



**ZERO NET ENERGY NEIGHBORHOOD  
FEASIBILITY, DESIGN, AND  
IMPLEMENTATION STUDY**

**FINAL REPORT**

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# 1 Introduction

The County of San Luis Obispo (CoSLO), funded through California Energy Commission (CEC) grant number LGC-16-005, seeks to identify a path to replicable conversion of existing neighborhoods to zero net energy (ZNE) that integrates energy efficiency and conservation, scalable renewable energy generation, and community engagement. The Oceano Study Area (also referred to as Study Area in this report) is the first such existing community in San Luis Obispo County to be assessed for feasibility of transition into a ZNE neighborhood (ZNEN).

## 1.1 Study Scope

The Study Team, comprised of TRC, Urban Footprint, the National Renewable Energy Laboratory (NREL), and the County of San Luis Obispo, provides the following final report that identifies technical, financial, and organizational needs and feasibility considerations for ZNEN implementation. This report refers to and builds upon three prior reports produced in earlier phases of this study:

- ◆ The Existing Conditions report, which assessed the energy use of the Study Area as well as the physical, planning, and policy conditions,<sup>1</sup>
- ◆ The Energy Efficiency and Conservation Potential report, which provided the technical potential for energy savings when accounting for the impact of energy efficiency and conservation programs,<sup>2</sup> and
- ◆ The Distributed Energy Resource Research Findings report, which identified the physical, financial, and operational resources available to supply renewable generation to the Study Area, focusing primarily on rooftop and community solar resources.<sup>3</sup>

This report aggregates findings from the three studies above to identify potential strategies that can achieve a ZNEN in the Study Area, as well as other improvements.

The definition of ZNE in the context of this report is the definition that has been adopted by the California Department of General Services for their new construction buildings. This definition requires renewable generation that offsets the total energy consumed on-site (including electricity and gas) when accounting for fuel extraction, transmission, delivery, and production losses on an annual source energy basis.<sup>4</sup>

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<sup>1</sup> TRC (October 2018) Zero Net Energy Neighborhood Feasibility, Design, and Implementation Study: Existing Conditions Report. Prepared for the County of San Luis Obispo. Available at: [https://www.slocounty.ca.gov/Departments/Planning-Building/Energy-and-Climate/Energy-Climate-Reports/CoSLO\\_Zero-Net-Energy-Neighborhood\\_Existing-Condit.aspx](https://www.slocounty.ca.gov/Departments/Planning-Building/Energy-and-Climate/Energy-Climate-Reports/CoSLO_Zero-Net-Energy-Neighborhood_Existing-Condit.aspx)

<sup>2</sup> TRC (January 2019) Zero Net Energy Neighborhood Feasibility, Design, and Implementation Study: Energy Efficiency and Conservation Potential Report. Prepared for the County of San Luis Obispo.

<sup>3</sup> TRC (June 2019) Zero Net Energy Neighborhood Feasibility, Design, and Implementation Study: Distributed Energy Resource Research Report. Prepared for the County of San Luis Obispo.

<sup>4</sup> More information on the Department of General Services (DGS) definition, including a calculator, available at DGS Office of Sustainability Resources website: <https://www.dgs.ca.gov/OS/Resources/Page-Content/Office-of-Sustainability-Resources-List-Folder/Zero-Net-Energy>

## 1.2 ZNEN Objectives

The ZNEN study scope is in service of four overarching and overlapping objectives that drove the methodology, analysis, and recommendations outlined in this report. These objectives arose repeatedly throughout data collection and stakeholder feedback over the duration of the study:

