---

[137] (California State Legislature, 2013)

[138] Ibid.

and workforce benefits."[139] The next subsection recounts the success of the California Solar Initiative, which stimulated the construction of 150,000 onsite solar energy systems.[140] Following this success, the state expects progress when expanding support for renewable energy procurement. By implementing the GTSR program all ratepayers would have access to benefits similar to onsite generation and a variety of renewable resources systems would be built. Success of the newly proposed program is bolstered by the wide interest of large, institutional customers and the flexibility of participation. The GTSR program will similarly stimulate construction of shared generation facilities due to increased demand of renewable energy resources. Jobs, decreased GHG emissions, and further energy independence are all benefits of this construction, according to this section of the bill. Those institutional customers unable to fully meet their energy demand with onsite generation, due to space or net-metering limitations can use this new program to meet their demand. This bill mandates that non-participating ratepayers and electrical corporations not suffer losses due to implementation, so persons opting out of the program will not face any negative impacts. Instead this legislation should foster a sustainable market for eligible renewable energy facilities, properly compensate electrical companies for their services, and transfer no extra cost to non-participants.

The next chapter of SB 43 describes the definitive deadlines for the GTSR programs. Utilities, defined as an electricity generation corporation with over 100,000 customers, must file their proposal by March 1, 2014 and the commission will report decisions on each application by July 1, 2014.[141] After public comment the commission will approve programs that are consistent with legislation. If utilities have similar pre-existing programs offered to its ratepayers, they are exempt from this deadline.

In order for the utilities' proposed programs to be approved they must meet several qualifications as stipulated in SB 43. First, utilities must utilize eligible renewable energy generation with a "nameplate rated generating capacity not exceeding twenty megawatts" except in pre-designated, impacted areas.[142] Next, tools and mechanisms of procurement used in the program must be commission approved in order for the renewable energy resources to be considered eligible. Also, all newly procured power for this program must meet the California Renewables Portfolio Standard. Other stipulations which proposals must include are, offering all customers under a utilities' jurisdiction the option to purchase into the program at a tariff approved by the commission. This means the cost to consumer should be reasonable and not a venture to expand utility revenue. Participants may join the program until the maximum state limit of renewables is reached at 600 megawatts (MW). Each utility will receive a size proportional allocation of this total. Exceptions to size allocations are regions zone as environmental justice communities, with high pollution and socioeconomic vulnerability. The City of Davis is also an exception.[143]

In order to provide the largest benefit to communities, SB 43 contains several sections regarding residential procurement and environmental justice. It mandates at least 100 MW of power be reserved for

---

[139] Ibid.

[140] Ibid.

[141] Ibid.

[142] Ibid.

[143] Ibid.

residential customers and that local procurement options be offered to these participants. No individual may purchase more than one hundred percent of their energy demand in renewable power or two megawatts. Government building users are exempt from this limit. Utilities are expected to purchase power in closest proximity to their service area and create a diverse portfolio of renewable energies.[144] Utilities should specifically market to minorities and low-income community members. Customers generating qualifying forms of renewable energy will receive a bill credit equal to the cost of generation in the class of participation is which the customer belongs and adjusted considering time-of-use versus time-of-generation.[145] Both the CPUC and the utility shall determine the tariff paid by participating customers to cover incurred cost to the utility for procurement of more renewables. Further costs or credits can be charged to the ratepayer, but must be approved by the commission. Utilities shall support further development of community based renewable resources.

Finally, the commission guarantees customers fairness of pricing and cost indifference to those outside of the GTSR program. Therefore, each utility must track costs and revenue of the program in order to ensure transparency. Customers will be credited with any RECs earned, but if they fail to utilize these credits the utility may count them toward its RPS. Renewable energy not demanded by customers can be applied to the RPS of the utility and banked for future benefit of all customers. A utility must exclude kilowatt-hours of renewable energy resources provided to program participants when calculating its procurement requirements as mandated by the California RPS.[146] Energy procured for this program must comply with the State Air Resources Board Voluntary Renewable Electricity Program, but GHG allowances earned with the program will be surrendered. Data regarding participation in the program and aggregate consumption will be made public and provided to the municipality. Community choice aggregators can offer a similar program to the GTSR. This entire program will conclude upon the repeal of the enabling legislation on January 19, 2019.[147]

The timeline of processing SB 43 through government approval caused the bill to be approved before CPUC made its ruling. Because legislative approval supersedes CPUC's regulatory proceedings, the CPUC still lists an undetermined position on SB 43. However, as the bill states, the CPUC will be the governing body in monitoring GTSR Programs. As the commission proceeds in reviewing submitted proposals by the IOU's, a variety of association file their comments as a further regulating measure in their interest.

Public Commentary on Proposals

As discussed, following the approval of SB 43 each large utility in California must devise a program for a GTSR under their jurisdiction. The Vote for Solar Initiative chronicles the CPUC's current review of proposed programs, noting its ruling that PG&E must offer subscribers' significant choice and flexibility in clean energy projects.[148] The Vote Solar Initiative strongly supports this decision believing that increasing consumer choice will create greater success for the GTSR program. PG&E's actions show resistance to this recent ruling, while SDG&E proposes half their program contain diverse procurement of

---

[144] Ibid.

[145] Ibid.

[146] Ibid.

[147] Ibid.

[148] (Churchill, 2014)

renewables. This particular lobbyist group has some concerns with utilities' programs moving forward, such as proper allocation of bill credits and construction of smaller clean energy projects in disadvantaged communities, that they will continue to monitor.[149]

After the submission by PG&E of their preliminary GTSR program proposal, Marin Clean Energy (MCE) made public comment on issues the group felt were inadequately addressed. Among their comments, MCE states that the IOU has not assured non-participants protection from cost-shifting, instead their proposal breezes through the issue simply stating those customers will remain "indifferent."[150] No solid provisions are given to the stakeholders associated with MCE, as they will be non-participants in this program. The group holds that PG&E has made little effort to meet SB 43's specific requirements and instead submitted a cursory update of their Green Option Settlement. By pointing out the full analysis of cost structure in SDG&E's proposal, MCE establishes gaps in PG&E's plan. MCE also voices concern about program participants no longer being subject to non-bypassable charges, specifically the Cost Allocation Mechanism.[151] This charge is lacking in both SDG&E's and PG&E's proposed cost structure for program participants, yet it is a charge which should apply to all ratepayers. In all, MCE is not satisfied with the level of detail in PG&E's proposal. In their opinion, it leaves significant chance their stakeholders will end up burdening incurred costs of the GTSR program, though they are not participants. This is strictly prohibited by SB43.

The City of San Francisco lodges similar complaints with PG&E's GTSR program proposal as MCE. Commentators specifically point out the lack of detail in the proposed cost structure and sight a misinterpretation of a section of SB 43, which the utility provides allows them to use non-participating ratepayers as a backstop to the GTSR program.[152] By assessing the legislation in this manner, the City of San Francisco believes PG&E will be allowed to improperly shift costs to ratepayers outside of the program. The City of San Francisco also addresses a lack of opportunity for purchasing energy from local renewable sources, a stipulation of SB 43.[153] In supporting the interests of both program participants and non-participants, the City of San Francisco makes note that PG&E does not explicitly state how renewable resources added for the GTSR program are in excess to the energy procured for California's RPS.

The commentary provided by California Utility Employees concerns both PG&E's and SDG&E's proposal. They support the efforts made by the utility, claiming that the programs are consistent with SB 43. Because PG&E's GTSR program served as a model for SB 43, the group contends that it meets all of the legislation's requirements. This statement of support is loosely worded, stating that PG&E's program meets SB 43 "at face value" and at its core is "in the public interest."[154] Comparing this terminology to the very specific concerns of the previous interests groups shows the huge disparity in opinion between supporters and non-supporters of the utility's proposal. Comments by California Utility Employees offer support of both programs based on the intent of each utility to provide more renewable energy to customers, rather than analyzing the specific operations required by SB 43.

Environmental justice provisions written into SB 43 were included with the help of the California

---

[149] Ibid.

[150] (Kelly, 2014)

[151] Ibid.

[152] (Herrera, 2014)

[153] Ibid.

[154] (Joseph, Mauldin, 2014)

Environmental Justice Alliance (CEJA) and the California Environmental Protection Agency. As experts on this subject, CEJA comments reflect specific concern for these issues. The organization believes the "disadvantages communities" referenced by SB 43 should be identified by a proven and publicly disclosed method.[155] This way the 100MW allocation to these particular communities will be ensured, not subject to economically advantageous zoning by the providing utility. PG&E's program glosses over its environmental justice requirements by stating often slighted by economic interests. CEJA's full commentary seeks to champion this issue.

Green Rate: Southern California Edison

SCE's current proposal that is under revision by the CPUC covers 269 MW, their proportionate share of the 600 MW limitation established by SB 43.[156] Customers with Bundled Service will be offered 50 or 100 percent of their energy consumption within twelve months of proposal approval. Each customer is limited to one hundred percent of their consumption or 2 MW. Enrollment for the Green Rate has no minimum load requirement. However, customers who enroll in the Green Rate program and later cancel must wait one year before re-enrollment.[157]

Southern California Edison Proposal

The following information covers the proposal for the Green Rate and amendments made to the program submitted by SCE to the CPUC on January 10, 2014 and March 11, 2014 respectively. This reflects the most up to date information regarding enrollment, pricing, RECs, marketing, and program alterations that are pending approval by the commission.

Enrollment

Ratepayers under SCE's territory can enroll in the Green Rate through four avenues. They can visit the online web portal, call the SCE call center, submit a paper form, or contact their assigned account manager. Though there are many options to enroll, customers are unlikely to flock to the Green Rate. SCE expects only .05% of its customer base to enroll in the Green Rate.[158]

Pricing

Two extra fees will be added to Green Rate participant's bills. The Green Rate Charge covers renewable integration, market participation, program administration, the green rate portfolio, and resource adequacy costs. The Generation Credit encompasses fees from class average retail generation rate, indifference adjustment, time-of-delivery adjustment, resource adequacy adjustment, and other CPUC approved costs.[159] These two charges will be in addition to the ratepayers otherwise applicable bill charges.

---

[155] (Lin, 2014)

[156] (Southern California Edison, 2014a)

[157] Ibid.

[158] Ibid.

[159] Ibid.

Renewable Energy Certificates

SCE proposes to retire the RECs generated from participation in the Green Rate on behalf of the customer to ensure this renewable energy is additional to RPS goals. However, the proposal also states that any procurement of renewables that is not used from Green Rate subscriptions will be "reincorporated back into SCE's renewables portfolio and count toward RPS goals."[160] More renewable power will be procured by SCE to fulfill RPS goals if the energy reserved for Green Rate subscriptions is completely consumed.

Taking a closer look at SB 43 in the context of various renewable energy regulations provides additional insight into the addition of renewable energy procured under SB 43. Additionality it refers to whether or not the energy would be produced if not for the enabling policy or financing, in this case SB 43. As previously stated, California utilities are mandated to reach 33% renewables by 2020. The intent of the SB 43 legislation is that electricity procured for compliance will be in acquired in addition to the 33% needed for this policy goal. Electricity used by the City of Hermosa Beach consumers under SCE's Green Rate option will only be additional if three conditions are met:

1. Hermosa Beach customers enroll in the Green Rate program prior to 2020
2. These customers maintain their status in the program through 2020
3. The SB 43 is extended beyond its planned sunset in 2019 to 2020,

Thus, there is some risk that the electricity produced for the consumers of the City of Hermosa Beach under SCE's Green Rate will not lead to long-term reductions in GHG emissions needed to pursue carbon neutrality.

Understanding international standards of GHG accounting will be key in order to determine the potential environmental benefit of switching to renewable energy with the Green Rate. As established by the World Resources Institute along with other stakeholders, the GHG Protocol's Scope 2 guidance sets the standard for accounting an entity's GHG from electricity.[161]

Until SCE begins the Green Rate program, it is not possible to determine if Hermosa Beach will be credited with GHG reductions of electricity from subscriptions. However, understanding the principles of GHG accounting will benefit the community in their decision process toward the decarbonization of electricity production. The most recent Scope 2 Accounting protocol considers many aspects of purchased renewable energy projects when calculating their emissions. These attributes include emissions from production and purchasing of instruments, identifying intended uses of instruments, assuring the quality of procured energy, preventing double counting of emissions attributes, surveying regional approaches to accounting, identifying the range of reporting, and creating appropriate calculations specific to the ownership of the renewable energy attribute.[162]

---

[160] Ibid.

[161](World Resources Institute, 2012)

[162] Ibid.

As different energies enter the grid they become indistinguishable, therefore the most important factor in determining emissions is tracking the source of energy production. Most notably, energy attribute certificates are logged and tracked for each unit of energy purchased. Generally these certificates are issued for renewable energy redeemed directly by the consumer participating in a voluntary program or by the utility. Through the use of RECs the utility can demonstrate their compliance with the California RPS and GTSR program demand. The GTSR program should in effect create a greater demand for RECs shifting the supply to less carbon-intensive energy. However, market analysis has shown that long-term contracts for RECs more effectively alter grid energy composition. This discrepancy in voluntary programs has led to greater vigilance in GHG reporting by the GHG Scope 2 Protocol. Now the guidance requires market-based method reporting, a recognition of a range of contractual instruments, all quality criteria be met, disclosure on regulatory relationships, and recommends purchase feature disclosure.[163] All of these measures are in an effort to provide reliable data to the energy purchaser and protect the integrity of low carbon intensity energy. Because long-term REC contracts can have a greater effect on renewable energy generation and grid composition than short-term purchases, Hermosa Beach should look to see that either the CCA or SCE's GTSR program offering use multi-year REC contracts in order to ensure real, additional renewable energy on the grid.

Marketing Green Rate

In order to utilize funds most efficiently, SCE will target marketing efforts to customers 'most likely' to enroll in the Green Rate. SCE defines this group as rate-payers currently in all Bundled Service.[164] This section mentions making efforts to include low income customers, however no detailed plan of outreach and education is explained. In general, this section is vague and focuses only on an efficient budget and saving money.

Green Rate Balance Account

SCE intends to recover all extra costs from implementing the Green Rate subscription process.The utility intends to establish a Green Rate Balance Account where all differences in Green Rate related costs are recorded. Entries should only include actual cost, and will result in the calculated cost per kWh of the Green Rate annually. Furthermore, as yearly costs vary in procurement, SCE proposes to refund or recover costs from the account, once it is established. The account would be monitored by the CPUC.[165] SCE recommends CPUC oversee its activity in the same method it reviews other balancing accounts and contracts.

Proposal Amendments

Due to an error in determining eligible facilities of renewable energy generation, SCE now forecasts different rates for customers opting into the Green Rate. Originally the utility projected 271 projects within their territory.[166] Now they have corrected their statement to include only 214 projects causing adjustment to the 2015 Green Rate Portfolio Charge, Time-of-Delivery Adjustment, Generation Credit,

---

[163] Ibid.

[164] (Southern California Edison, 2014a)

[165] Ibid.

[166] (Southern California Edison, 2014b)

and the revenue requirement for 2015. Listed below are the current estimated charges by SCE

Component		Charge	
Green Rate Portfolio Charge	+	10.839 ~~9.281~~	¢ / kWh
Renewable Integration and Market Participation Charge	+	0.00002	¢ / kWh
Program Administration Charge	+	0.7684	¢ / kWh
Resource Adequacy Charge	+	0.6586	¢ / kWh
Green Rate Charge	=	12.266 ~~10.7080~~	¢ / kWh
Class Average Retail Generation Rate	-	8.71	¢ / kWh
Indifferance Adjustment	+	2.767 ~~2.97~~	¢ / kWh
Time-of-Delivery Adjustment	-	0.0 ~~0.0005~~	¢ / kWh
Resource Adequacy Adjustment	-	0.0063 ~~0.0458~~	¢ / kWh
Other CPUC-approved Charges or Values	-	0	¢ / kWh
Generation Credit	=	(-)5.9493 ~~5.7863~~	¢ / kWh

Table 4.1. Projected Green Rate Pricing Components for Residential Schedule D-"G"

Public Commentary: Specific to SCE Proposal

Several third parties submitted responses to SCE's Green Rate proposal. The Interstate Renewable Energy Council (IREC) filed several briefs with the CPUC in opposition to the proposals made by PG&E, SDG&E, and SCE. Their concerns center around the price structure dictated in these utilities' current plans. As a non-profit, IREC provides a third party insight to the proposal proceedings and offers a wealth of experience dealing with regulatory energy policy. Using this experience, IREC came to the conclusion that current proposal rates would hinder consumer access to renewable energy rather than support SB 43's legislative mission.[167] Included in their briefs, are opposition to the utilities' rate structure regarding non-participant indifference, price fluctuation, and total cost.

The first aspect of rate design which the IREC takes issue with is in regards to ratepayer indifference. The IREC contends that non-participants will actually benefit, as the utility also stands as a non-participant. Currently charges listed as "resource adequacy value," administrative costs, and "renewable energy generation rate" are variable.[168] This lack of stability and ultimate fluctuation in price could be used to benefit the utility, not provide economical access to low-impact energy. Essentially the IREC argues that non-participants are free riding off the benefits provided by GTSR program in the long-run. As California begins to standardize higher renewable energy requirements for utilities, projects attained for GTSR program subscriptions will become relevant to all ratepayers, therefore placing a burden of establishment

[167] (Interstate Renewable Energy Council, 2014a)

[168] Ibid.

costs on only participants while supplying the long-term benefit to everyone. Furthermore, program participants are "facilitating a strong renewable energy market" for future use.[169] An SDG&E representative already expressed opposition to incorporating long term benefits into non-participant bill accounting. In further testimony, the SDG&E representative acknowledged that ratepayer indifference includes ensuring that all participants receive the full benefits associated with the costs they provide, but rejects the cost benefit methodology for distributed generation created by Decision D.[170] Instead both utilities insist that costs and credits to participants should be determined by the Direct Access methodology. This is a short-term framework which IREC describes as designed to allow customers to purchase renewable energy at market-price, rather than a utilities generation supply.[171] The intent of GTSR programs is to develop new renewable generation facilities, therefore long-term benefits to non-participants greatly exceeds the short-term Direct Access framework for indifference, leaving program participants with a loss of value.

Next, IREC contends that each utility can provide a more stable rate structure for participants in GTSR programs. They reason that in general there are months where served customers pay more or less for services rendered on a normal electricity plan.[172] Cost accuracy is currently imperfect. It is nonsensical to assume GTSR program accounts will avoid this if the utility fluctuates rates frequently. Furthermore for the utilities' to contest fixed rates under the pretense they cannot support them is misguided. SCE must buy power on time scale of twenty years. They could not require suppliers to charge on a yearly basis according to short-term market fluctuations.[173] For these reasons, IREC suggests a model for GTSR programs which includes fixed rates based on the term of a participant's commitment to make participation more financially accessible.[174]

Last, IREC establishes a price comparison between each utility, determining SCE's proposal significantly more expensive, warranting a re-evaluation of its rate design. SCE's current premium for the Green Rate is inappropriate proven by the fact that it is well in excess of the national and California average for green pricing programs, PG&E's, and SDG&E's proposed rates.[175] See table for side by side comparison.

---

169 Ibid.

170 (Interstate Renewable Energy Council, 2014c)

171 Ibid.

172 Ibid.

173 Ibid.

174 Ibid.

175 (Interstate Renewable Energy Council, 2014b)

Table 4.2. Additional Costs of Electricity Under a CCA[176]

Utility	Program Name	Additional Cost of Generation (¢/kwh)
National Average	Similar green pricing programs	1.1
California Average	Similar green pricing programs	1.8
San Diego Gas & Electric	SunRate	~2.7
Pacific Gas & Electric	Enhanced Community Renewables Option	~2.7
Southern California Edison	Green Rate	~4.2

[176] Ibid.

Chapter 5: Community Choice Aggregation

One option to bring carbon neutral electricity to the City of Hermosa Beach is the establishment of a CCA, allowed by the implementation of AB 117. Under a CCA, the community can specifically allocate sources of electricity generation. Thus, a CCA gives autonomy to the City of Hermosa Beach to select zero emissions energy and accomplish their goal of carbon neutrality. Furthermore, a CCA is structured such that the public utility would continue their role of long range transmission, community distribution, and billing. As a result, IOUs will continue with such duties and would charge a fee for their services. In order to offset the additional charges of IOUs' services, the City of Hermosa Beach may consider implementing a Joint Powers Authority (JPA). The formation of a JPA will be beneficial as it will integrate progressive cities into the CCA to divide costs. Collectively, a CCA would give the City of Hermosa Beach control over its sources of electricity procurement, but a JPA is a plausible solution to mitigate the additional surcharges. This chapter explains the details of establishing a CCA.