1. **Energy Affordability** – Oceano is a predominantly low-income community of renters and seniors who identify as Hispanic (see Section 2.1.1 for details). Affordability of energy, and of any energy use reduction measures, is paramount for economic sustainability of the Study Area, as evidenced by the approximately 40 percent of the residents within the Study Area being on California Alternate Rates for Energy (CARE) utility rate. According to a recent study by the American Council for an Energy-Efficiency Economy, low-income households, households of color, and renting households spend a higher portion of their income on electricity, heating, and cooling utility bills.<sup>5</sup> Cost-effective energy efficiency and renewable generation measures reduce energy cost burdens for households, and therefore must be a primary pillar of achieving a ZNEN.
2. **Decarbonization** – Over the past two years, there has been a significant shift in California energy policy at various levels to directly target greenhouse gas emissions from the existing building sector.<sup>6</sup> Converting natural gas end uses to electric end uses (electrification) now results in overall emissions reductions due to the increased number of renewables powering the state’s electrical grid.<sup>7</sup> State and local decision-making are driven by the scientific evidence and stakeholder advocacy towards building electrification. While electrification has certain environmental benefits, it may increase operational heating costs in the short-term, while long-term electricity and gas utility rates remain uncertain due to the potential of stranded gas infrastructure and the proliferation of community owned utilities. Combining electrification with energy efficiency and renewable generation measures substantially reduces potential on-bill increases.
3. **Resiliency and Local Control** – Outside of the potential hazards of wildfire or earthquakes, the Study Area is adjacent to and partially within a flood zone that sustains significant and frequent flooding. To mitigate adverse health and economic impacts during hazardous events, the Study Area can maintain community services by implementing resiliency strategies such as local renewable energy generation, energy storage, and microgrid control. Furthermore, investing in localized resiliency allows for greater autonomy and empowerment of community members over energy usage and

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<sup>5</sup> Dehobl, A. and Ross, L. (April 2016). Lifting the High Energy Burden in America’s Largest Cities: How Energy Efficiency Can Improve Low-Income and Underserved Communities. American Council for an Energy-Efficiency Economy. Available at: <https://aceee.org/research-report/u1602>

<sup>6</sup> **Senate Bill (SB) 100** in 2018 set a goal of 100% fossil-fuel free electricity by the year 2045. **Executive Order B-55-18** established a statewide goal to achieve carbon neutrality no later than 2045. **SB 1477** calls on the CPUC to develop, in consultation with the CEC, Building Initiative for Low-Emissions Development (BUILD) and Technology and Equipment for Clean Heating (TECH) programs aimed at reducing GHG emissions associated with buildings. **Assembly Bill 3232** calls on the CEC to, by 2021, develop an assessment of the feasibility of reducing the GHG emissions of California’s buildings by 40 percent below 1990 levels by 2030, in consultation with the CPUC and other state agencies. The California Public Utilities Commission (CPUC) has recently changed the **‘three-prong’ test** for fuel switching to better support building decarbonization goals and align with state legislation.

<sup>7</sup> Energy+Environmental Economics. (April 2019) Residential Building Electrification in California: Consumer Economics, Greenhouse Gases and Grid Impacts. Prepared for Southern California Edison, Sacramento Municipal Utility District, and Los Angeles Department of Water and Power. Available at: [https://www.ethree.com/wp-content/uploads/2019/04/E3\\_Residential\\_Building\\_Electrification\\_in\\_California\\_April\\_2019.pdf](https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf)

costs. Local control of resiliency assets can lead to long-term self-sufficiency and better economic outcomes.

4. **Workforce Training and Economic Development** – Energy initiatives should enable tangible benefits to community residents by offering local jobs, training, and living wages. Integrating local economic development with energy initiatives will create a positive feedback loop maximizing economic and environmental benefits. The ZNEN Study has an opportunity to build upon other regional efforts, described in Section 3, to support economic development in Oceano and offer workforce education and training to residents.

## 1.3 Report Structure

This report is structured in the following way:

- ◆ Section 2 reviews the Study Area characteristics including environmental conditions, energy use, and water infrastructure. The section assesses the Study Team’s perceived needs for the Study Area.
- ◆ Section 3 reviews the strategies that are available to the Study Area and recommended as foundational to future energy-related initiatives.
- ◆ Section 4 outlines aspirational strategies intended to address some of the challenges facing the Study Area residents above and beyond the foundational strategies in Section 3.
- ◆ Section 5 summarizes the Study Team’s understanding of the needs of the community and provides recommended next steps.

The strategies outlined in Sections 3 and 4 address multiple objectives listed in Section 1.2. Section 5 in turn summarizes how the objectives are addressed by each strategy.