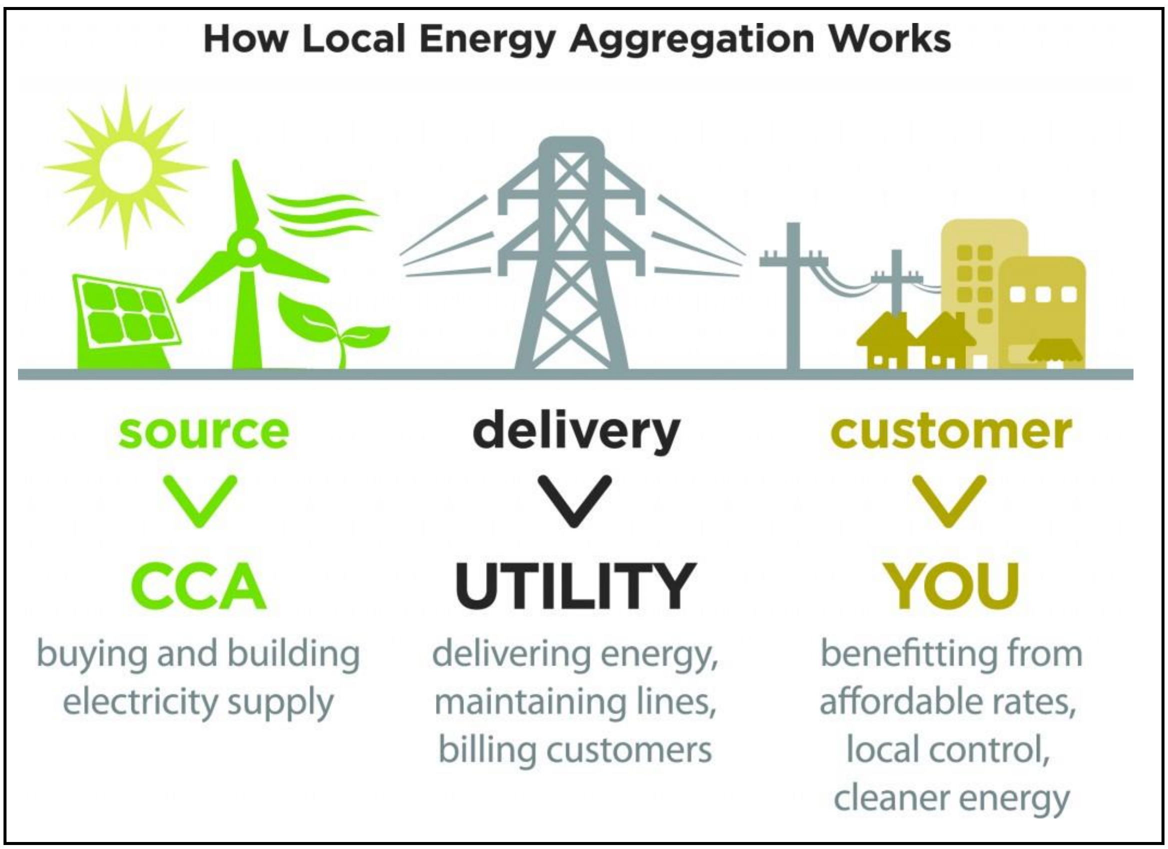


Figure 5.1. This graphic describes CCA to a customer.[177]

History

The first CCA project occurred in Massachusetts in 1997 in Cape Cod which successfully led to the creation of Cape Light Compact. In a short period of time, the idea of CCA was able to expand to other states including Ohio and Illinois. In 1997, California's electricity market was restructured in order to increase competition between electricity suppliers and reduce rates. This reform was not very effective as many customers failed to participate due to the cost and inconvenience of switching to another energy provider. In the early 2000's California experienced an energy crisis which escalated the call for change in energy policy. The new pressure for increased energy options eventually led to the passage of California State Assembly Bill 117 (AB 117).

California State Assembly Bill 117

AB 117 was passed in 2002. It sets the legal precedent for a CCA and it provides the guidelines for CCA programs in California. A CCA program can be formed by any community governing board that "elects to combine the loads of its residents, businesses, and municipal facilities in a community-wide electricity buyers' program." In addition, a group of cities, counties or both can form a CCA through the formation of a JPA with a Joint Powers Agreement.[178]

Attempted Community Choice Aggregation Programs in California

There have been a number of communities in California where CCA options have been explored, two of which are operational while others are on the horizon. Table 5.1 is a list of governmental bodies that have explored the implementation of a CCA in their community and their current implementation status:

Table 5.1. Governmental bodies that implemented CCAs.

CCA	Status
San Joaquin Valley Power Authority	Suspended (Created feasibility report)
Marin Energy Authority (Marin Clean Energy)	Operational (All customers phased in)
Sonoma Clean Power Authority (Sonoma Clean Power)	Operational (Phasing in customers)
City and County of San Francisco (Clean Power S.F.)	Suspended (Implementation plan submitted to CPUC)
County of San Diego	Suspended (Created feasibility report)

177 (Lean Energy U.S., 2014)

178 (Legalinfo.ca, 2002)

Lancaster Power Authority (Lancaster Community Choice Aggregation)	Implementation in progress (Expected 2015)

Power Purchase Agreement

If the City of Hermosa Beach establishes a CCA, it will have to procure electricity from independent power producers (IPP) through PPAs. A PPA is a contract between an IPP and a buyer that dictates electricity production, delivery, and payment. Through PPAs, buyers can selectively allocate the source of energy, thus most PPA's correlate to solar production and other means of renewable energy. Most PPAs typically last 5-20 years.

The main entities involved in a PPA are the IPP, buyer, and utility company. A buyer negotiates with the IPP to supply them with a certain amount of electricity. A contract then binds the IPP to the buyer for an arranged number of years. Through that contract, the IPP must supply all the agreed amount of electricity and must arrange a cost for the longevity of the contract. The utility company will deliver the electricity from the IPP to the buyer through its transmission lines. The utility company will charge a fee for its service and they will also bill the customer. The utility company is given this task because they can easily tell from their metering how much electricity each customer uses.

Benefits of Community Choice Aggregation

CCA programs provide various benefits to the regions that they serve. These benefits are directly related to the nature of a CCA which allows local governments, rather than the IOU, to make decisions about power procurement. Currently, SCE performs the task of power procurement for the City of Hermosa Beach. In all areas of the state not served by an established CCA or a direct access agreement, customers do not choose from where and how their energy is produced. A CCA transfers the authority from the IOU to the community, so that community members along with their local governing board can decide how their electricity is purchased and generated. Further, a CCA could provide competition for both lower rates and for a higher percentage of renewables in electricity generation.

A CCA is a local not-for-profit agency that is generally overseen by elected officials or their appointees and managed by a hired staff or a contracted service provider. The incorporation of city officials ensures that energy procurement decisions are made in light of the community's goals. If the City of Hermosa Beach started a CCA, it would have a much greater level of control in energy policies.

Due to the bulk power purchases a CCA makes, it possesses greater leverage upon the negotiation of rates with IPPs. Therefore, there can be a potential expansion in the market for competitively priced renewable power generation. The two CCAs that are currently operational in California are MCE and Sonoma Clean Power (SCP). Both CCAs were able to provide their customers with more renewable energy rates that are slightly lower than their IOU, PG&E. This is shown in Table 5.2 and 5.3.

Table 5.2. Marin Clean Energy vs. PG&E Rates[179]

	PG&E	MCE Light Green	MCE Deep Green
Renewables	19%	50%	100%
Residential Total Cost	$76.16	$75.70	$80.78
Commercial Total Cost	$187.65	$185.20	$197.02

*Residential Based on 508 kWh/ E-1, Res-1; Commercial Based on 1,182 kWh/ A-1, Com-1 (Winter) as of 1/1/14

Table 5.3. Sonoma Clean Power vs. PG&E Rates

	PG&E	SCP CleanStart	SCP EverGreen
Renewables	20%	33%	100%
Residential Total Cost	$80.43	$75.80	$93.30
Commercial Total Cost	$348.49	$329.41	$389.91

*Residential Based on 500 kWh/ E-1, Commercial Based on 1,500 kWh/ A-1 as of 5/1/14

CCAs in California have proven to offer competitive rates compared to current energy providers while increasing the renewable energy load. However, customers do need to pay more than the general utility rate to receive energy from 100% renewable sources. Due to its earlier formation, MCE has had more time to refine its program by establishing better financial practices and acquiring more energy procurement contracts, therefore allowing them to offer a higher RPS for the cheaper option.

Starting a Community Choice Aggregation Program

Political action is crucial to the implementation of a CCA as there needs to be a simple majority to approve the program. First, the city will need to explore the feasibility of forming a new CCA by performing a calculated feasibility study. Once the analysis is complete the results are used to guide the town in their voting. After the vote, additional research and approvals are required to ensure the long-term success of the CCA. Many of these approvals come from the CPUC, who is in charge of overseeing and regulating energy companies as well as CCA programs. Table 5.4 shows the first steps to forming a CCA, which are further elaborated in the following sections, each of which require the approval of the

[179] (Marin Clean Energy, 2014a)

city council.

Table 5.4. Steps to Start a CCA

Steps to Start a CCA
1) Perform a feasibility study which assesses the potential of CCA in a given community
2) Establish a JPA with nearby communities to aggregate total demanded load (optional)
3) Write an Implementation Plan that fulfills the CPUC's requirements
4) Submit a Statement of Intent (SI) to the CPUC and wait for correspondence
5) Once (SI) is approved, submit formal application for registration to the CPUC
6) Begin following through with Implementation Plan to build CCA

1) Feasibility Study

In order to fully assess the economic impacts and viability of a CCA, the City of Hermosa Beach should consult with a third party to create a feasibility report. Navigant Consulting is an existing firm that has experience conducting the feasibility report for MCE. Furthermore, John Dalessi, a former senior management at Navigant, created his own firm called Dalessi Management Consulting. Thus John Dalessi has expertise in CCA cost analysis because of his association with the feasibility reports for both SCP and MCE. Due to the importance of an accurate feasibility study, the costs of the third party consultation may be significant. Sonoma stated that the cost of the study should not exceed $150,000, but due to service extensions and new agreements this limit has been exceeded by $101,000.[180]

The City of Hermosa Beach might not need to bear the full cost of a feasibility report if it joins with other cities or considers joining an existing CCA. For example, the City of Albany, CA is similar in size (1.8 square miles) and population (18,969 people) to the City of Hermosa Beach. Albany set aside $20,000 for a city-scale feasibility study in consideration of joining MCE.[181] Thus costs to generate a feasibility report for a single city joining a JPA with an existing CCA may be significantly lower than if the city decides to establish a CCA alone. The cost of a city joining a JPA with an existing CCA may be closer to $20,000.[182] This is significantly lower to the $251,000 that Marin County set aside for its county wide feasibility report.[183]

2) Joint Powers Authority

The City of Hermosa Beach currently has a population of 19,773, and an annual electricity demand of 78

[180] (County of Sonoma, 2011)

[181] (City of Albany, 2013)

[182] Ibid.

[183] (County of Sonoma, 2011)

GWh. Due to the city's small demand, bargaining power may be limited when negotiating with IPPs, leading to higher electricity costs per kWh. Simultaneously, this demand may be too large to be supplied by the excess electricity of an IPP. A possible solution for this size demand, is creation of a JPA with neighboring communities.

A JPA is an entity that can jointly exercise power over the participating communities in order to combine resources and address a common issue. This would allow a CCA to aggregate the electrical loads of other communities in the area, thereby increasing the CCA's power to negotiate low-cost renewable energy contracts from an IPP. In effect, this would increase the buying power of the City of Hermosa Beach, allowing for the formation of an effective CCA. Start-up costs can also be spread out causing the financial risk of a forming CCA to be mitigated for each participating city. Resources from each city in the JPA can be shared and used efficiently between all parties involved.

Benefits of a Joint Powers Authority for a Community Choice Aggregation

JPAs are beneficial as they promote synergism between cities in order to reach a common goal. JPAs work efficiently to ensure that the foundation of a CCA is centralized by hiring staff that will be representative of all cities in the JPA. As a result of a centralized system, overlapping services will be reduced and there will be a consistency of service amongst cities participating in the JPA.

Once a JPA is established, the addition of cities into the JPA will be beneficial and less risky. Generally, as a JPA expands, the risk is lessened upon financing a CCA. A JPA also provides a way of mitigating risk for the cities involved by separating the budget and assets of a CCA from the general funds of the member cities. The debts and liability of a JPA do not extend to its member cities.[184] A city can be a part of JPA, but not necessarily be serviced by its associated CCA. However, for those cities involved in the JPA, it is much easier for them to be incorporated into the CCA. For example the City of Richmond, California was a part of the JPA Marin Energy Authority since 2008, and recently in 2013 began receiving service from MCE. During an interview with Ben Choi, an account manager for MCE, he stated that there was little to no financial risk to Richmond as it entered into the established CCA.[185] MCE was already established and running smoothly. There was no reason for Richmond to believe that entering the CCA would jeopardize their energy reliability. By joining Richmond was able to increase its renewable portfolio. At the same time, MCE was able to increase its purchasing power while decreasing the amount of overall financial risk from an increased load and customer base.

Risks of a Joint Powers Authority and Potential Solutions

Despite the increase in buying power that comes with a JPA, the voice of the City of Hermosa Beach may be overpowered in a JPA due to its small size, low electricity demand, and thus expected lesser influence in the JPA's goals. If a JPA is established with neighboring cities, a JPA council must be created with representatives from each party. If a large scale JPA is implemented in the South Bay and the number of representatives in the JPA council is based on population size, the City of Hermosa Beach risks losing significant authority over JPA council actions.

---

[184] (Lancaster Choice Energy, 2014)

[185] (Choi, 2014a)

To counter this, the JPA can be structured in a similar way to MCE's JPA: Marin Energy Authority. Marin Energy Authority partitions half of the voting shares equally to each member city and the other half of the voting shares according to each city's annual energy usage.[186] This helps ensure that representation is fair between each city, while still recognizing city size. The JPA can also be structured so that only founding cities have a say in the decision making. If desired, the charter can be expanded to include more cities. The City of Hermosa Beach's goal is to achieve carbon-free electricity; consequently it should make sure to explicitly present this goal when forming a JPA, as other cities might not have this same objective. If the City of Hermosa Beach can form a JPA while meeting its goals of carbon neutrality, it should do so. Ideally, the JPA would be focused on providing 100% renewable electricity generation.

Effective Joint Powers Authority Size for a Community Choice Aggregation

An effective CCA is able to provide a higher amount of renewable energy to its customers at a competitive price. In order to do this, a CCA must have a large enough electricity demand to increase their purchasing power and reduce fixed costs as a percentage of total costs.

Marin County and Sonoma County both run CCAs that are competitive with PG&E's rates and provide a greater percentage of renewable energy. The JPA energy load size of Marin and Sonoma serve as examples from existing CCA programs.

A comparison of the counties' energy loads are shown in Table 5.5 to compare how large a newly created CCA should be. The estimates are the total load of the counties before opt-out rates are factored in. The chart depicts the load of the entire county regardless of enrollment. Some cities in both counties elected not to participate in the CCA, so these numbers can only serve as a rough estimate to the necessary load, but are useful for modeling.

Table 5.5. Electricity load for Marin and Sonoma County.[187]

Type of Load	Marin (2010)	Sonoma (2010)
Non-Residential (GWh)	716.66	1,520.57
Residential (GWh)	705.54	1,354.34
Total (GWh)	1,422.21	2,874.91

In comparison, the total load of the City of Hermosa Beach was 77.97 GWh during the same year.

3) Implementation Plan

Another step that must be taken to start a CCA is the creation and submission of an Implementation Plan to the CPUC for approval. This plan would investigate feasibility and assess the benefits and challenges of a CCA in the specified area. In addition, the CPUC uses the plan to determine the cost responsibility

[186] (Marin Energy Authority, 2012a)

[187] (California Energy Commission, 2010)

surcharge (CRS).[188] This surcharge prevents the existing electricity supplier from experiencing an increase in costs due to lost customers. The electricity supplier, namely the IOU, uses customer's payments to finance the high cost of building transmission lines. The CRS is a measure used to protect the IOU from losing its initial investment needed to serve customers. According to AB 117, an Implementation Plan must include several attributes in order to reach approval at public hearing by the CPUC.

First, the Implementation Plan must explain the "organizational structure of the program, its operations, and its funding."[189] This includes how the CCA is run, as well as how the leaders in the CCA are chosen. It also outlines what each person's duties are and how decisions are made. Second, the plan also entails rate setting and other costs to participants.[190] This section can include a plan to keep rates stable, competitive with the IOU, and a plan to ensure that the CCA will be able to pay back its costs over time. AB 117 also requires provisions for transparency in determining rates and public disclosure when the CCA votes to adjust established prices.[191]

Third, the plan includes methods for entering and terminating agreements with other entities. "The rights and responsibilities of program participants, including, but not limited to, consumer protection procedures, credit issues, and shut off procedures." All this means that the plan will include procedures for customer opt-outs and what happens if the whole CCA program is terminated. Fourth, the plan also includes a description of the third parties electricity suppliers. the description covers the information about financial, technical, and operational capabilities.[192]

Finally, an implementation plan should also include a statement of intent. The statement of intent should ensure universal access and equal treatment of all classes of customers within the CCA's service area. Reliability of service should also be ensured and any additional requirements from state law or the CPUC concerning aggregated service should be addressed here. Examples of implementation plans can be found in Table 5.6.

Table 5.6. Implementation plans of Marin, Sonoma, and Lancaster CCAs.

	Date of plan	Link
Marin	October 4, 2012	http://marincleanenergy.org/sites/default/files/key-documents/Implementation_Plan_w-Resolution_%26_JPA_Revised_1.22.13.pdf

[188] (California State Assembly, 2002)

[189] Ibid.

[190] Ibid.

[191] Ibid.

[192] Ibid.

Sonoma	August 26, 2013	http://2tgc4v3kjp5mrjtdo183d8716ao.wpengine.netdna-cdn.com/wp-content/uploads/2013/12/Sonoma-Clean-Power-CCA-Implementation-Plan-2013-08-20.pdf
Lancaster	May 2014	http://www.cityoflancasterca.org/Modules/ShowDocument.aspx?documentid=24050

4) Statement of Intent

A prospective CCA must submit a Statement of Intent to the CPUC in order to begin service. This filing includes a detailed Implementation Plan that the CCA is expected to follow if their application is accepted. The application will include any additional information that the CPUC requests, a service agreement with the serving utility, and evidence of insurance or bond. The insurance or bond value must cover costs such as potential re-entry fees into the IOU, penalties for failing to meet operational deadlines, and forecasting errors that may come with the CCA.[193]

5) Application for Registration

The application for formal registering is the process that the CPUC uses to officially catalog the formation of a CCA. Through this application the CPUC is able to legally oversee the CCA to ensure that it is following mandates. Once the application is processed the CCA operation status will be officially active and the CCA can begin executing its tasks listed in the Implementation Plan.

6) Building a Community Choice Aggregation Program

When first creating a CCA, involved governments must make many decisions that will be key determinants of future success. One of the more critical decisions is whether or not to join with other local governments to establish a joint CCA program with the formation of a JPA. As detailed above in the JPA discussion, establishing a joint program can reduce the City of Hermosa Beach's control over future CCA decisions by spreading out control to many cities. To sidestep this risk, the City of Hermosa Beach can ask to have certain regulations written into the bylaws, or contract, of the JPA. Hermosa Beach should request that 100% renewable energy would be procured so that it may achieve its goal of decarbonizing electricity generation. The City of Hermosa Beach should request that specific bylaws be adopted into the JPA in advance in order to ensure that its wishes can be accommodated.[194] Two important objectives that must be pursued early are, the RPS, and the entity that the renewable energy will be procured from. Without clearly stating these two objectives, directing the CCA would be difficult.

Table 5.7. Objectives for a CCA once application is accepted by the CPUC:

Administrative
Recruit and hire staff
Submit notification information to CPUC

[193] Ibid.

[194] (Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs)

Customer Care
Develop information and program marketing materials
Establish call center for customer inquiries
Contact key customers to explain program, obtain commitment and release customer information
Send eligible customers notices and opt-out notices
Fiscal/Contracts
Prepare short and long-term load forecast
Develop capability or negotiate contracts for operational services (such as electronic data interchange with utility, customer bill calculations, schedule coordinator services etc.)
Execute contracts for electric supply, identify generation projects and negotiate participation, if applicable
Obtain financing for program capital requirements
Execute service agreement with utility

Funding a Community Choice Aggregation

A CCA requires an initial investment for formation and thereafter the CCA is funded through revenues eventually resulting in the return of the initial investment. When Marin County was moving forward with its CCA in 2011, Shawn E. Marshall, a project consultant and vice chair of the Marin Energy Authority, estimated that forming a new CCA in California would cost approximately $1.5 to $2 million. This included planning, a feasibility report, the costs associated with the JPA formation, and working capital needed to cover initial operations. The costs of implementing a CCA according to SCP are shown in Table 5.9. Notably, Marin began the first CCA in California. Consequently, their work has provided an example for other communities. This effectively makes future startup times shorter and decreases costs.

MCE began providing electricity to its initial 8,100 customers in May 2010 and by 2013, the customer base has then significantly expanded to approximately 90,000 customers.[195] During the developmental stage in 2009-2010, debt was issued to fund its operations. After MCE was able to secure a substantial amount of customers, revenues began to stabilize, resulting in a positive change in net position. With much success, in the 2010-2011 fiscal year, revenues have exceeded expenses by over $1.2 million causing net assets to increase from a $961,000 deficit to a positive $319,000.[196] Thereafter, in the 2012-2013 fiscal year, net income rose by nearly $4 million resulting a net position of almost $8 million by the end of the fiscal year in March.[197] From MCE's 2012-2013 financial statement, its economic outlook intends to continue its conservative use of financial resources and expects ongoing operating profits.

[195] (Marin Energy Authority, 2010)

[196] (Marin Energy Authority, 2011)

[197] (Marin Energy Authority 2012)

Table 5.8. A table of MCE Net Asset and Net Income Increases from 2010 to 2013

Fiscal Year	Net Position ($)	Net Income($)	Number of Customers
2009-2010	-961,251	-788,786	8,100
2010-2011	318,838	1,280,089	8,100
2011-2012	3,917,925	3,599,087	13,900
2012- 2013	7,912,874	3,994,949	90,000

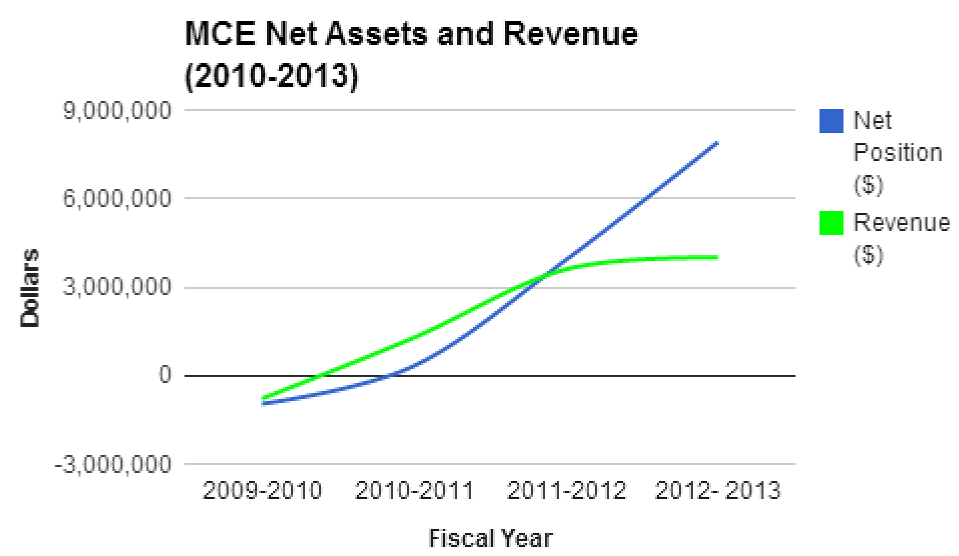


Figure 5.3. A graph of MCE Net Asset and Revenue Increases from 2010 to 2013

Table 5.9. Estimation of CCA Start-up Costs[198]

Cost	Amount
Staffing and Professional Services	$1,125,000
Marketing and Communications	$180,000
Data Management	$150,000
PG&E Service Fees	$40,000
Misc. Administrative and General	$150,000
Financial Security/ Bond Carrying Cost	$3,000

[198] Ibid.

Total	$1,648,000

Staffing of a Joint Community Choice Aggregation Program

A Joint Community Choice Aggregation Program is directed by a governing body which is made up of representative for each of the cities. The governing body essentially sets policy and directs staff to ensure the smooth day-to-day operations of the CCA. Table 5.10 is the staffing plan for MCE.

Table 5.10. Staffing Plan for Marin Clean Energy [199]

Position	Staff (Full Time Equivalents)
Management	
Executive Officer	1
Resource Analyst	1
Data Analyst	1
Administrative Assistant	1
Clerk	1
Sales and Marketing	
Communications Director	1
Account Manager	1
Local Energy Programs	
Energy Efficiency Program Coordinator	1
Legal and Regulatory	
Legal and Regulatory Counsel	1
Regulatory Analyst	1
Total Staffing	**10**

Time Frame for Establishment

The formation of a CCA may take place over several years. However, since the formation of MCE, California's first CCA, the amount of time necessary to establish a fully functional CCA has reduced by more than half. This is evidenced in the cases of SCP and Lancaster Community Choice Aggregation (LCCA). The amount of time taken to form a CCA in each of these cases is compared in Table 5.11.

The concept of a CCA was relatively new in California when Marin County first expressed interest in forming one. Their successful navigation of this formerly uncharted territory has served as an example

[199] (Marin Energy Authority, 2011)

for the formation of subsequent CCAs. One of the most noticeable differences between MCE and SCP is the time between the publishing of a feasibility report and the formation of a JPA. For MCE, this process took over three and a half years. In the case of SCP, however, the JPA was established in just over a year following the feasibility report. A possible explanation for this is that Marin's example eliminated some of the doubt surrounding the risks associated with CCAs and JPAs, making other municipalities less skeptical to join in such an endeavor. Furthermore, comparisons of the total time needed to form CCAs in Marin, Sonoma, and Lancaster show undeniable evidence that practice increases efficiency. While MCE required five years from the time of the finalized feasibility report to the formation of a functional CCA, SCP took less than three. LCCA is anticipated to require even less time and is anticipated to launch in May 2015, just over a year following the feasibility report. From these examples it can be deduced that starting a CCA in the South Bay would not be as time intensive as the creation of other programs in the past.

Table 5.11. Significant dates in the creation of CCAs in Marin, Sonoma, and Lancaster.

	MCE[200]	SCP[201]	LCCA[202]
Feasibility Report	3/2005	10/10/11	1st quarter of 2014
JPA Established	12/19/08	12/4/12	3/8/11
Implementation Plan Created	12/4/09	8/22/13	5/13/14
Implementation Plan Approved by CPUC	2/3/10	10/4/13	6/1/2014 *(expected)*
Service Agreement established with IOU	2/17/10	8/22/13	9/30/2014 *(expected)*
Registration as a CCA Approved by CPUC	4/9/10	1/21/14	N/A
Program Launched	5/7/10	5/14	5/1/2015 *(expected)*

Community Choice Aggregation Program Roll-Out

Upon the enrollment of customers, CCA programs use the phase approach to enroll customers. It enrolls customers gradually in different phases to ensure operations run smoothly in order to identify issues on a smaller scale to prevent future occurrences. An issue of phasing may include losing the production of renewable energy from one of the contracted energy producers. However, with fewer customers initially enrolled there is more room to make mistakes without jeopardizing the provision of energy for customers. Additionally, phasing produces an advocacy base in enrolled customers that will increase public engagement and awareness. Specifically, it can restore confidence in residents and business owners that CCAs do have smooth management operations and that they can provide reliable and affordable renewable energy.

Phasing allows a CCA to be more cost efficient by initiating phasing with municipal and commercial

[200] Ibid.

[201] (Sonoma Clean Power, 2014)

[202] (City Council of Lancaster, 2014)

organizations that have a larger and more predictable load. The cost efficiency characteristics will allow the CCA to easily estimate larger electricity loads which will allow the CCA to recover a larger portion of costs than if they were to begin servicing residents with smaller loads.

The first and smallest stage of phasing begins with the enrollment of municipal and commercial accounts. In the second phase, additional customers are enrolled, and in the third phase, the remaining customers are enrolled in the CCA.

Table 5.12. Marin Clean Energy Power Phases[203]

Phase	Number of Accounts
Phase 1: 2010	8,000 municipal and commercial accounts
Phase 2 A&B: 2011&2012	89,000 commercial and residential accounts
Phase 3: 2013-2014	All remaining customers and Richmond*

*The City of Richmond was added to MCE in this year

Table 5.13. Sonoma Clean Power Phases[204]

Phase	Number of Accounts
Phase 1: 2014	20,000 municipal and commercial accounts
Phase 2: 2015	60,000 commercial and residential accounts
Phase 3: 2016	All remaining accounts

Table 5.14. Lancaster Community Choice Aggregation Proposed Phases[205]

Phase	Number of Accounts
Phase 1: May 2015	640 municipal accounts
Phase 2: November 2015	4,800 commercial accounts
Phase 3: February and/or November 2016	37,500 residential accounts

Investor Owned Utility Opposition to Community Choice Aggregation

IOUs may view CCAs as a threat as it introduces competition to what largely has been a natural monopoly. Any attempt to form a new CCA or join an existing CCA may face resistance from existing

[203] (Marin Energy Authority, 2012b)

[204] (Sonoma Clean Power, 2013)

[205] (City Council of Lancaster, 2014)

IOUs due to the loss of customers. The legislation that established a pathway for CCA formation in California, AB 117, requires that: "all electrical corporations shall cooperate fully with any community choice aggregators that investigate, pursue, or implement community choice aggregation programs."[206] Due to AB 117, IOUs are legally bound to cooperate with the implementation and the operation of a CCA despite its opposition. However, the CCA-enabling legislation is subject to change.

The San Joaquin Valley Power Authority (SJVPA) was one of the first agencies to officially explore the option of a CCA. In June 2007, SJVPA filed a complaint against PG&E with CPUC alleging that PG&E was actively opposing the creation of a CCA. Before this complaint, there were no other signs that an IOU would oppose the formation of a CCA. In March 2009, SJVPA raised concerns with CPUC staff regarding PG&E actively attempting to convince customers to opt out of CCA service even though SJVPA had not informed customers that CCA service was beginning.[207] In June 2009, SJVPA decided to suspend their efforts to establish a CCA program and "along with the tight credit market, the volatility in energy prices and the uncertainty with California's energy regulations, SJVPA cited strong opposition from PG&E as one of the factors leading to its decision to suspend the program."[208]

In the case of MCE, PG&E actively tried to convince customers in Marin that a CCA was not an option worth pursuing. According to the CPUC, PG&E has been cited for many violations of the rules and regulations governing IOU activities surrounding CCA formation. These violations include soliciting customers via telephone calls to opt out of the program and sending letters to residents that had received an opt-out notice in order to encourage customers to do so.[209]

According to PG&E, customer rates pay for normal utility functions, while some spending, known as "below the line" spending, is paid by shareholders. This spending is classified but may include "political activities and contributions, charitable contributions, brand image advertising"[210] Many of these funds might have gone towards anti-CCA campaigns. However, without a formal audit, the validity of the complaints that the CPUC received cannot be verified. The table below depicts PG&E's CCA related shareholder spending in three areas it serves at the time of considering or starting a CCA.

Table 5.15. January 2007- August 2011 PG&E Shareholder Spending Related to CCA[211]

	Shareholder Spending
SJVPA	$3,954,501
Marin County/MCE	$4,226,703
San Francisco CCA	$1,631,080

206 (California State Legislature, 2002)

207 (California Public Utilities Commission, 2011a)

208 Ibid.

209 (California Public Utilities Commission, 2010b)

210 (California Public Utilities Commission, 2011b)

211 (California Public Utilities Commission, 2011b)

PG&E was the main proponent in favor of 2010 California Proposition 16, which if passed would have created additional barriers on the creation of a CCA program. According to the official campaign finance disclosures, PG&E provided $46.4 million of the $46.5 million in contributions to the campaign.[212] The details of Proposition 16 are discussed in a later section.

Risks of forming a Community Choice Aggregation Program

Many of the risks related to CCA programs are associated with costs due to unanticipated events. These events include increasing costs of a CCA, a change in the CRS and the implementation of AB 2145. AB 2145 will be discussed in a later section. Most importantly financing remains a crucial impediment. One senior staffer with MCE commented on recommendations and feasibility of a CCA by saying, "There are three legs to the CCA stool, political, technical, and financial. And the greatest of these three is financial."[213] This is because CCAs do not begin generating ratepayer funds until power contracts have been approved and customers have been transferred from the incumbent utility.[214] And once transferred, the CCA must be able to keep customers satisfied. If rates of energy imposed by the CCA are intolerably greater than those from the IOU, customers may become dissatisfied and return to the IOU. CCA's are not for profit entities and do not have an excess pool of capital by which to sacrifice in the event that customer acquisition is unsuccessful.

Dalessi Management Consulting, the consulting group which created the feasibility report for Sonoma County reports that "over the 20-year study period, consumers would pay between 3% and 8% more than PG&E rates."[215] Dalessi also stated that "projected rates will be slightly higher than PG&E's to begin, then trended down below PG&E's rates over time."[216] As initial rates may be at a premium, customers might logically return to the IOU for lower pricing. For this reason it is especially important to emphasize that customers enrolled with the CCA would be receiving a higher grade of energy from renewable sources and would be contributing to local community government, as opposed to private management. Another reason why rates may rise would be due to CRS fluctuations in accordance with the market price which will be explained further in the chapter.

Additionally, the passing of AB 2145 poses a great risk to CCAs due to its opt-in clause which may significantly decrease program participation. If a CCA fails to secure enough customers they will potentially lose bargaining power when securing contracts. The large magnitude of lost customers can potentially dissolve a CCA by resulting in a CCA that fails to generate enough revenue to pay for its costs.

Dalessi Management Consulting reports that CCAs are subject to additional risks such as:

- "A CCA could over-rely on long-term contracts with fixed prices, potentially

---

212 (California Secretary of State)

213 (Marshall, 2010)

214 Ibid

215 Ibid

216 (Sonoma County Water Agency, 2011)

resulting in a high-cost portfolio at a time when market prices are falling.[217]

- "A CCA's energy suppliers could default on supply contracts (credit risk) at times when energy spot markets are high, forcing the CCA to purchase energy at relatively high prices"[218]

- "Customers could fail to pay the CCA's charges, and the CCA's credit policies and customer deposits may be insufficient to recover the uncollectible bills"[219]

- "The IOU could make changes to rates that reduce the cost of generation and increase the costs of delivery services or that shift costs among customer classes in a manner that disadvantages the customer mix served by a CCA"[220]

Customer-Related Issues

When a CCA is established in a community, all customers are enrolled in the CCA unless they choose to opt-out. Customers may not notice any direct effects due to the establishment of a CCA because the changes are mostly internal. Customers will still continue to pay their bills to the IOU as billing will continue to be handled by the IOU, but the generation service rates will be determined by the City of Hermosa Beach. Table 5.16 is SCE's CCA handbook that explains the responsibilities of the CCA and the IOU. Figure 5.4 is a sample CCA bill from PG&E.

Table 5.16. SCE CCA Handbook[221]

A CCA will be responsible for:	SCE will be specifically be responsible for calculating:
Energy Generation Charges	Cost Responsibility Surcharge
City Tax	CCA Service Fee
State Tax	Transmission
	Distribution
	Existing Miscellaneous Fees

217 Ibid

218 Ibid.

219 Ibid.

220 Ibid.

221 Ibid

Pacific Gas and Electric Company® WE DELIVER ENERGY®

MARY GREEN
123 STREET AVENUE
SAN RAFAEL CA 94901

ELECTRIC ACCOUNT DETAIL

Serivce ID #: 1234567890
Rate Schedule: E-1
Billing Days: 32 days

Serial	Rotating Outage Bulk	Meter #	Prior Meter Read	Current Meter Read	Difference	Meter Constant	Usage
0	0	0	0	0	0	1	540 Kwh

Charges

08/02/2012 - 09/02/2012			
Electric Charges		$44.68	
Baseline Quanity	330.00000 Kwh		
Baseline Usage	330.00000 Kwh		
101-130% of Baseline	99.000000 Kwh		
131-200% of Baseline	111.00000 Kwh		
CRS		10.67	
Franchise Fee Surcharge		.26	
Net Charges			$55.60

The net charges shown above include the following component(s).
Please see definitions on Page 2 of the bill.

Transmission	$7.54
Distribution	38.64
Public Purpose Programs	8.67
Nuclear Decommissioning	.30
DWR Bond Charge	2.77
2012 Vintage Power Charge Indifference Adj.	4.54
Ongoing CTC	.63
Energy Cost Recover Amount	2.72
Conservation Incentive Adjustment	10.48 -
Franchise Fee Surcharge	.26

TOTAL CHARGES **$55.60**

Pacific Gas and Electric Company® WE DELIVER ENERGY®

THIRD PARTY ENERGY CHARGES FOR:

MARY GREEN
123 STREET AVENUE
SAN RAFAEL CA 94901

THIRD PARTY ELECTRIC DETAIL

Serivce ID #: 1122334890
ESP Customer Number: 1123457980
Billing Days: 30 days

Prior Meter Read	Current Meter Read	Difference	Meter Constant	Usage
0	0	0	1	540 Kwh

Charges

Rate Schedule: RES-1
08/02/2012 - 09/02/2012

GENERATION - TOTAL	540.00000 Kwh	@ $0.069	37.26	
Net Charges				$37.26

MCE's charges for clean, renewable energy replace PGE's electric generation charges. PG&E still charges for delivering electricity. There are no duplicate electric charges. Questions? Call 1-888-632-3674 or visit marincleanenergy.com.

Taxes and Other

Energy Surcharge	$0.16
TOTAL CHARGES: Marin Clean Energy	$37.42

Figure 5.4. A Sample CCA Bill from PG&E.[222]

[222] (Marin Clean Energy, b)

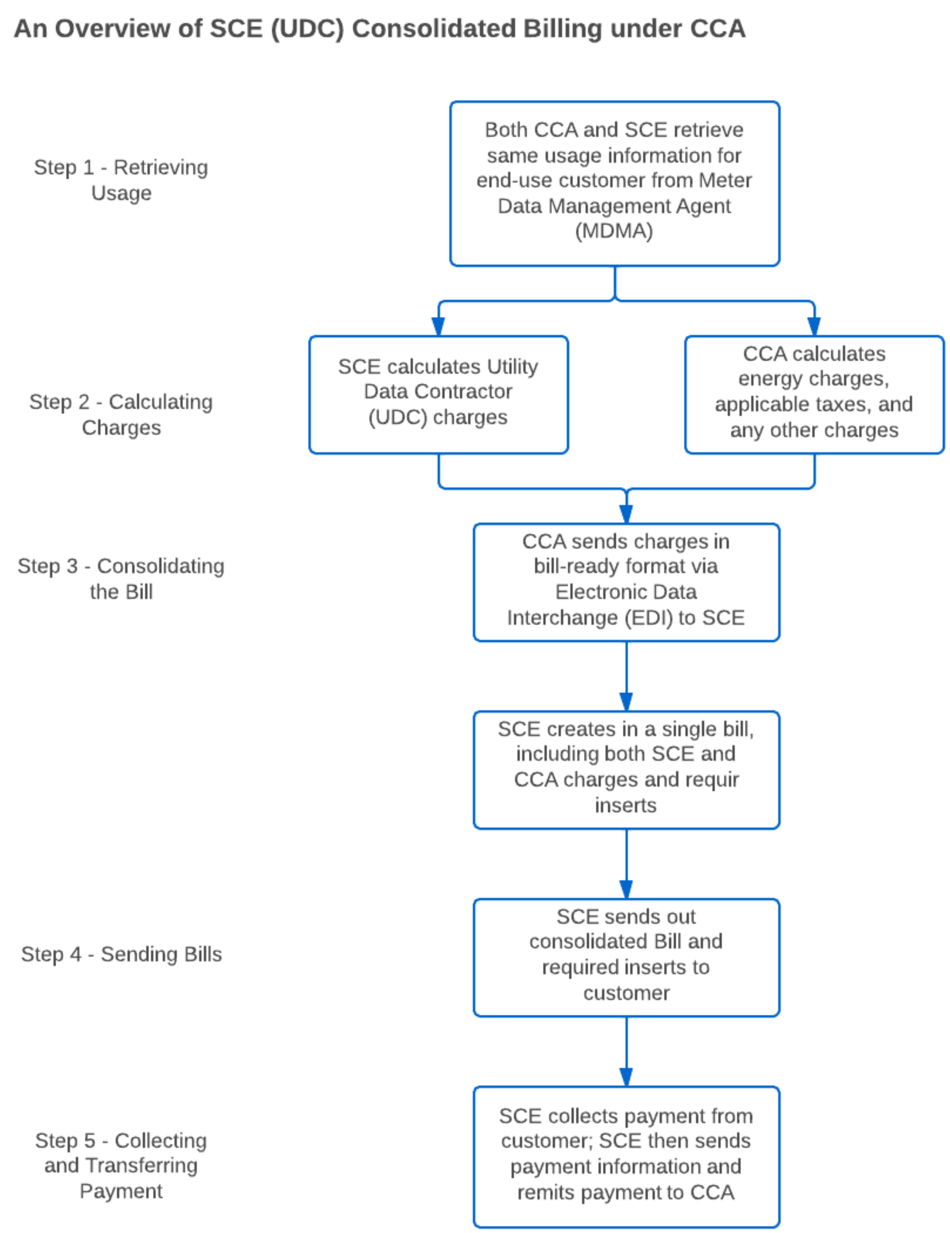


Figure 5.5. An Overview of (UDC) Consolidated Billing under CCA.[223]

[223] Ibid.

The Importance of Public Engagement

Public engagement is crucial for the operation of a CCA as it is established on the basis of community choice. The effectiveness of a CCA increases significantly with a larger customer base, thus this is a pivotal element of a successful program. In order to accomplish this, energy consultants from Navigant Consulting recommend "incorporation of a more comprehensive community engagement and education program to motivate residents and businesses to do their part in addressing climate change."[224] This means that outreach and education will be imperative to evoke participation. Through these programs, the public can learn the details of a CCA, including the process, impacts and benefits. For example, open council meetings offer opportunities for citizens to learn about the operation and establishment of a CCA while also voicing their concerns. These and other similar forums increase transparency and public awareness, allowing for a CCA to truly represent the popular interest. Additionally, the knowledge that individual input can significantly impact a city's policy increases resident involvement and satisfaction. Therefore, when residents pay electricity bills, they feel confident that their money is spent locally in the way that they want.

Customer Options

Once a CCA program is established, each customer has the option to participate or opt out. The two CCAs currently operating in California provide the opportunity for customers to decide between two levels of renewable energy usage. In the case of MCE, customers that do not opt-out of the program start at a base level of 50% renewable energy but have a choice of upgrading to 100% renewable energy usage. SCP customers default to 33% or choose 100%.

Opting Out

Under AB 117, when a CCA program is established in a community, all customers within its jurisdiction are transferred over to service by the CCA unless they opt out. If a customer chooses to opt out, they remain with the existing utility. Each customer must be given two notices of their opportunity to opt out of their community's program before being enrolled and two notices after they are enrolled during the first two billing cycles. If the customer has not opted out after these four notices, no additional notices will be given and they will continue to be enrolled in the CCA.

California law requires that there be no consequences to opting out. However, if a customer does opt out, they cannot return to CCA service until one and a half years have passed. Speaking with MCE account manager Ben Choi, he further explained that if an opt out occurs after the initial sixty days of service, such as 4 months into having service with MCE, then the re-enrollment waiting period would be in effect. If, however, the customer opts out before enrollment in MCE, or within the first couple of months of service, the customer would be eligible to enroll in MCE at any time.[225] The information from Mr. Choi shows that customers that opt out before sixty days of service are able to opt in again before having to wait the full time period. This is important because some residents might later understand the financial and environmental benefits of participating in a CCA and wish to resume enrollment.

---

[224] (The County of Santa Barbara, 2012)

[225] (Choi, 2014b)

Different Renewable Energy Options in the Program

MCE customers have the option to choose between 50% and 100% renewables options, while SCP customers can choose between the 33% and the 100% renewables program. Offering an option with a lower portfolio of renewable resources allows the CCA to remain price competitive with the utility, however it decreases the amount of carbon mitigated by the CCA's service (Refer to Table 5.2 and 5.3 for price comparison). In the case of MCE, enrollment in the Light-Green option is much more significant compared to the Deep Green option, comprising 74.4% versus 1.44% of all ratepayers respectively.[226] This means that most of MCE subscribers are demanding an energy load comprised of only half renewable energy, while the rest is supplied by non-renewable sources with significant emissions factors. Unfortunately, if the City of Hermosa Beach were to offer similar options, a high subscription rate to the less expensive plan is expected, resulting in a smaller reduction of carbon emissions. However, the amount of carbon emissions produced by CCA procurement is still less than created by SCE's general energy mix because overall there is a higher content of renewable resources being provided. Nevertheless, the impact of CCA formation is still decreased because less carbon is mitigated through enrollment of a partial renewables plan as opposed to a completely renewable energy load.

Table 5.17. Emissions Abated When Switching to a CCA

Program	Demand	Emissions (MT of CO2)	Total Emissions (MT of CO2)
SCE	Non-renewables 62.4 GWh Renewables 15.6 GWh	Non-renewables 15,210 MT Renewables 0 MT	15,210 MT
CCA*	Opt-Out 19.97 GWh Light Green (50%) 56.91 GWh Deep Green (100%) 1.12 GWh	Opt-Out 5,338 MT Light Green (50%) 3,894 MT Deep Green (100%) 0 MT	9,232 MT
Difference (Abatement)			**5,978 MT Abated**

*We assumed MCE's enrollment rates, fuel mix, and light/dark green options.

Additional Requirements for Community Choice Aggregation Programs

If a CCA customer is involuntarily returned to the service of an IOU then all re-entry fees are the obligation of the CCA. One of the requirements for starting a CCA is that it must demonstrate sufficient

[226] (Marine Clean Energy, 2013)

insurance to cover these fees. The CPUC is responsible for determining the methodology by which re-entry fees will be calculated. The CCA must also be able to demonstrate that it has sufficient electrical generating capacity to meet the projected peak demand plus a 15% reserve.

Cost Responsibility Surcharge

In order for the IOU to service its existing customers without increasing rates, the IOU will charge a CRS to customers who join a CCA. The CRS will vary every year making it inversely related to the market price of electricity. For example, if the market price of electricity falls, the CRS will increase and vice versa. In order for a CCA to offer prices that are competitive with the IOU, the CCA would have to procure power below market prices. The initial CRS will be set at 2.0 cents per kWh which is "subject to true up to 18 months or sooner if the utilities forecast is 30% higher or lower than the amount."[227] Thereafter, the CRS will forecast and be tried on annual basis after 18 months by the CPUC. The CRS is determined by the CPUC and it consists of:

- Department of Water Resources Bond Charge:
    - Used to recover the interest and principal of DWR bonds
- Competition Transition Charge
    - Recovers the above market costs of utility generation
- Power Charge Indifference Adjustment
    - It is either a charge or credit designed to maintain bundled customer indifference associated with other customers departing bundled utility service.

Laws Relating to Community Choice Aggregation

2010 Proposition 16

In June 2010, Proposition 16 was placed on the ballot in the California state election. If put into effect Proposition 16 would have changed the law by requiring a two-thirds majority of local voters, instead of city council vote, to vote in favor of changing the community energy provider. In effect this regulation would have restricted the development of CCAs by requiring this two-thirds majority vote in a municipality to approve any new CCA.

Table 5.18. Comparison of Proposition 16 Changes to Current Law for CCAs[228]

Action	Current Law	Proposition 16
Establishing a CCA	Public hearings and approval by the affected local governments	Public hearings, approval by the affected local governments, and ⅔ voter approval
Providing electricity service within the CCA's territory	Board approval; each customer may opt out	Board approval and ⅔ voter approval; each customer may opt out

[227] (Local Government Commision et al. 2009)

[228] (Moren, Weissman, 2010)

Expanding the CCA's territory to a new city	Board approval, public hearings in city, and approval by the city's governing body	Board approval, public hearings in the city, approval by the city's governing body, and ⅔ voter approval (both by the CCA's voters and the city's voters)
Expanding the CCA's territory to an unincorporated territory	Board approval and voter approval according to state annexation laws	Board approval and ⅔ voter approval (both by the CCA's voters and the unincorporated area's voters)
Issuing bonds	board approval and ⅔ voter approval	board approval and ⅔ voter approval

52.8% of voters opposed Proposition 16 and consequently the bill was not passed. This vote is indicative of the support that people in California have for CCAs. In many of the counties that currently have CCA programs, like Marin and Sonoma Counties, voters overwhelmingly opposed the proposition. A noteworthy aspect of the election was that PG&E was one of the heaviest supporters of the proposition, though in most of its service areas people voted no on the proposition (e.g. Sonoma and Marin Counties).[229]

Table 5.19. Proposition 16: Local Electricity Providers Votes Percent[230]

	Yes (Percent)	Yes (Votes)	No (Percent)	No (Votes)
Total	47%	2,526,544	52.80%	2,820,135
LA County	46.80%	443,797	53.20%	503,546
Marin County	37.10%	27,224	62.90%	46,008
Sonoma County	33.00%	39,705	67.00%	80,381

Proposition 23

Proposition 23 was a ballot measure defeated in California in 2010 proposing to suspend AB 32, also referred to as the Global Warming Solutions Act of 2006, and potentially delay the reduction of GHGs indefinitely. By analyzing the results of this ballot measure in cities surrounding the City of Hermosa Beach, it can be determined which municipalities might be interested in decarbonizing its electricity as well. All of the municipalities examined in the South Bay, with the exception of Rolling Hills, opposed Proposition 23 by a majority vote. Due to the significant opposition to Proposition 23, it shows there is a large support for environmental regulations in the areas surrounding the City of Hermosa Beach.

[229] (Baker, 2010)

[230] (California Secretary of State, 2010)

However, if joining a CCA would result in higher utility cost for residents, it is possible that citizens of lower income municipalities might be hesitant to join.

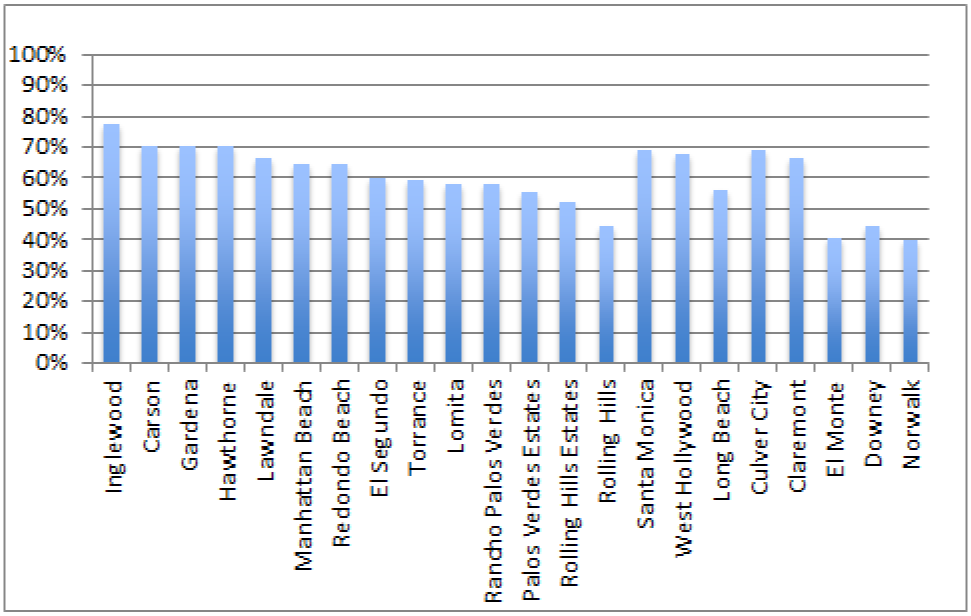


Figure 5.6. This graph shows the percentage of voters who opposed Proposition 23 in cities surrounding the City of Hermosa Beach. Municipalities with higher rates of opposition can be assumed to be more supportive of environmental issues and in favor of reducing carbon emissions.

Assembly Bill 2145

AB 2145 known as "Electricity: community choice aggregation" is an act to amend Section 366.2 of the Public Utilities Code that was added by AB 117. In its current state AB 2145 would fundamentally change laws regarding CCA programs, requiring a customer to opt in to a CCA instead of opting out.[231] This would require each customer to send notice to the CCA of their intent to opt in and could drastically decrease program participation in a CCA. The possibility of a CCA losing customers by the opt-in methodology greatly threatens the CCA's ability to negotiate for competitive rates. If a CCA cannot secure the competitive rates, customers will choose not to enroll in a CCA and this positive feedback system will potentially dissolve a CCA due to the high costs and small customer pool.

Currently AB 2145 is going through the California State Legislature's committees and is subject to change. In order to pass, the bill must receive a majority in the California Assembly and Senate and be signed into law by the Governor. On May 28, 2014 AB 2145 passed the assembly though is subject to change in the Senate. Table 5.19 is a list of registered supporters and opposition to the bill.

[231] (California Legislature, 2014)

Table 5.20. List of registered support and opposition to the bill [232]

Registered Support	Registered Opposition
California Labor Federation	350 San Francisco
Coalition of California Utility Employees (CCUE) (Sponsor)	Alliance for Retail Energy Markets (AReM)
Individual Letters (310)	Asian Pacific Environmental Network (APEN)
Pacific Gas and Electric (PG&E)	Brad Wagenknecht, Napa County Supervisor, District 1
State Building and Trades Council	California Solar Energy Industries Association (CALSEIA)
	California State Association of Counties (CSAC)
	Carbon Free Mountain View
	City of Richmond
	City of San Pablo
	City of Sunnyvale
	Climate Protection Campaign
	Community Environmental Council
	County of Marin
	Enlightenment Energy
	Environmental Health Coalition (EHC)
	Geenlining Institute
	Haight Ashbury Neighborhood Council
	Individual Letters (31)
	League of California Cities
	LEAN Energy US
	Local Clean Energy Alliance of the San Francisco Bay Area
	Los Angeles County Board of Supervisors
	Marin Clean Energy (MCE)

[232]Ibid

	Marin County Board of Supervisors
	Monterey Regional Waste Management District (MRWMD)
	Office of Ratepayer Advocates (ORA)
	Our City San Francisco
	Our Evolution Energy & Engineering
	Pacific Energy Advisors, Inc.
	Public Interest Coalition
	Resilient Neighborhoods
	San Diego Clean Energy
	San Francisco Clean Energy Advocates Alliance
	San Francisco Green Party
	Santa Cruz County Board of Supervisors
	School Project for Utility Rate Reduction (SPURR)
	Shell Energy North America
	Sierra Club California
	Solar Energy Industries Association (SEIA)
	SolEd Benefit Corporation
	Sonoma Clean Power
	Sonoma County Board of Supervisors
	Sonoma County Regional Climate Protection Authority (RCPA)
	Sonoma Water Agency
	Sungevity
	Sustainable Marin
	The Utility Reform Network (TURN)
	Thomas Cromwell, Mayor, City of Belvedere
	Town of Fairfax
	Western Power Trading Forum (WPTF)

Conclusion

CCAs can provide an opportunity for cities, especially the City of Hermosa Beach, to procure carbon neutral electricity. Programs can be designed to meet the needs and desires of specific communities. For the City of Hermosa Beach, this would mean increasing renewable energy resources up to 100%. As CCAs are relatively new to California, it is important to learn from programs that are already in existence. MCE and SCP provide valuable examples in the successful formation and operation of CCA programs. It is advisable that the City of Hermosa Beach join a JPA to alleviate associated risks. Also, as the process of creating a CCA becomes more practiced, the amount of time required to establish a fully functional program is reduced. This means that instituting a CCA for the City of Hermosa Beach should be relatively easy.

Chapter 6: Recommendations

This section presents the following recommendations: implement energy efficiency programs, establish a CCA via a JPA, and improving the electricity grid system. A discussion about the GTSR will also be presented.

Energy Efficiency

Renewable energy resources alone are not enough to supply all electricity if energy use continues following current trends. Energy efficiency and renewable energies must grow together in order to make a significant difference in the carbon emissions associated with electricity generation. If more renewable energy is implemented without increasing efficiency, energy use will still continue to grow. This means that renewable energy use will only prevent a growth in carbon emissions as opposed to enabling energy companies to retire or curtail operations at generation facilities that produce electricity by burning fossil fuels.[233] Additionally, unlike the implementation of renewable energy sources, efficiency improvements usually result in a negative cost to the consumer because initial investments are paid off over time from the reduced electricity costs. Ultimately, decreasing current carbon emissions requires a combination of both renewable electricity generation and energy efficiency efforts.

Electricity efficiency improvements can also become more viable through Property Assessed Clean Energy (PACE) financing programs. PACE provides financing for energy efficiency upgrades and renewable energy installation through property tax assessments. This is usually more manageable than fronting the entire cost. These costs also remain a part of the property taxes if the property is sold, so home and business owners do not have to worry about losing their investment if they move. However, PACE programs have faced a history of opposition from the Federal Housing Finance Agency (FHFA), specifically the mortgage lenders Fannie Mae and Freddie Mac. This is because the liens associated with residential PACE financing take precedence over existing mortgages and in the event that the homeowner defaults, the outstanding PACE assessment is paid off first.[234] For this reason, the FHFA deemed the residential PACE financing programs as a risk to lenders. Fannie Mae and Freddie Mac issued letters to lenders stating that they would not purchase mortgages with outstanding PACE loans, thus a property with a Fannie Mae or Freddie Mac loan could not transfer the PACE assessment to a new owner.[235] These issues still exist, but some programs have continued to operate or create residential PACE programs using individual approaches to the FHFA conflict.[236]

LA PACE is an example of a PACE program available only to commercial buildings, such as offices, hotels, apartment buildings, etc. The City of Hermosa Beach is already eligible for the LA PACE program, so the next step would be encouraging local businesses to invest in these efficiency upgrades. The HERO program is an example of a newly created residential PACE program in California, which jointly finances energy efficiency improvements and renewable energy. This program operates around the FHFA rules by "using affirmative acknowledgements from the first lien holders, conservative underwriting

---

233 (Prindle, Eldridge, Eckhardt, & Frederick, 2007)

234 (Kaatz & Anders, 2013)

235 Ibid.

236 Ibid.

requirements, and/or signed disclosures regarding FHF concerns and risks."[237] The HERO program has been operating successfully in Riverside County since 2011. In June 2013, Orange County entered into a memorandum of understanding with the Western Riverside Council of Governments to facilitate the introduction of the HERO program there as well.[238]

HERO is also poised to become available in Los Angeles County in 2014. Initially, the renovations covered will include insulation, water and electricity efficiency improvements, windows and entry doors, heating, ventilation, air conditioning, HVAC and whole house fans, and photovoltaic solar panels.[239] As a part of Los Angeles County, the City of Hermosa Beach will be eligible to take advantage of the HERO program when it is implemented, which is expected soon. Also, as the program proves to be successful and economically profitable, as it has in Riverside County, it is possible that more energy efficiency improvements and renewable energy sources, such as thermal solar water heating systems, will become available for residents. These programs allow residents to lower their electricity use without being intimidated by a hefty price tag. Through these easily implemented changes, there is potential for great energy saving and even the possibility of a carbon neutral city.

Green Tariff Shared Renewables Program

As it stands, the Green Rate program with SCE could provide an avenue for the City of Hermosa Beach to reach carbon neutral electricity generation. However, due to the price, structure, and the legislation's sunset date this is not the best option for the city.

Price is a primary concern voiced by groups tracking the progression of each utilities' proposals including the Green Rate. The City of San Francisco cites concern over the generalized nature of the cost structure proposed by PG&E and the IREC demands a new rate design on the basis that participants will burden a large cost for benefits ultimately shared with all ratepayers.[240] [241] These critiques, coupled with the fact that an amendment to the Green Rate was already filed by SCE, increases fees, clearly displays the high probability of rate fluctuation.[242] These rate fluctuations put the customers of the City of Hermosa Beach at the mercy of the utility. Furthermore the price proposed by SCE is higher than the other utilities, as seen in Table 6.1. Clearly this premium is significantly larger than other IOU GTSR programs. The relatively large cost premium may dissuade the City of Hermosa Beach from joining the program, especially as prices will fluctuate in the future, minimizing enrollment and thus the amount of energy demanded from renewable sources.[243] For this reason, it is recommended that city seeks an alternative solution.

[237] Ibid.

[238] (Association of California Cities, Orange County, 2013)

[239] (HERO Financing, 2013)

[240] (Herrera, 2014)

[241] (Interstate Renewable Energy Council, 2014)

[242] (Southern California Edison, 2014b)

[243] (Interstate Renewable Energy Council, 2014c)

Table 6.1. Additional Costs of Electricity under a CCA[244] [245]

Utility	Program Name	Additional Cost of Generation (¢/kwh)
National Average	Similar green pricing programs	1.1
California Average	Similar green pricing programs	1.8
San Diego Gas & Electric	SunRate	~2.7
Pacific Gas & Electric	Enhanced Community Renewables Option	~2.7
Southern California Edison	Green Rate	~4.2

To clearly display the increase in premium to a rate-payer bill when switching to the Green Rate, take an average household using 329 kWh over a month period. See the table below for a comparison of this customer's bill on the general SCE service versus the Green Rate for a month period.

Table 6.2. Additional Monthly Costs of a CCA in SCE Territory

Program	Delivery Charges	Generation Charges	Total Charges
General Energy Plan	**Tier 1** 314 kwh x 0.4165 = 13.08 **Tier 2** 15 kwh x 0.7286 = 1.11	314 kwh x 0.8592 = 26.98 15 kwh x 0.8592 = 1.29	
TOTAL			**$42.46**
Green Rate	**Tier 1** 314 kwh x 0.4165 = 13.08 **Tier 2** 15 kwh x 0.7286 = 1.11	314 kwh x .12266 = 38.52 15 kwh x .12266 = 1.84	
TOTAL			**$54.55**

244 (Southern California Edison, 2014b)

245 (San Diego Gas & Electric, 2014)

Though the customer receives service of 100% renewable energy directly from the utility on the Green Rate, they pay a significant premium each month. As shown in other sections of this report, there are ratepayers under CCA jurisdictions paying a much smaller premium, for the same service of renewable energy. Thus, it is recommended that the residents of City of Hermosa Beach pursue the formation of CCA to ensure a lower rate for renewable energy.

Programs for renewable energy will be monitored by the CPUC, however they are ultimately run by the utility. SB 43 stipulates that each supervising utility procure renewable energy from local sources.[246] However the proximity from the source of generation to the customer is not defined by the legislation, therefore leaving it up to the utilities' discretion. Surely this is an effort by legislators to make GTSR programs both economically and technically feasible for each utility, but it also concerns stakeholders. This could be an avenue for IOU's to seek distant renewable sources rather than investing in local generation. According to SCE's proposal, the utility plans to use its current renewable energy resources that are in excess to RPS goals to fill Green Rate subscriptions.[247] IREC points out that this does not serve the mission of SB 43 because it does not create new resources for generation, unlike SDG&E's and PG&E's procurement plan.[248] This is just a singular example of how SCE's control of the program could lessen the benefit of Green Rate subscriptions. In this situation, SCE also falls short of the other utilities again, displaying their resistance to these legislative changes. Their behavior should be accounted for as ratepayers within the limits of the City of Hermosa Beach will be subject to SCE's business preferences. Considering the City of Hermosa Beach is opting to institute renewable energy as part of a larger sustainable mission, their choices could affect greater impact if made autonomously.

Lastly, SB 43 provides support for GTSR programs until January 1, 2019.[249] Without continued support from the legislation it is unclear what will happen to established GTSR programs. The overall goal is to expand the supply of renewable resources for the future, however SB 43 runs out just before RPS goals in 2020.[250] Any number of possibilities arises from after this deadline. For example, utilities could cease to offer their respective GTSR programs and reallocate these renewable resources to reach their RPS goal the next year. The fate of GTSR programs, including the Green Rate is unclear after SB 43's deadline. An option with greater longevity would better serve the City of Hermosa Beach.

Community Choice Aggregation via a Joint Powers Authority

The analysis of CCAs shows that pursuing this option is the most feasible method of delivering zero emission energy to the City of Hermosa Beach at a cost competitive with existing electricity rates. Furthermore the possibility of forming a JPA with other cities to minimize costs and risks borne by the City of Hermosa Beach makes the option more economically viable.

---

[246] (California State Legislature, 2013)

[247] (Southern California Edison, 2014a)

[248] (Interstate Renewable Energy Council, 2014b)

[249] (California State Legislature, 2013)

[250] Ibid.

A CCA grants a local authority decision-making powers over energy procurement. Under the existing utility model, SCE makes such procurement decisions. But under a CCA, control is given to the city, or cities in a JPA situation. Thus, the City of Hermosa Beach does not have to be under the scrutiny of SCE and can be more proactive in their decision making, potentially electing to only utilize carbon neutral electricity. For example, customers under SCE's current tiered rate system are subject to the fuel mix and costs that the utility offers. This is controlled by state legislation, the RPS, and CPUC regulation. However, a CCA can form contracts with IPPs that specify the sources of energy that should be utilized and the price the CCA is willing to pay. Thus the City of Hermosa Beach has more autonomy through formation of a CCA.

Moreover, the Marin and Sonoma County CCAs have shown that delivering clean energy can be competitively priced compared to the conventional utility rate. In order to reduce the price premium of zero-GHG electricity, the City of Hermosa Beach should follow Marin and Sonoma's footsteps and establish a JPA. The formation of a JPA with the City of Hermosa Beach and other cities interested in pursuing zero-GHG electricity would increase the CCA's aggregate electricity demand. This will in turn give the CCA increased bargaining power and induce negotiations with a larger selection of potential IPPs to conjure power at competitive rates. Furthermore, the initial costs for the startup of a CCA will be divided among the cities involved; thus fixed costs such as staffing, promotion, and service fees will be partitioned accordingly. The formation of a CCA via a JPA may be the most cost-effective method of delivering carbon neutral energy to the City of Hermosa Beach because the fixed costs will be divided among the cities involved and the generation costs, which are variable, will be negotiated with increased bargaining power.

Potential disadvantages in forming a CCA include excessive surcharges, customers opting out of the program, and the potential for the relatively small City of Hermosa Beach to have their priorities diluted in a larger JPA. Existing JPAs are structured to give more votes and board members to the cities that have the largest energy demand. Thus if the City of Hermosa Beach is on the smaller scale of electricity consumption, their influence over decisions within the JPA will be reduced.

Moreover, customers are legally allowed to opt-out of the CCA. If the CCA's rates are high compared to SCE's rates, they may choose to do so. In this case, the City of Hermosa Beach's goal of having 100% carbon neutral electricity will be difficult. Thus, the City of Hermosa Beach should follow the examples of Marin and Sonoma, offering two rate options: a cost-competitive "light green" option in addition to a 100% renewable option. The City of Hermosa Beach, or the JPA it joins, can increase the percentage of renewables in the cost-competitive option over time, as Marin has done. In this way, the CCA can move customers toward a higher concentration of renewable energy.

Despite these drawbacks of a CCA, we still recommend that the City of Hermosa Beach create a JPA. To mitigate the risk that competing priorities in a JPA would jeopardize the city's long-term goal of carbon neutral electricity, the JPA and CCA charter could include certain provisions. For example, a provision requiring a 100% renewable option and that the JPA continually increase the percentage of renewables in the cost-competitive rate option, would ensure the City of Hermosa's priorities are continually advanced.

The current regulation guiding CCA formation is far more attractive to establishing a viable electricity decarbonization pathway than the procedures for individual customers to join the GTSR program. The CCA option allows customers to opt-out of a CCA, while SCE's Green Rate will require customers to opt-in. The percentage of customers who explicitly opt-out is far less than those expected to opt-in to the Green Rate. MCE currently has an opt-out rate of 23.6%.[251] Thus 76.4% of the residents will be served by the CCA and will be provided with renewable energy, which is much greater participation in comparison with enrollment rates of opt in programs. Despite not having full participation, this formality of a CCA induces more participation than SCE's Green Rate, an opt-in program which is projected to have an enrollment rate of 0.5%.[252] This lack of participation stems from the fact that asking customers to actively reach out, making a choice different from the status quo, creates a barrier to enrollment in the program. This comes from the unwillingness of the customer to take the time and effort to switch from the default service. The Green Rate's projected participation rate of 0.5% will not allow the City of Hermosa Beach to make meaningful progress toward its goal of 100% carbon neutral electricity.

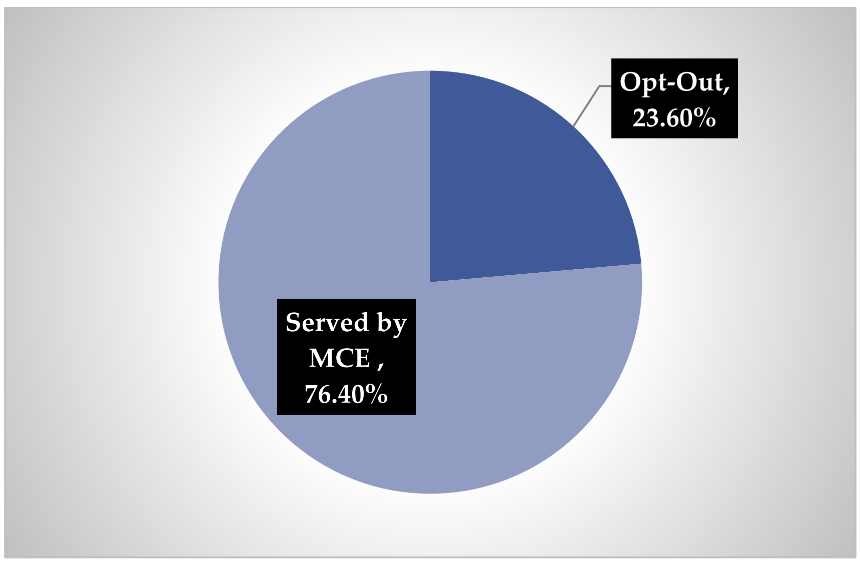


Figure 6.1. Marin Clean Energy's Opt-out Percentage[253]

[251] (Choi, 2014)

[252] (Shigekawa & Karlstad, 2014a)

[253] (Choi, 2014)

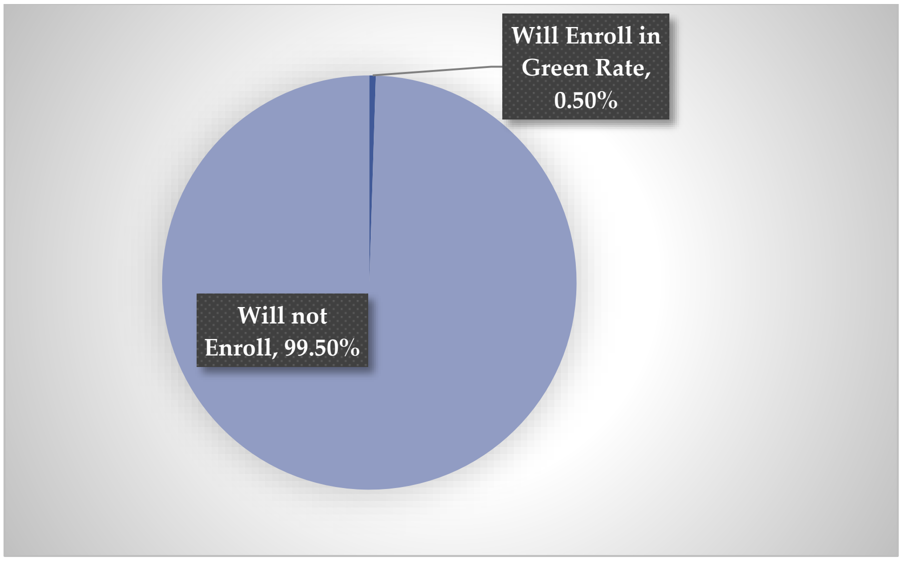


Figure 6.2. Southern California Edison's Projected Enrollment Rate for the Green Rate Program[254]

A bill currently before the California State Legislature, AB 2145, would significantly change the regulation governing CCA program establishment. If passed and signed in its current form, AB 2145 would require all future CCAs to become opt-in programs. This would decrease CCA program participation rates, perhaps to levels similar to that projected for the GTSR program. CCAs would aggregate less electricity demand because they would have less bargaining power when negotiating contracts. This would all-but-eliminate the ability of CCAs to provide cost-competitive rates with higher renewable content as compared to the utility. The City of Hermosa Beach should consider formally opposing AB 2145 in order to preserve their options to decarbonize the city's electricity in pursuit of aggressive GHG emissions reductions. AB 2145 passed the Assembly in late May. It still must be approved by the Senate and signed into law by the governor in order to take effect. The bill will apply to any customer not enrolled in a CPUC-approved CCA by January 1, 2015. Given the time needed to establish a CCA and roll-out to customers, it will be extremely difficult for Hermosa Beach to establish or join a CCA so that customers can default into an opt in program.

The City of Hermosa Beach can further investigate the feasibility of a CCA by analyzing the City of Lancaster's progress toward creation of a CCA. The City of Lancaster is similarly in SCE's service territory. Thus the City of Hermosa Beach can monitor the proceedings in Lancaster. Lancaster's experience as the first CCA in SCE territory will reduce some costs and risks to Hermosa Beach, should Hermosa Beach decide to create a separate CCA in Lancaster's footsteps.

Perhaps a more attractive option for the City of Hermosa Beach is to join Lancaster as CCA pioneers in SCE territory. Lancaster, as of 2011, created a JPA titled the Lancaster Power Authority (LPA). Through the LPA, Lancaster seeks to establish a CCA. Currently, Lancaster has sent a Statement of Intent to the CPUC and is awaiting correspondence. Approval from the CPUC would allow Lancaster to move

[254] (Shigekawa & Karlstad, 2014a)

forward and begin enrolling customers as soon as May 2015. All this would be beneficial to the City of Hermosa Beach because the City of Lancaster could serve as an example or partner in renewable energy procurement. Lancaster is located in the Mojave Desert, near the Tehachapi Pass - two of the best areas for renewable generation in the state. This abundance of opportunity to build renewable energy infrastructure could work to power the energy needs of the larger Southern California area.

However, Hermosa Beach may sacrifice some local control by joining a non-adjacent CCA, such as Lancaster. A multi-city CCA is governed by a JPA that must have public meetings. If these meetings are geographically remote to Hermosa Beach, public participation in the oversight process may be hindered.

Furthermore, contiguous cities are more likely to have similar interests, problems, and future goals, whereas cities that are farther away may have different goals. Thus a non-contiguous CCA, such as the City of Lancaster's, may not be as beneficial to the City of Hermosa Beach as a contiguous CCA in the South Bay.

Possible Candidates for a Local JPA

If the City of Hermosa Beach created a JPA, the most likely candidates to join would be other cities in the South Bay area of Los Angeles County. Depicted in the map and charts below are possible candidates to include in a JPA.

The chart contains important information for considering the formation of a JPA. It includes information on the commercial and residential energy demand, the total demand, and the monthly usage of electricity per household is included. The viability of each city's participation in a CCA is also assessed on the table with the percentage of citizens in each city who voted against California's Proposition 16 and 23 from 2010.

Proposition 16 would have imposed a "new two-thirds voter approval requirement for local public electricity providers."[255] If it would have passed, Proposition 16 would have made it very difficult to start a CCA in California. In effect the percentage of votes against Proposition 16 hints at the chances of starting a public utility or CCA program in a city.

Proposition 23 would have suspended Air Pollution Control Law AB 32 which required major sources of emissions to report and reduce GHG emissions that cause global warming. By the percentage that a city voted against this proposition we can infer a city's commitment to climate change mitigation policy and thus their propensity for joining a CCA in the future.

[255] (California Secretary of State, 2010)

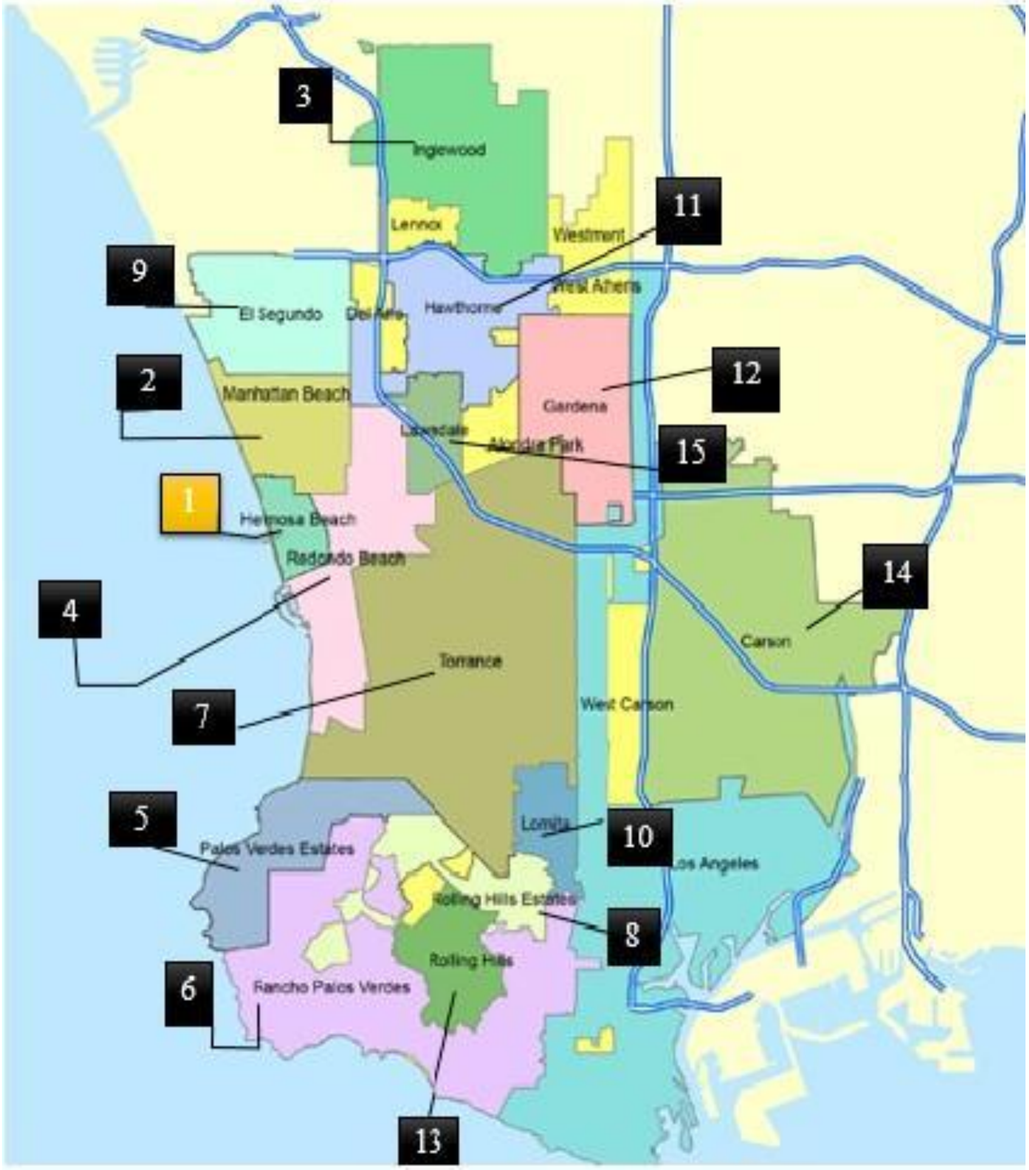


Figure 6.3. Map of the South Bay Cities[256]

[256] (South Bay Cities, 2014)

Table 6.3. Potential JPA candidates in the South Bay. [257]

#	City	Residential Electricity (kWh)	Commercial / Industrial Electricity (kWh)	Total Consumption (kWh)	Monthly kWh per Occupied Household	% No on 16	% No on 23
1	Hermosa Beach	41,007,643	36,967,197	77,974,840	364	0.6233	0.6704
2	Manhattan Beach	91,548,042	24,308	91,572,350	541.5	0.6172	0.6403
3	Inglewood	142,303,056	234,394,496	376,697,552	325.1	0.5878	0.7726
4	Redondo Beach	127,946,783	73,774,968	201,721,751	373.6	0.576	0.6392
5	Palos Verdes Estates	37,665,360	25,109,166	62,774,526	638.5	0.5592	0.5533
6	Rancho Palos Verdes	114,945,124	52,607,910	167,553,034	636.7	0.5559	0.5804
7	Torrance	242,404,763	703,728,574	946,133,337	376.5	0.5274	0.588
8	Rolling Hills Estates	28,960,929	18,868,387	47,829,316	824.8	0.5207	0.517
9	El Segundo	31,830,933	4,237,140	36,068,073	364.3	0.52	0.599
10	Lomita	31,616,132	28,848,747	60,464,879	338.2	0.4855	0.578
11	Hawthorne	96,819,255	218,952,705	315,771,960	283.4	0.4833	0.696
12	Gardena	66,598,997	207,049,798	273,648,795	263.7	0.4805	0.702
13	Rolling Hills	24,696,938	16,112,129	40,809,067	3385	0.4793	0.439
14	Carson	155,513,973	301,856,331	457,370,304	520.4	0.4651	0.7037
15	Lawndale	28,445,764	31,583,974	60,029,738	240.9	0.4224	0.6623

Within the South Bay, five cities stand out as the most likely to join a CCA. These cities include citizens who voted against Proposition 16 and 23 by a wider margin and combined would have a large enough electric load to create an effective CCA. Below is a projection of how the estimated $1.7 million in start-up costs could be spread among the communities in accordance to their electricity consumption and how much the City of Hermosa Beach would have to pay in this scenario.

[257] (Los Angeles Registrar, 2010)

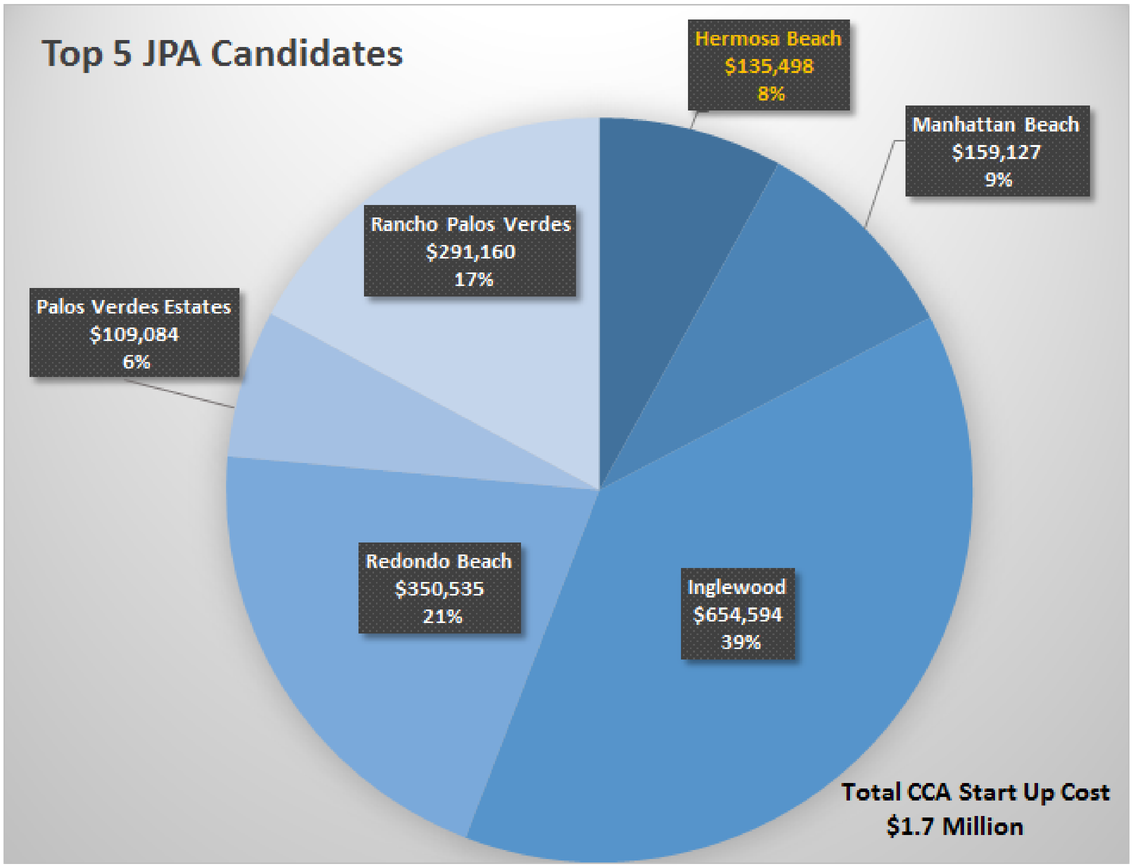


Figure 6.4. Pie Chart of CCA Start-Up Cost Split Amongst 5 Cities According to their Consumption[258]

Table 6.4. Table of CCA Start-Up Cost Split amongst 5 Cities According to their Consumption

City	Total Consumption	% of Total Consumption[259]	CCA Startup Cost Split Amongst 5 Cities[260]
City of Hermosa Beach	77,974,840	8.00%	$135,498.35
Manhattan Beach	91,572,350	9.40%	$159,127.00
Inglewood	376,697,552	38.50%	$654,594.43
Redondo Beach	201,721,751	20.60%	$350,535.69
Palos Verdes Estates	62,774,526	6.40%	$109,084.48
Rancho Palos Verdes	167,553,034	17.10%	$291,160.06

[258] (Sonoma Clean Power, 2011)

[259] Ibid.

[260] (ICF International, 2012)

A JPA for a CCA does not need to be contiguous and cities who are not connected to the City of Hermosa Beach geographically can be a part of a CCA. In addition to the CCA options in the South Bay, there are other cities that Hermosa Beach could look to in forming a JPA. Though creating a non-contiguous CCA may not be as beneficial, the possibility of their inclusion should not be dismissed. The cities below have either been proven to be environmentally progressive or have populations over 100,000 making them candidates in the forming of a CCA in the Greater Los Angeles area.

Table 6.5. Table of Non-South Bay Cities Consumption Values and their Voting Percentages on Prop 16 and 23.[261]

Non-South Bay City	Residential Electricity (kWh)	Commercial/ Industrial Electricity (kWh)	Total Consumption (kWh)[262]	Monthly kWh per Occupied Household	% No on 16	% No on 23
City of Hermosa Beach	41,007,643	36,967,197	77,974,840	364	62.33%	67.00%
Santa Monica	162,016,611	611,024,003	773,040,614	290.1	69.10%	79.90%
West Hollywood	18,566,109	56,491,373	75,057,482	67.8	67.81%	82.80%
Long Beach	638,254,139	378,349,425	1,016,603,564	328.5	55.60%	65.10%
Culver City	49,619,296	97,352,937	146,972,233	245.1	68.58%	77.70%
Claremont	77,457,398	2,308,840	79,766,238	577.7	66.22%	68.10%
El Monte	104,567,170	271,167,977	375,735,147	315.8	40.51%	50.50%
Downey	163,817,050	368,113,838	531,930,888	408.8	44.18%	63.50%
Norwalk	129,525,144	203,595,957	333,121,101	389.6	39.90%	64.30%

Ultimately, the process to achieve carbon neutrality will take time and should not be rushed. In order to establish an effective CCA, the City of Hermosa Beach should invest adequate time and money to form a strong JPA and for a private company to produce a feasibility report. The creation of a CCA will take place over a period of years, but, as shown in Chapter 5, it will likely not take as long as previous programs in Marin and Sonoma. With the formation of each subsequent CCA in California, the amount of time required for establishment has reduced. This is shown in Table 6.4 below.

[261] (Los Angeles Registrar, 2010).

[262] Ibid.

Table 6.5. Significant dates in the creation of CCAs in Marin, Sonoma, and Lancaster.

	MCE[263]	SCP[264]	LCCA[265]
Feasibility Report	3/2005	10/10/11	1st quarter of 2014
JPA Established	12/19/08	12/4/12	3/8/11
Implementation Plan Created	12/4/09	8/22/13	5/13/14
Implementation Plan Approved by CPUC	2/3/10	10/4/13	6/1/2014 *(expected)*
Service Agreement established with IOU	2/17/10	8/22/13	9/30/2014 *(expected)*
Registration as a CCA Approved by CPUC	4/9/10	1/21/14	N/A
Program Launched	5/7/10	5/14	5/1/2015 *(expected)*

A Pathway to Future Grid Improvements

The current electricity grid system is not well suited for high levels of distributed generation penetration. Various grid upgrades are required to allow the City of Hermosa Beach to efficiently and reliably utilize the locally available renewable energy sources. Once adequate grid upgrades are made, such as improving infrastructure to support bidirectional power and installing energy storage units, the city could take greater advantage of its estimated 76.2 GWh solar potential.[266]

Currently SCE owns the transmissions infrastructure and facilities that operate in the City of Hermosa Beach. It is unlikely that SCE will institute the necessary grid upgrades in the near future due to economic restrictions. However the residents of the City of Hermosa Beach could vote to establish a municipal utility district (MUD), allowing the city jurisdiction over providing electricity to the district residents. Once a MUD is formed, it can negotiate the purchase of SCE's existing grid infrastructure in the city and make necessary upgrades to the system to allow for the integration of distributed generation sources.

The Municipal Utility District Act was passed by the California State Legislature in 1921, within the California Public Utilities Code. It authorized the formation and governance of a MUD. A MUD is a special-purpose district that provides public utilities to district residents. Local residents can vote to establish a MUD, after which they will be represented by a board of directors.

Sacramento County and Lassen County have each created MUDs. In 1923, citizens of Sacramento voted to create Sacramento Municipal Utility District (SMUD) as a community-owned electric service provider.

---

263 (Marin Energy Authority, 2011)

264 (Sonoma Clean Power, 2014)

265 (City Council of Lancaster, 2014)

266 (DeShazo, J,R,, Matulka, R., Wong, N., 2011)

However, the years following the creation of SMUD were filled with engineering studies, political battles, elections and court filings.[267] In March 1946, the California Supreme Court denied PG&E's final petition to halt the annexation and PG&E finally sold its distribution system at a price fixed by the Railroad Commission.[268] SMUD is a public agency of the State of California, and therefore is not subject to the FERC's jurisdiction under the Federal Power Act.[269] In the 1980s, residents of Folsom voted to join SMUD. Despite efforts from PG&E to halt Folsom from joining, Folsom residents are now served by SMUD. In 2006, PG&E successfully convinced SMUD and Yolo County ratepayers to vote down a proposal that would have expanded SMUD's service territory to include the cities of West Sacramento, Davis, Woodland and all the areas in between.

SMUD serves 604,053 meters over a service territory of 900 square miles.[270] Figure 6.3 is a map of SMUD's service territory. SMUD has 2,007 employees and owns 10,257 miles of power lines.[271] It is the sixth largest customer-owned electric utility in the nation.[272] Figure 6.4 is SMUD's 2013 projected power content label.

[267] (Sacramento Municipal Utility District, 2014b)

[268] Ibid.

[269] (Cornell University Law School)

[270] (Sacramento Municipal Utility District, 2014b)

[271] Ibid.

[272] Ibid.

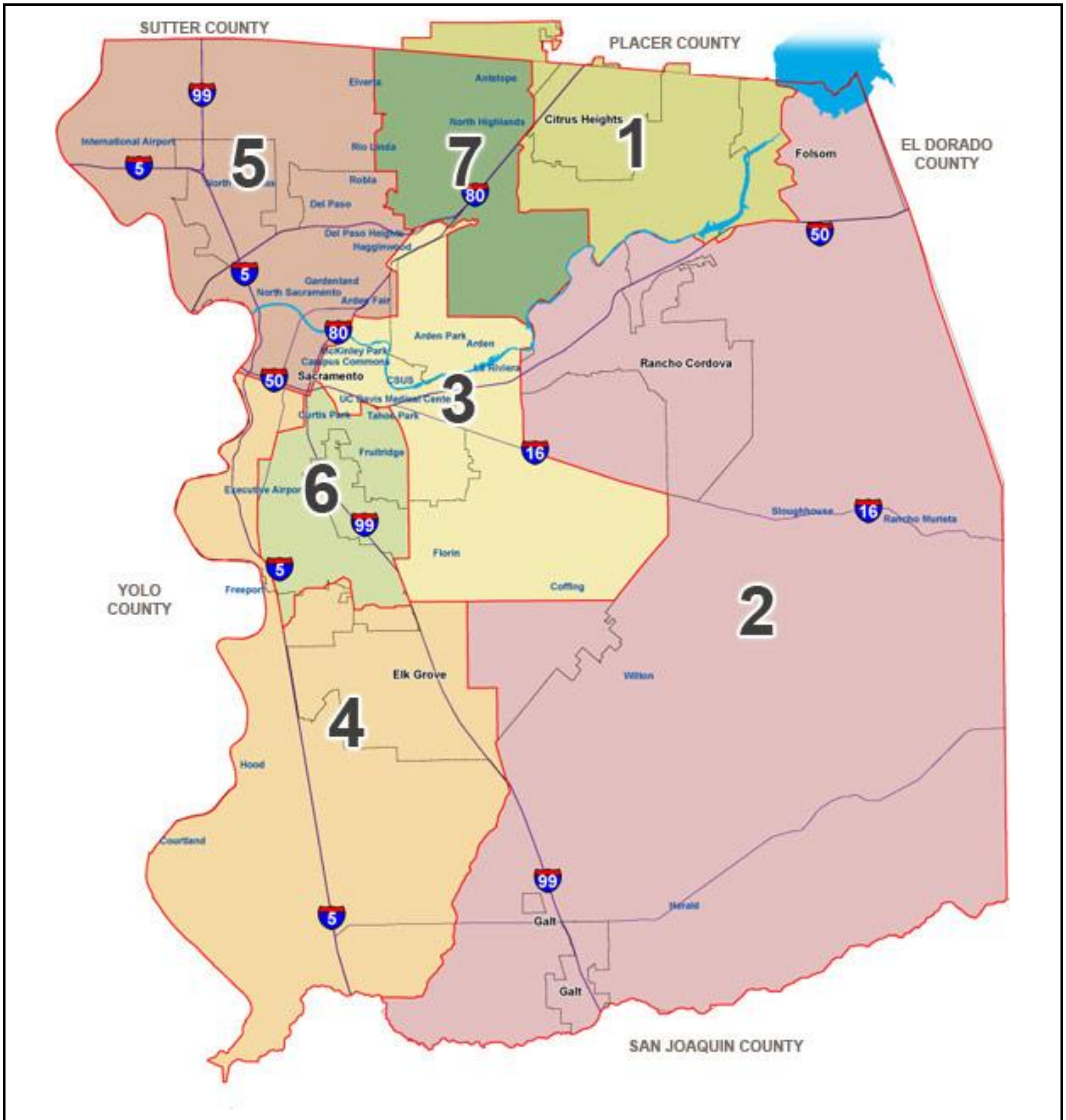


Figure 6.5. Map of SMUD's service territory. [273]

[273] (Sacramento Municipal Utility District, 2014a)

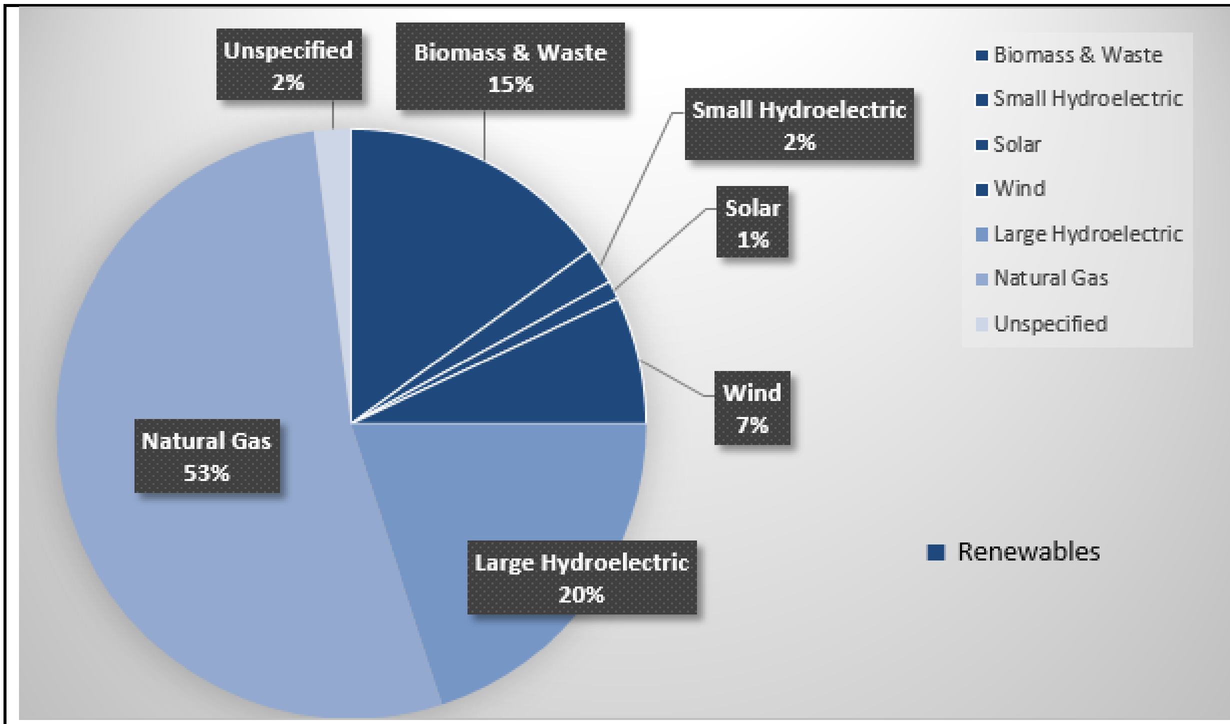


Figure 6.6. SMUD's projected 2013 power content label.[274]

Lassen Municipal Utility District (LMUD) was voted into existence in 1986.[275] In 1988, LMUD acquired electrical facilities from CP National Corporation and began serving residents of Lassen County.[276] LMUD serves 10,500 meters over a service territory of 900 square miles.[277] LMUD has 38 employees and owns over 500 miles of power lines.[278]

If the City of Hermosa Beach pursues the establishment of a MUD, opposition from SCE can be expected, just like what SMUD encountered from PG&E. In addition, difficulties in purchasing SCE's infrastructure include determining a price that is acceptable for both parties and how the grid system is to be divided for sale since it cannot be done according to city boundaries. After a MUD has been successfully established, the City of Hermosa Beach will also need a team of skilled employees to operate, maintain and upgrade the local grid system. The entire process of establishing a MUD and purchasing SCE's infrastructure can take years, as seen from the examples of SMUD and LMUD. These issues mentioned are significant challenges, but they are also necessary steps for the City of Hermosa Beach to take advantage of the city's ample rooftop solar potential in pursuit of its noble long-term carbon neutrality goals.

---

[274] (Sacramento Municipal Utility District, 2014b)

[275] (Lassen Municipal Utility District, 2014a)

[276] Ibid.

[277] (Lassen Municipal Utility District, 2014b)

[278] Ibid.

References

Abou-Diwan, A. (2014). Development of Hudson Ranch II geothermal plant suspended. *Imperial Valley Press.* Retrieved March 31 2014: http://www.ivpressonline.com/news/local/development-of-hudson-ranch-ii-geothermal-plant-suspended/article_78058770-9de4-11e3-8832-0017a43b2370.html

Aerovironment, Inc. (2014). Architectural wind. Retrieved April 5, 2014 from: http://www.avinc.com/engineering/architecturalwind1

Aerovironment, Inc. (2008). AVX1000 building integrated wind turbine. Retrieved June 1, 2014 from: http://www.avinc.com/downloads/AVX1000_online.pdf

American Wind Energy Association. (2014). State wind energy statistics: California. Retrieved May 27, 2014 from: *http://www.awea.org/Resources/state.aspx?ItemNumber=5232*.

Antelope Valley Press. May 12, 2014. City Seeks to Own Streetlights. Retrieved May 20, 2014 from:http://www.lancasterpower.com/news-articles/AVP%205-12-14%20City%20seeks%20to%20own%20streetlights.pdf

Association of California Cities, Orange County. (2013). California HERO program in Orange County. Retreived April 5, 2014 from: http://www.accoc.org/california-hero-program-in-orange-county/

Ascent Systems. (2013, October 8). Thermal Energy Production (KJ) vs. Time of day (hours). *Ascent Systems - Connecting Technologies*. Retrieved March 26, 2014from http://ascentsystems.blogspot.com/2013/10/connecting-technologies-part-2-or-what.html

Balijepalli, V. M., Pradhan, V., Khaparde, S., & Shereef, R. (2011). *Review of Demand Response under Smart Grid Paradigm.* Retrieved May 8, 2014, from http://www.desismartgrid.com/wp-content/uploads/2012/07/review_of_demand_response_vskmurthy.pdf

Bayod-Rújula, A. A. (2009). Future development of the electricity systems with distributed generation. *Energy*, *34*(3), 377–383.

Beaudry-Losique, J., Boling, T., Brown-Saracino, J., Gilman, P., Hahn, M., Hart, C., Johnson, J., McCluer, M., Morton, L., Naughton, B., Norton, G., Ram, B., Redding, T., & Wallace, W. (2011). A national offshore wind strategy: Creating an offshore wind industry in the United States. *U.S. Department of Energy, Energy Efficiency and Renewable Energy.*

Breslin, Mike. January 2011. Trans Bay Cable Completed Under San Francisco Bay. Electrical Contractor. Retrieved May 15, 2014 from: http://www.ecmag.com/section/your-business/trans-bay-cable-completed-under-san-francisco-bay.

BrightSource Energy, Inc. (2014). *Ivanpah*. Retrieved May 27, 2014 from: http://www.brightsourceenergy.com/ivanpah-solar-project

Bureau of Labor Statistics, U.S. Department of Labor. (2014). Average energy prices, Los Angeles – Riverside – Orange County – March 2014. Retrieved April 1, 2014 from: http://www.bls.gov/ro9/cpilosa_energy.htm

CalEnergy Generation. (2014). Imperial valley project. Retrieved March 25, 2014 from: http://www.midamericanrenewablesllc.com/imperialvalley_geothermal.aspx

California Energy Commission. (2014). Blythe solar power project. Retrieved April 5, 2014 from: http://www.energy.ca.gov/sitingcases/blythe_solar/

California Energy Commission. (2003). Wind resource areas in California [Map].

California Energy Commission. (2014). *Utility Annual Power Content Labels for 2012 - Investor Owned Utilities (IOUs)*. Retrieved May 8, 2014, from http://www.energy.ca.gov/sb1305/labels/2012_labels/IOUs/.

California Public Utilities Commission. (2010a). *CPUC Puts PG&E On Notice Over Violations of Community Choice Rules*. Retrieved on May 5th 2014 from http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/117229.htm

California Public Utilities Commision. (2010b). *Letter to Pacific Gas and Electric*. Retrieved May 5, 2014 from: http://www.cpuc.ca.gov/NR/rdonlyres/677EC1E6-3420-42A8-BBF0-B8E69859A00E/0/PGELetter051210.pdf

California Public Utilities Commission. (2011a). *Issues and Progress on the Implementation of Community Choice Aggregation, First Quarterly Report.* Retrieved on May 5th 2014 from http://www.cpuc.ca.gov/NR/rdonlyres/81BE8AA1-D87C-4EC4-9EB6-866F1072E119/0/CCAReportthetheLegislatureJanuary312011.pdf

California Public Utilities Commission. (2011b). *Issues and Progress on the Implementation of Community Choice Aggregation, Fourth Quarter Report.* Retrieved on May 5th 2014 from http://www.cpuc.ca.gov/NR/rdonlyres/3F8C54CF-C051-45FA-A7B1-EAAF9CD13775/0/CCAFourthQuarterLegislativeReportFINAL11311_v3.pdf

California Public Utilities Commission (n.d.). California's Renewable Portfolio Standard (RPS). Retrieved June 1, 2014 from: http://www.cpuc.ca.gov/PUC/energy/Renewables/

California Energy Commission. (2010). *Electricity Consumption by County 2010*. Retrieved May 16, 2014, from http://www.ecdms.energy.ca.gov/elecbycounty.aspx

California Legislative Information. February 20, 2014. AB-2145 Electricity: community choice aggregation. Retrieved June 1, 2014 from: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB2145

California State Legislature. (2002). *California State Assembly Bill No. 117*. Retrieved on April 5th, 2014, from http://www.leginfo.ca.gov/pub/01-02/bill/asm/ab_0101-0150/ab_117_bill_20020924_chaptered.pdf

California State Legislature. (2013). *Electricity: Green Shared Renewables Program*. Public Utilities Code 2831. September 28.

CCE Generation, LLC. (2005). Annual report pursuant to section 13 or 15(d) of the Securities Exchange Act of 1934.

Choi, Ben. Personal interview. April 23, 2014a.

Churchill, Susan. "California's New Solar Program SB 43 Nears the Finish Line." The Vote for Solar Initiative, 5 Sept. 2013. Web. 4 Mar. 2014.

City Council of Lancaster. (2014). Community choice aggregation implementation plan. Retrieved on May 5th, 2014 from http://www.cityoflancasterca.org/Modules/ShowDocument.aspx?documentid=24050

City of Hermosa Beach. (2011). Selected 'Green Project Activities' 1970-2011. Retrieved May 25, 2014 from http://www.hermosabch.org/modules/showdocument.aspx?documentid=681

City of Hermosa Beach. (2014). City facts. Retrieved April 20, 2014 from: http://www.hermosabch.org/index.aspx?page=47

Clarke, C. (2013). Water birds turning up dead at solar projects in the desert. *KCET.* Retrieved April, 1 2014 from: http://www.kcet.org/news/rewire/solar/water-birds-turning-up-dead-at-solar-projects-in-desert.html

Cooper, D. (2014, January 1). *Johnson's Energy Club Competes in Renewable Energy Case Competition*. Retrieved May 8, 2014, from http://www.johnson.cornell.edu/Center-for-Sustainable-Global-Enterprise/News-Events/CSGE-Student-Article-Detail/ArticleId/1791/Johnson-s-Energy-Club-Competes-in-Renewable-Energy-Case-Competition.aspx

Cornell University Law School. *16 U.S. Code & 824 - Declaration of policy; application of subchapter*. Retrieved June 2, 2014, from http://www.law.cornell.edu/uscode/text/16/824

Dickinson, L., Fan, J., Goh, V., Maki, A., Savarani, S., Shabnoor, T., and Trans, D. (2013). Hermosa Beach carbon neutral scoping plan. *UCLA Institute of the Environment and Sustainability.*

Dvorak, M., Archer, C., & Jacobson, M. (2009). California offshore wind energy potential. *Renewable Energy*, 35, p. 1244-54.

Edison International. (2014). *A Look Back: Our History*. Retrieved June 2, 2014, from http://www.edison.com/home/about-us/our-history.html#27764

EIA MER New England. (2013, January 29). Typical U.S. Power Supply and Demand Load Curves. *The Energy Collective.* Retrieved March 21,2014 from http://theenergycollective.com/jemillerep/178096/expanded-wind-and-solar-power-increase-need-natural-gas

Electrical Engineering Tutorials. *Base Load Plants - Peak Load Plant: Difference.* Retrieved May 8, 2014, from http://electricalengineeringtutorials.com/base-load-plants-peak-load-plant-difference/

Energy Storage Association. (n.d.). Community Energy Storage. Executive Summary. Retrieved April 15, 2014 from: http://energystorage.org/energy-storage/technology-applications/community-energy-storage

Fastfission. (2005, January 21). Atom Diagram. *Wikipedia.* Retrieved March 21,2014 from http://en.wikipedia.org/wiki/File:Atom_diagram.png

Flex Alert. (2013, January 1). *Generation, Transformation, and Transmission.* Retrieved May 8, 2014, from http://www.flexalert.org/energy-ca/grid

Gamel, Jay. March 15, 2014. Get Ready for Sonoma Clean Power. Retrieved June 5, 2014 from: http://www.kenwoodpress.com/pub/a/7607?full=1

Geothermal Education Office. (2000). Turbine Generator. Retrieved March 26, 2014 from http://geothermal.marin.org/geopresentation/sld038.htm

GHG Protocol Scope 2 Guidance: Draft for Public Comment. (2012) World Resources Institute. Washington D.C.3-35.

Glassley, W. [CaliforniaIRES]. (2011). *William Glassley, director, California geothermal energy collaborative.* [Video file]. Retrieved from http://www.youtube.com/watch?v=gzClLcJuiPE.

Halstead, Richard. February 26, 2010. Coalition opposing Marin Clean Energy has strong ties to PG&E. Marin News. Retrieved June 1, 2014 from: http://www.marinij.com/marinnews/ci_14480227

Hay, F. J. (2013). Economics of photovoltaic systems. *University of Nebraska, Lincoln.*

Hering, G. (2014). 4 reasons the Ivanpah plant is no the future of solar. *GreenBiz.* Retrieved April 3, 2014 from: http://www.greenbiz.com/blog/2014/02/19/largest-solar-thermal-plant-completed-ivanpah. Retrieved 3 April 2014.

HERO Financing. (2013). HERO financing program [video file]. Retrieved from https://www.youtube.com/watch?v=63zc5MZHi_o.

Herrera, Dennis. "Reply Comments of the City and County of San Francisco." Proc. of Public Utilities Commission of the State of California, San Francisco. 1-18. *California Public Utilities Commission*. Web. 10 Mar. 2014.

Hughes, G. (2012). The performance of wind farms in the United Kingdom and Denmark. *Renewable Energy Foundation.*

ICF International (2012). Unpublished 2010 LA County Regional Inventory Summary.

Interstate Renewable Energy Council. (2014a). “Opening Brief of the Interstate Renewable Energy Council, Inc.”, CPUC Hearing: 73199. 21 March.

Interstate Renewable Energy Council. (2014b). "Phase II Opening Brief of the Interstate Renewable Energy Council, Inc. Regarding the Application of Southern California Edison Company for the Approval of an Optional Green Rate", CPUC Hearing:74380. 13 May.

Interstate Renewable Energy Council. (2014c)."Phase II Reply Brief of The Interstate Renewable Energy Council , Inc." CPUC Hearing: 74618. 14 May.

ISO New England. (2011, February 15). An Example: ISO-NE Electric Load, June 24, 2010. *U.S. Energy Information Administration.* Retrieved March 21,2014 from http://www.eia.gov/todayinenergy/detail.cfm?id=130

Joseph, Marc and Mauldin, Jamie. "Reply Comments of the Coalition of California Utility Employees on Revised Testimony." Proc. of Public Utilities Commission of the State of California, South San Francisco. 1-6. *California Public Utilities Commission*. Web. 10 Mar. 2014.

Kaatz, J. & Anders, S. (2013). Residential and commercial property assessed clean energy (PACE) financing in California. *California Center for Sustainable Energy.*

Kelly, Elizabeth. "Reply Comments of Marin Clean Energy." Proc. of Public Utilities Commission of the State of California, San Rafael. 1-15. *California Public Utilities Commission*. Web. 10 Mar. 2014.

KEMA. (2012a). Storage Ratings by Technology Type. *Market Evaluation for Energy Storage in the United States.* Retrieved March 26, 2014 from http://www.copper.org/about/pressreleases/pdfs/kema_report.pdf

KEMA. (2012b). Storage Efficiency and Lifetime by Technology Type. *Market Evaluation for Energy Storage in the United States.* Retrieved April 2, 2014 from http://www.copper.org/about/pressreleases/pdfs/kema_report.pdf

KEMA. (2012c). Storage Capital Costs by Technology Type. *Market Evaluation for Energy Storage in the United States.* Retrieved April 2, 2014 from http://www.copper.org/about/pressreleases/pdfs/kema_report.pdf

KEMA. (2013, July). Smart Grid Roadmap for Renewables Integration. *Energy Research and Development Division Final Project Report.* Retrieved June 3, 2014, from http://www.energy.ca.gov/2010publications/CEC-500-2010-029/CEC-500-2010-029.pdf

Kim, D. (Director) (2014, April 14). Doug Kim Lecture. *Environment 188B: Challenge of Low-Carbon Electricity in California*. Lecture conducted from University of California, Los Angeles, Los Angeles.

Kyle, G. A. *Solar Insolation*. Retrieved May 8, 2014, from http://education.gsfc.nasa.gov/experimental/July61999siteupdate/inv99Project.Site/Pages/solar.insolation.html

Lancaster Choice Energy. (2014). *FAQs*. Retrieved May 16, 2014, from http://www.lancasterchoiceenergy.com/faq-s.html

LCCA Implementation Plan. NB 1 Attachment. New Business. Retrieved May 15, 2014 from: http://www.cityoflancasterca.org/index.aspx?recordid=4081&page=545

Lean Energy U.S. (2014). *How it Works Final*. Retrieved April 6, 2014 from: http://www.leanenergyus.org/wp-content/uploads/2013/10/how-it-works_final.jpg

Leone, S. (2011). $4.5 billion in loans to support three first solar projects. *Renewable Energy World.* Retrieved April 5, 2014 from: http://www.renewableenergyworld.com/rea/news/article/2011/07/4-5-in-loans-to-support-three-first-solar-projects?cmpid=WNL-Wednesday-July6-2011.

Lin, Roger. "California Environmental Justice Alliance Reply Comments." Proc. of Public Utilities Commission of the State of California, Oakland. 1-14. *California Public Utilities Commission*. Web. 10 Mar. 2014.

Lueken, C., Cohen, G. E., & Apt, J. (2012). Costs of solar and wind power variability for reducing CO2 emissions. *Environmental Science & Technology*, *46*, 9761 - 9767.

Lassen Municipal Utility District. (2014a). About. Retrieved June 2, 2014, from http://www.lmud.org/about/

Lassen Municipal Utility District. (2014b). LMUD at a Glance. Retrieved June 2, 2014, from http://www.lmud.org/

Lawrence Berkeley National Laboratory. (2005). Aggregate (Community) Electricity Consumption. *Electropaedia.* Retrieved March 21, 2014 from http://www.mpoweruk.com/electricity_demand.htm

Mahmud, M. A., Hossain, M. J., & Pota, H. R. (2011) *Analysis of Voltage Rise Effect on Distribution Network with Distributed Generation.* Retrieved May 8, 2014, from http://seit.unsw.adfa.edu.au/staff/sites/hrp/papers/mhp11a-c.pdf

Marin Clean Energy. (2013). *MCE: Integrate Resource Plan Update*. Retrieved May 8, 2014, from https://mcecleanenergy.com/sites/default/files/PDF/2013_Integrated_Resource_Plan.pdf

Marin Clean Energy. (2014a). *MCE: Green Power Community Choices.* Retrieved May 8, 2014, from http://marincleanenergy.org/sites/default/files/key-documents/MCEGeneralPresentation1.15.14_0.pdf

Marin Clean Energy. (2014b). Deep Green 100% Renewable Energy. Retrieved June 1, 2014 from: https://mcecleanenergy.com/sites/default/files/PDF/DG_Content_Label_2014.pdf

Marin Clean Energy. (2014c). Sample Residential Cost Comparison. Retrieved June 1, 2014 from: https://mcecleanenergy.com/rates-res

Marin Clean Energy. (2014d). Board of Directors Meeting. Retrieved June 2, 2014. http://marincleanenergy.org/sites/default/files/board-meeting/06.5.14_Supplemental_Packet.pdf

Marin Clean Energy (2014e). MCE Service in Richmond. Retrieved June 1, 2014 from: https://mcecleanenergy.com/richmond

Marin Clean Energy Implementation Plan. October 2012. Chapter 5 Program Phase In. Retrieved June 1, 2014 from: http://marincleanenergy.org/sites/default/files/key-documents/Implementation_Plan_w-Resolution_%26_JPA_Revised_1.22.13.pdf

Marin Energy Authority. (2011). Revised community choice aggregation implementation plan and statement of intent.

Marin Energy Authority. (2012a). Revised Community Choice Aggregation Implementation Plan and Statement of Intent. Retrieved May 8, 2014, from: http://marincleanenergy.org/sites/default/files/key-documents/Implementation_Plan_w-Resolution_%26_JPA_Revised_1.22.13.pdf

Marin Energy Authority. (2012b). *2/12/2012 Meeting Packet*. Retrieved May 16, 2014, from http://marincleanenergy.org/sites/default/files/board-meeting/2.2.12_MEA_Board_Packet.pdf

Marshall, Shawn E. (2010). Forming a National Community Choice Aggregation Network: Feasibility ,Findings and Recommendations. Marin Energy Authority. Retrieved April 6, 2014 from http://www.galvinpower.org/sites/default/files/Community_Choice_Aggregation_Report_Final_1-4-11.pdf

Montgomery, J. (2013). NextEra chops Blythe solar project proposal amid switch to solar PV. *Renewable Energy World.* Retrieved April 5, 2014 http://www.renewableenergyworld.com/rea/news/article/2013/04/nextera-chops-blythe-solar-project-proposal-amid-switch-to-solar-pv.

National Renewable Energy Laboratory. (2003). California 50m wind resource map [Map]. Retrieved December 10, 2013 from: http://www.windpoweringamerica.gov/maps_template.asp?stateab=ca

National Renewable Energy Laboratory. (2014). Genesis solar energy project. Retrieved April 3, 2014 from: http://www.nrel.gov/csp/solarpaces/project_detail.cfm/projectID=54

Nemet, G. (2006). Beyond the learning curve: factors influencing cost reductions in photovoltaics. *Energy Policy*, *34*, 3218 - 3232.

NextEra Energy Resources. (2014b). Genesis solar energy center fact sheet.

NextEra Energy Resources. (2014a). Solar - How solar plants work. Retrieved 27 May, 2014 from: http://www.nexteraenergyresources.com/what/solar_works.shtml

NRG Solar. (2014). Ivanpah project. http://www.nrgsolar.com/projects/us-mainland/ivanpah-project/. Retrieved 5 April 2014.

Ogin Inc. (2014). Our technology. http://oginenergy.com/our-technology. Retrieved 27 March 2014.

Osborn, J., & Kawann, C. *Reliability of the U.S. Electricity System: Recent Trends and Current Issues.* Retrieved May 8, 2014, from http://emp.lbl.gov/sites/all/files/REPORT%20lbnl%20-%2047043.pdf

Pepermans, G., Driesen, J., Haeseldonckx, D., Belmans, R., & D'haeseleer, W. (2005) Distributed Generation: Definition, Benefits and Issues. *Energy Policy*, *33*, 787-798. http://www.sciencedirect.com/science/article/pii/S0301421503003069.

Pickard, W. F. (2013, October) The Limits of HVDC Transmission. *Energy Policy*, *61*, 292-300. http://www.sciencedirect.com/science/article/pii/S0301421513001845

Prindle, B., Eldridge, M., Eckhardt, M., & Frederick, A. (2007). The twin pillars of sustainability: Synergies between energy efficiency and renewable energy technology and policy. *American Council for an Energy-Efficiency Economy.*

Renewable Energy World. (2011). DOE closes on four major solar projects. Retrieved 3 April, 2014 from: http://www.renewableenergyworld.com/rea/news/article/2011/09/doe-closes-on-three-major-solar-projects?cmpid=SolarNL-Tuesday-October4-2011

Roe, S. (2014, January 1). *Most Efficient Solar Panels Comparison.* Retrieved May 8, 2014, from http://sroeco.com/solar/most-efficient-solar-panels

Sacramento Municipal Utility District. (2014b). *Company Profile*. Retrieved June 2, 2014, from https://www.smud.org/en/about-smud/company-information/company-profile.htm

Sacramento Municipal Utility District. (2014a). *History*. Retrieved June 2, 2014, from https://www.smud.org/en/about-smud/company-information/history/

Sacramento Municipal Utility District. (2014a). SMUD's Service Territory. *SMUD.* Retrieved April 2, 2014 from https://www.smud.org/en/about-smud/company-information/board-of-directors/ward-map.htm

Sacramento Municipal Utility District. (2014b). Power Content Label. *Power Sources.* Retrieved April 3, 2014 from https://www.smud.org/en/about-smud/company-information/documents/Power-Content-Label.pdf

San Diego Gas & Electric. (2013). *Update to Prepared Direct Testimony on behalf of San Diego Gas and Electric Company*, CPUC Hearing 70876:. 6 Dec.

San Diego Gas and Electric. (n.d.). Smart Meter Opt Out Program. Retrieved May 15, 2014 from: http://www.sdge.com/residential/smart-meter-opt-out/smart-meter-opt-out-program

The City Council of Santa Barbara. (2012). Draft Santa Barbara Climate Action Plan. Retrieved June 1, 2014 from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAA&url=http%3A%2F%2Fservices.santabarbaraca.gov%2FCAP%2F%2FMG104527%2FAS104531%2FAS104545%2FAS104550%2FAI108425%2FDO108426%2F2.DOCX&ei=MI-WU-

TKOIy6oQTz8oCgDg&usg=AFQjCNHoyWbT8D2-hJVfaQygpar3f_1Bag&sig2=xSg6uMGtjVm0nq8f3l8icg

S&C Electric Company. (n.d.). PureWave® Community Energy Storage System. Ratings. Retrieved May 16, 2014 from: http://www.sandc.com/products/energy-storage/ces.asp

Sanseverino, E. R., Luisa Di Silvestre, M., Giuseppe Ippolito, M., De Paola, A., & Lo Re, G. (2011). An execution, monitoring and replanning approach for optimal energy management in microgrids. *Energy*, *36*(5), 3429–3436.

Shlatz, E., Buch, N., & Chan, M. (2013, November) *Distributed Generation Integration Cost Study*. Retrieved May 8, 2014, from http://www.energy.ca.gov/2013publications/CEC-200-2013-007/CEC-200-2013-007.pdf

Shephard News Team. (2013). Fort Bliss microgrid enters demonstration phase. Retrieved May 1, 2014 from: http://www.shephardmedia.com/news/mil-log/fort-bliss-microgrid-enters-demonstration-phase/

Selim Ustun, T., Ozansoy, C., & Zayegh, A. (2011). Recent developments in microgrids and example cases around the world—a review. *Renewable and Sustainable Energy Reviews*, *15*(8), 4030–4041.

SmartGrid.gov. *Southern California Edison Company (Tehachapi Wind Energy Storage Project)*. Retrieved May 9, 2014, from https://www.smartgrid.gov/project/southern_california_edison_company_tehachapi_wind_energy_storage_project

Sonoma Clean Power. (2013). Community Choice Aggregation Implementation Plan and Statement of Intent. Retrieved May 8, 2014, from: http://2tgc4v3kjp5mrjtdo183d8716ao.wpengine.netdna-cdn.com/wp-content/uploads/2013/12/Sonoma-Clean-Power-CCA-Implementation-Plan-2013-08-20.pdf

Sonoma Clean Power. (2014) Implementation Plan. Chapter 5 - Program Phase In. Retrieved June 1, 2014 from: http://2tgc4v3kjp5mrjtdo183d8716ao.wpengine.netdna-cdn.com/wp-content/uploads/2013/12/Sonoma-Clean-Power-CCA-Implementation-Plan-2013-08-20.pdf

Sonoma Clean Power. (n.d.). Residential Rates. Retrieved May 8, 2014 from: http://sonomacleanpower.org/for-my-home/rates/

Sonoma Clean Power. (n.d.) Residential Rates. Retrieved June 1, 2014 from: from:http://sonomacleanpower.org/for-my-home/rates/

South Bay Cities. (n.d.) *Map.* Retrieved May 16, 2014 from: http://www.southbaycities.org/about-us

Southern California Edison. (2010). Renewable power purchase and sale agreement between Southern California Edison Company and Caithness 251 Wind LLC.

Southern California Edison. (2014). *Powering Southern California for 125+ Years*. Retrieved June 2, 2014, from https://www.sce.com/wps/portal/home/about-us/who-we-are/!ut/p/b1/rVRdT8IwFP0r-rDH0gvtvnyb0cCQYBSIri-k2-7GDKxzK2L89RZCoia6QWIfmt7mnpPTc09KBX2mopRvRS51oUq53tfCWfa9YTAKZxAO59yG8HrgsuF1yOa3tmmITAP8sQI44P0h3I7G93v8A4OQPcB0FgQMwKFPVFCRlLrSKxo1CS4TVWos9RJLC45nC2Sstvpi21iwWymyQyJr3AMrmWOKTZGXhyopUhq5WcqBAyOZEyPhntsn0k58s6W2dNCL08w7ym7R1fLsG86P-JaGDtsOz-4wrss60SVyTEW-VvFhjFFQxszLqagxwxrr3rY21yutq-bKAuPrbtfLlcrX2EvUxoLfICvVaPr8s5NGxgn3TxV3Np19jUYmzPYTGZOBiw7hcQpEmikRHz2fY2pzCVkXIfw34eBswvEJ6SheXl9FYKK9j_C7sa0z2-06533-XedJIW8nXPT_m5CdTTg-4Xs538kfv0S1WWy8l-xu4jyOPib4RGTsAbOrt49JNp0eq3V--QkMWT0J/dl4/d5/L2dBISEvZ0FBIS9nQSEh/

Southern California Edison (2014a). *Applications of Southern California Edison Company for approval of optional green rate*. CPUC Hearing 1401007. January 10.

Southern California Edison (2014b). *Amendments to prepared testimony of Southern California Edison Company in support of application for approval of optional green rate*. CPUC Hearing 1401007. March 11.

Southern California Edison. *Understanding Your Energy Bill for Net Energy Metering Customers.* Retrieved May 8, 2014, from https://www.sce.com/wps/wcm/connect/101d6d56-55b2-438c-bc79-75b1fca5b2be/NEM_FactSheet01012012.pdf?MOD=AJPERES

Southern California Edison Smartgrid Roadmap. (n.d.). Smart Grid Engineering and Architecture. Distribution System Design. Retrieved April 15, 2014 from: https://www.sce.com/NR/rdonlyres/BFA28A07-8643-4670-BD4B-215451A80C05/0/SCE_SmartGrid_Strategy_and_Roadmap.pdf

Swan, Heather. Electronic Mail. May 30, 2014a.

Swan, Heather. Personal interview. May 26, 2014b.

Terra-Gen Power (2008). Wind projects.Retrieved March 29, 2014 from: http://www.terra-genpower.com/Projects/Projects_Wind.aspx.

The County of Sonoma. (2013). *Second Amended and Restated Joint Powers Agreement*. Retrieved on May 5th, 2014 from https://sonomacleanpower.org/wp-content/uploads/2013/12/SCPA-Second-Amended-Joint-Powers-Agreement-Approved-7-25-13.pdf

Thomas, Paul. (2011). Community Energy Storage. American Electric Power. Retrieved May 1, 2014 from: https://www.smartgrid.gov/sites/default/files/doc/files/American_Electric_Power_Community_Energy_Storage_201109.pdf

T.R. Ayodele et al., Vol.2, No.4, 2012. Challenges of Grid Integration of Wind Power on Power System Integrity: A Review. Retrieved April 1, 2014 from: http://www.ijrer.org/index.php/ijrer/article/viewFile/317/pdf

U.S. Department of Energy (2003). California 50m wind resource map [Map]. Retrieved December 10, 2013 from: http://www.windpoweringamerica.gov/maps_template.asp?stateab=ca

U.S. Energy Information Administration. (n.d.). How much electricity does an American home use? Retrieved April 15, 2014 from: http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3

U.S. Energy Information Administration (2014). Levelized cost and levelized avoided cost of new generation resources in the annual energy outlook 2014.

U.S. Energy Information Administration. (2013, February 27). *Energy Explained, Your Guide To Understanding Energy*. Retrieved May 8, 2014, from http://www.eia.gov/energyexplained/index.cfm?page=electricity_home

U.S. Energy Information Administration. (2012, April 27). *What is the Electric Power Grid, and What Are Some Challenges it Faces?*. Retrieved May 8, 2014, from http://www.eia.gov/energy_in_brief/article/power_grid.cfm.

U.S. Department of the Interior, Bureau of Land Management. (2014). Renewable energy projects approved since the beginning of calendar year 2009. Retrieved March 29, 2014 from: http://www.blm.gov/wo/st/en/prog/energy/renewable_energy/Renewable_Energy_Projects_Approved_to_Date.html

United States Census. (2010.) Retrieved May 31, 2014 from: http://www.census.gov/2010census/

U.S. Department of Energy Office of Electricity Delivery & Energy Reliability. *National Electric Transmission Congestion Studies*. Retrieved May 8, 2014, from http://energy.gov/oe/services/electricity-policy-coordination-and-implementation/transmission-planning/national

Whitfield, John. (n.d.). The Electricians Guide fifth edition. The Radial Circuit. Retrieved April 1, 2014 from: http://www.tlc-direct.co.uk/Book/6.3.3.htm

Wilson, A. (2009). The folly of building-integrated wind. Environmental Building News. http://www2.buildinggreen.com/article/folly-building-integrated-wind?ip_login_no_cache=881cc2ad87392af394f4d8dedac46c87. Retrieved June 1, 2014.

Wiser, R., & Bolinger, M. (2013). 2012 wind technologies market report. U.S. Department of Energy.

Weisenmiller, R. (Director) (2014, April 21). Robert Weisenmiller Lecture. *Environment 188B: Challenge of Low-Carbon Electricity in California*. Lecture conducted from University of California, Los Angeles, Los Angeles.

APPENDIX

Case Studies

Lancaster Community Choice Aggregation

Lancaster is a city sixty miles north of Los Angeles and is known for its sunny days and open desert landscape. It is home to many photovoltaic projects and has quickly become recognized for the bounty of its renewable resources like wind and sunshine. As the city progresses towards its municipal goal of net zero status it seeks to do so primarily through forming a CCA. Lancaster is very unique in that it is the first city to begin forming a CCA in SCE territory. This case study will attempt to track its progress in hope of better understanding the necessary steps to establishing a CCA.

Ms. Heather Swan, the senior project coordinator for the Lancaster Power Authority (LPA) was able to share information with the UCLA student group by commenting on the status of the LCCA. She began by explaining that the JPA that Lancaster formed, the LPA, did not originally form for the purpose of aggregating powers from outside the community. Rather, she explained that JPAs are typically formed so as to protect general operating funds. The LPA was formed so that the City of Lancaster, Lancaster Redevelopment Agency, and the Lancaster Housing Authority could financially support one another.[279] The original intention of the LPA was not to aggregate other cities outside of Lancaster, but this is one possible application for the future.

Table A.1. Lancaster's Total Load for 2013 [280]

Type of Load	Accounts	Load in 2013
Municipal (GWh)	640	38
Residential (GWh)	48,900	383.5
Commercial (GWh)	5,500	345

Table A.2. Lancaster Community Choice Aggregation Phase Enrollment [281]

Phase	Number of Accounts
Phase 1: May 2015	640 municipal accounts
Phase 2: November 2015	4,500 commercial accounts
Phase 3: February 2016 and/or November 2016	37,500 residential accounts

[279] (Swan, 2014a)

[280] Ibid.

[281] (LCCA Implementation Plan, 2014)

There are two joint power agreements that Lancaster is involved in. The first authorizes the High Desert Power Authority (HDPA) and the second establishes the previously mentioned LPA. Heather Swan shed some light on the difference between the two joint power agreements. Ms. Swan noted that the HDPA is made with Pittsburg, CA, while the LPA is currently only citywide. Pittsburg is located in the San Francisco Bay Area, forty miles northeast of the City of San Francisco. The sole reason that Lancaster is involved with Pittsburg is not for CCA purposes, but rather it is so that Lancaster may gain technical expertise.[282] In 2007 the CAISO approved an energy transmission project proposed by the city of Pittsburg. The transmission project was to build a submersible 400 MW transmission line that would begin at the power generation facility in Pittsburg, run through the San Francisco Bay, and deliver power to the City of San Francisco.[283] The City of Lancaster is particularly interested in this technical expertise because it is in the project phase of proposing a transmission line that would run east to west in north eastern Lancaster. The proposed transmission line would provide relief to the grid from electricity congestion.[284]

In unison with CCA efforts Lancaster is trying to acquire ownership of its 17,856 street lights from SCE. If successful, Lancaster would be able to save an estimated 1.5 million dollars on operating costs. The application will soon be sent to the CPUC.[285] Any transfer of assets must be approved by the governing body that oversees any of the IOUs, which is the CPUC. According to Ms. Swan, the CPUC has not yet commented on this proposal and thus the acquisition is still awaiting approval. In the Antelope Valley Press, a Lancaster local newspaper, the author wrote that Lancaster officials desire to buy the lights from SCE because they believe that they can more cheaply supply energy to their street light system.[286] As mentioned this purchase will decrease the amount paid to Edision by an expected 1.5 million dollars annually. The price tag for buying the streets lights is 12 million dollars. Lancaster expects the CPUC to respond within 9 to 12 months.[287] Notably, Lancaster will be the first city serviced by SCE to purchase their street lights from the IOU.[288] Hermosa Beach officials should take note of this attempted acquisition because if approved it could be one way for Hermosa Beach to decrease its expenditures in energy distribution.

Once the CCA is formed, the City of Lancaster plans to enroll customers in 3 phases. Information is presented in the table below. Once the program starts, each phase will be supplied with 35% of its load coming from renewable sources. As found on the CPUC website California's RPS was established in 2002 under Senate Bill 1078, accelerated in 2006 under Senate Bill 107 and expanded in 2011 under Senate Bill 2. The RPS program requires IOUs, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 33% of total procurement by 2020.[289] The Lancaster CCA will exceed this requirement at its inception in 2015 with a 35% renewables portfolio.

282 Ibid.

283 (Breslin, 2011)

284 (Swan, 2014b)

285 (Swan, 2014b)

286 (AVP, 2014)

287 (Swan, 2014b)

288 (AVP, 2014)

289 (CPUC, 2014)

In February 2014, AB-2145 Electricity: community choice aggregation was introduced into the legislature. This bill specifically addresses CCAs in California. This bill states that after January 1st 2015 any CCA that is formed must no longer be an opt out program at its inception, but rather an opt in program.[290] This could potentially make CCA registration much more tedious and detract potential members. When a new CCA forms all residents in the CCA's territory would remain in contract with their IOU. This could pose a threat to the working capital that a CCA is dependent on for financing and operations. Ms. Swan, the LPA project manager, was asked if there is any rush to enroll members into the LCCA before the January 1st 2015 deadline. As of now the LCCA proposal of enrollment does not begin until May 2015 with Lancaster's municipal accounts. Ms. Swan stated that the May 2015 enrollment date cannot feasibly be started earlier and thus Lancaster cannot rush to form their CCA before the January 1st 2015 deadline. Rather she noted that Lancaster city officials are trying to work with California legislative officials to rework AB 2145.

The goal of this case study is to evaluate the necessary action required to best form a CCA. This case study is particularly important because also like the City of Hermosa Beach, the City of Lancaster also falls under the service of SCE. Ms. Swan mentioned that as of to date, SCE has posed no barriers for Lancaster's energy independence. However the barriers that have been cumbersome for Lancaster mainly include financing. In the LCCA Implementation Plan some of the startup costs listed include hiring staff, acquiring power producer contracts, and general consulting costs. Another labor filled and time intensive undertaking is the feasibility report. Ms. Swan mentioned that as a city tries to find out how to pay for any energy independence programs it must also figure out if a CCA is the best option for its community. This is done using the feasibility report.

When looking closely at table 9, as found on page 38 of the LCCA Implementation Plan, one may believe that under the LCCA residents would be paying more per kWh than. SCE charges $0.085 while the LCCA is projected to charge $0.10.[291] Ms. Swan mentioned that $0.085 is only the base load price for SCE. After SCE customers exceed the allotted base load energy provided they are required to begin paying higher rates. This is part of SCE's 4 tier pricing approach. In reality most SCE customers will pay more than $0.085 for kWh because they progress into the third and fourth tier.[292] Ms. Swan said that typically SCE residents pay about $0.132 per kWh. And importantly, this means that the LCCA does project to offer a cheaper option for residential electricity than SCE.

[290] (CA Legislative Info, 2014)

[291] (LCCA Implementation Plan, 2014)

[292] (Swan, 2014b)

Table A.3. Comparison of SCE rates and LCCA draft rates[293]

Customer Segment	SCE Specific Rate	SCE ($/kWh) Summer	SCE ($/kWh) Winter	Initial Draft LCCA Rate
Large and Medium Commercial	TOU-8 (>500kW)			
	On-Peak	$0.34217	N/A	
	Mid-Peak	$0.1069	$0.05817	
	Off-Peak	$0.03389	$0.03875	
	GS-3 (200kW<>500kW)			
	On-Peak	$0.30124	N/A	
	Mid-Peak	$0.10195	$0.05618	
	Off-Peak	$0.03264	$0.03718	
	GS-2 (20kW<>200kW)			
	On-Peak	$0.30228	N/A	$0.20
	Mid-Peak	$0.10641	$0.05979	$0.06
	Off-Peak	$0.03431	$0.03909	$0.03
Small Commercial	GS-1 (<20kW)			
	On-Peak	$0.15038	N/A	$0.20
	Mid-Peak	$0.10589	$0.08106	$0.08
	Off-Peak	$0.07631	$0.06971	$0.06
Residential	Usage	$0.08592	$0.08592	$0.10
Municipal	Various	Various	Various	$0.08
	Street Lights (LS-1, LS-3)	Various	Various	TBD

293 (LCC Implementation Plan, 2014)

Marin Clean Energy (MCE)

Marin County is connected to San Francisco County by the Golden Gate Bridge. MCE is the CCA formed by Marin County. It was created in 2008, as the first CCA program in California, and began serving customers in 2010. MCE is technically able to service those parties through which it has partnership by the JPA, Marin Energy Authority. The thirteen parties that have been a part of the JPA since its birth include five towns, seven cities, and the County of Marin. Notably all parties are in close proximity to one another. Up until July 2013, only Marin County residents and businesses were serviced by MCE. Since July of 2013 the City of Richmond has begun receiving service by MCE through MCE's Light Green option, which ensures that 50% of energy procurement is from renewable sources.[294]

Table A.4. Load Breakdown for Marin County[295]

Type of Load	Marin (2010)
Non-Residential (GWh)	716.66
Residential (GWh)	705.54
Total (GWh)	1,422.21

Table A.5. MCE Phase Enrollment[296]

Phase	Number of Accounts
Phase 1: 2010	9,000 municipal and commercial accounts
Phase 2 A&B: 2011&2012	80,000 commercial and residential accounts
Phase 3: 2013-2014	All remaining customers and Richmond*

MCE Account Manager, Ben Choi, provided much of the information that is listed in this case study. He was contacted via telephone for an interview and via email for follow up questions.

The reason the CCA formed was because Marin County did not have other opportunities instead of a CCA. Marin was proactive in combating climate change and took practical steps in doing so. One of those

[294] (MCE, 2014a)

[295] (California Energy Commission, 2010)

[296] (MCE Implementation Plan, 2012)

steps for example was replacing the municipal fleet of cars with a cleaner fleet. Deciding to form a CCA was not in opposition to another choice, rather deciding to form a CCA was the natural progression of tactics in decreasing the amount of carbon emissions brought about by Marin County.[297]

MCE provides two renewable energy plans for its customers. The first is the Light Green option which incorporates 50% of the energy procured from renewable sources and the Deep Green option which incorporates 100%. Although residents of Marin County and Richmond tend to be more concerned about environmental practices, price is still the chief factor in decision making. Costs for MCE and PG&E service are very close. Through inference, residents likely decided to remain enrolled in the CCA for reasons like: environmental concerns, wanting to take hold of energy independence, or simply doing it because it was recommended by a friend.

Mr. Choi, explained that one of the most difficult barriers to forming a CCA were the pressures from PG&E. The relationship that Marin has had with PG&E has been an evolving one. In some ways they are competitors and in others they are collaborators.[298] One way PG&E acted as a competitor was during the MCE's attempt to enroll customers. PG&E spent millions of dollars trying to convince customers in Marin County that a CCA was not a good choice. For example PG&E sponsored the Coalition for Reliable and Affordable Electricity which sent a series of mailers to residents in Marin that spoke negatively about MCE.[299] As of the 2008 tax returns, the president of the Coalition was Dan Richards. He was also the former senior vice president for public policy and government relations for PG&E.[300] CCAs, also, do not have private stakeholders who can contribute funds, so financing their formation is a another large barrier.

Table A.6. MCE Enrollment Percentage[301]

	Opt-in %	Opt-out %
Overall MCE Enrollment%	76.40%	23.60%
Marin MCE Enrollment%	74%	26%
Richmond MCE Enrollment%	82.50%	17.50%

[297] (Choi, 2014a)

[298] Ibid.

[299] (Halstead, 2010)

[300] Ibid.

[301] (Choi, 2014b)

A majority of the renewable energy that MCE produces comes from wind. For example the Deep Green option is comprised of 100% wind energy.[302] The way it works is that electricity that is produced via wind turbines is not funneled directly to MCE customers. The turbines contracted by MCE simply produce the energy and uploaded it onto the grid whenever the wind blows. In order for MCE to ensure that they can provide enough energy from renewable sources they have to make sure to consume as much as or less electricity than they produce. Companies in California are building infrastructure to harness renewable energy.[303] This is adding more renewable energy as a part of the base load power. California as a whole will have to begin incorporating technologies and strategies to make this renewable energy more reliable. This means that there has to be a growth in battery storage, intelligent communications i.e. smart grid, and energy conservation.

The staff at MCE is employed by the JPA, Marin Energy Authority. The staff is dedicated to accomplish the goals set out by the council members. Further, the council members are elected by the individual parties that comprise the JPA. For example the City of Richmond would elect a member to the council as representation for their city.

Table A.7. Sample Residential Cost Comparison[304]

	Cost per kWh	Price for 508 kWh	Service Fee	Total
MCE	$0.08	$39.62	$5.89	$45.51
PG&E	$0.09	$46.73	0	$46.73

MCE charges $0.078/kWh in the E-1/Res-1 category. For the same category PG&E charges $0.092/kWh. Although Marin is able to charge less there is a $5.89 added service fee towards MCE customers to cover the cost of using PG&E transmission lines. Given an energy bill of 508 kWh, the MCE customer would pay $0.72 less for that pay cycle than a PG&E customer.[305] The benefit is that 50% of the energy MCE offers comes from renewable sources compared to 19% offered by PG&E. Given that prices are close to the same, it is likely that the reason why customers opt out is not because the CCA's service is more expensive, but because they do not understand the function of a CCA. This highlights the importance of CCA awareness campaigns and public meetings that discuss the CCA's environmental benefit.

The primary way that MCE keeps costs down is by being a not-for-profit public agency with a fraction of the staff and costs of PG&E. Also, the primary reason for the upcoming generation investments, and FIT contracts is not to keep costs down, but rather to promote local renewable energy generation, and spur on the local green economy.[306] The number one goal of MCE is to combat climate change by providing energy generated from renewable sources. One of the current topics of discussion for MCE is to

302 (MCE, 2014b)

303 (Choi, 2014a)

304 (MCE, 2014c)

305 Ibid.

306 (Choi, 2014a)

potentially begin constructing its own renewable energy generation infrastructure.[307] MCE has to contract power generation with IPPs, but now MCE is looking toward owning its own generation facilities leading to an even greater ability to provide reliable renewable energy.

Opt out procedures have also been another area where change has been occurring frequently. The reasons why residents opt out is multi-faceted, however for whatever the reasons, they must wait for one and half years before joining the CCA again. The waiting period was initially three years, but the CPUC changed the ruling to benefit CCA programs. CCA programs would benefit most if residents could opt back in at any time. This would logically increase enrollment. Speaking with MCE account manager Ben Choi, he further explained that if an opt out occurs after the initial sixty days of service, such as 4 months into having service with MCE, then the re-enrollment waiting period would be in effect. If, however, the customer opts out before enrollment in MCE, or within the first couple of months of service, the customer would be eligible to enroll in MCE at any time.

In September of 2013, MCE received a letter from the County of Napa that expressed their interest in joining the CCA because of this MCE completed an analysis to assess the effects of Napa joining the program with Napa's current customer size. In 2013 the County of Napa used 336,223 MWh of energy while MCE used 1,297,694 MWh. Using these numbers, adding the County of Napa would increase MCE's demand by 25.9%. Through the analysis MCE discovered that adding Napa to the CCA would create a 3% reduction in rates to customers.[308]

If the City of Hermosa Beach residents or staff would like more information on financial documentation, it can be found online at: http://marincleanenergy.org/key-documents

---

[307] Ibid.

[308] (MCE, 2014d)

Sonoma Clean Power (SCP)

Sonoma County is the next northernmost county from Marin County. It is home to the second operational CCA in California. SCP has followed in MCE's footsteps by mimicking many of its decisions and operational tactics. For example SCP's Implementation Plan is almost identical to that of MCE. It is apparent that both counties worked side by side to bring SCP online.

Sonoma Clean Energy provides two renewable energy plans for its customers. The first is the CleanStart option which incorporates 33% of the energy procured from renewable sources and the EverGreen option which incorporates 100%. Costs for Sonoma and PG&E service are very close though the difference between PG&E's service and EverGreen is a greater difference than that of MCE's Deep Green Program. This means MCE's customers pay less for 100% renewable energy. Currently they pay $12.52 less per month for 100% renewable energy when compared to SCP.[309] SCP is working to bring customers to a 100% renewable energy rate while remaining competitive with PG&E in prices. They plan to increase their CleanStart option to 50% renewable energy by 2018.[310]

A majority of the renewable energy that SCP produces comes from geothermal. Additionally, the renewable energy procured by SCP is locally generated increasing green jobs and stimulating the local "green" economy. The CleanStart option incorporates 33% of energy generation from renewable sources and 37% from hydro power.[311] In comparison PG&E claims 22% from renewable sources and 11% from hydro.[312] All in all, SCP, like MCE is concerned primarily with increasing the amount of renewables that penetrate the energy market. Price for this energy is also a concern, but less important.

The staff at SCP is employed by the JPA, Sonoma Clean Power Authority which was created specifically for SCP on December 4, 2012.[313]

Below are SCP's rates in comparison to PG&E's for each level of service.

Table A.8. SCP vs. PG&E Rates[314]

	PG&E	SCP CleanStart	SCP EverGreen
Renewables	20%	33%	100%
Residential Total Cost	$80.43	$75.80	$93.30
Commercial Total Cost	$348.49	$329.41	$389.91

309 (MCE, 2014)

310 (Sonoma Clean Power, 2012)

311 (Gamel, 2014)

312 Ibid.

313 (The County of Sonoma, 2013)

314 (Sonoma Clean Power, 2014)

Table A.9. SCP Load Breakdown[315]

Type of Load	Sonoma (2010)
Non-Residential (GWh)	1,520.57
Residential (GWh)	1,354.34
Total (GWh)	2,874.91

Sonoma County's load in 2010 is depicted in the chart above. Not all of the cities in Sonoma County are serviced by SCP. SCP has started phasing in municipal and commercial accounts. This is part of the enrollment first phase and started in May 2014. The first phase enrolled municipal and some commercial accounts because these two groups are less likely to opt out and their load can be better estimated. Correctly estimating load allows the CCA to more easily procure energy. The planned phases of enrollment for SCP customers are shown in the chart below.

Table A.10. Sonoma Clean Power Phase Enrollment[316]

Phase	Number of Accounts
Phase 1: 2014	20,000 municipal and commercial accounts
Phase 2: 2015	60,000 commercial and residential accounts
Phase 3: 2016	All remaining accounts

---

315 (California Energy Commission, 2010)

316 (SCP Implementation Plan, 2013)