## 2 Existing Conditions

The Study Team reviewed a variety of data sources pertaining to the Oceano Study Area, depicted within the red outline in Figure 1, to begin understanding the Study Area and its population characteristics and to develop recommendations aligning with the community's needs and expectations. The Study Team reviewed in detail:

- ◆ County Planning & Building Department and Assessor's Office permit and parcel data
- ◆ Census data from the 2014 American Community Survey
- ◆ Utility data, including publicly available energy data provided by zip code or city on utility websites, as well as power infrastructure capacity maps<sup>8</sup>
- ◆ CalEnviroScreen 3.0<sup>9</sup>
- ◆ Analysis Report for EcoDistrict Development in Oceano<sup>10</sup>

Data was insufficient in some regards: parcel data has properties with missing floor areas or vintages, census block group boundaries do not align with the Study Area, and utility data is required to disassociate energy consumption from actual properties to meet statewide privacy regulations. The Study Team tailored or extrapolated findings to the extent possible to portray an accurate representation of the Oceano Study Area.

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<sup>8</sup> PG&E public data available at: [https://pge-energydatarequest.com/public\\_datasets](https://pge-energydatarequest.com/public_datasets). SoCal Gas public data available at: <https://energydatarequest.socalgas.com>. PG&E distribution resource planning maps available at: [https://www.pge.com/en\\_US/for-our-business-partners/distribution-resource-planning/distribution-resource-planning-data-portal.page](https://www.pge.com/en_US/for-our-business-partners/distribution-resource-planning/distribution-resource-planning-data-portal.page)

<sup>9</sup> CalEnviroScreen available at: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>

<sup>10</sup> Muscarella, M. (February 2018). Analysis Report for EcoDistrict Development in Oceano. Habitat for Humanity San Luis Obispo County, Supported by The California Sustainable Communities Planning Grant and Incentives Program Best Practices Pilot.



Figure 1. Oceano Study Area (red outline)

## 2.1 Study Area Characteristics

The Oceano Study Area is a resource-constrained, suburban, **renter majority, primarily single-family** neighborhood with buildings that are repaired mostly on an as-needed basis. **The population tends to be older and low-income, with a significant portion of residents whom identify themselves as Hispanic and/or Latin American and are likely Spanish speakers.** The County's Department of Planning and Building estimates that the Study Area contains:

- ◆ 684 single family housing units.
- ◆ 296 multifamily housing units (on approximately 70 parcels).
- ◆ 32 nonresidential properties, including Oceano Elementary School (part of the Lucia Mar Unified School District) as well as the Oceano Community Center.

The total 980 residential housing units in the Study Area tend to be older than residential buildings in the rest of the County. Most buildings use natural gas for space and hot water heating, and approximately 85 percent of residential dwellings do not have any mechanical cooling.



### 2.1.1 Environmental and Socioeconomic Conditions

The Study Team reviewed California EnviroScreen (CES) 3.0, utility data, and the “Local Hazard Mitigation Plan” to assess challenges faced by the Oceano Study Area. CES 3.0 estimates and combines several quality-of-life indicators to assess the overall disadvantages faced by the community. CES 3.0 designates census tracts as disadvantaged communities (DACs) if they are in the upper quartile (75 percent or greater) of the CES 3.0 scale. This official designation often increases DAC access to special state funding and resources.

According to CES 3.0 findings, the Oceano census tract is a relatively low-percentile score (35 – 40 percent), and it is not considered a DAC.<sup>11</sup> However, CES 3.0 does rank Oceano among the higher percentiles when examining poverty (69th percentile), high housing cost burden (60th percentile), exposure to pesticides (92nd percentile), contaminated drinking water (72nd percentile), low levels of academic education (79th percentile), and linguistic isolation (58th percentile).

### 2.1.2 Energy Use

**Utility data for the Study Area shows that 40 percent of the residents within the Study Area are on California Alternate Rates for Energy (CARE) utility rate**, which allows low-income customers to receive discounts on their electric and natural gas bills.<sup>12</sup> Approximately 50 percent of multifamily residences and 35 percent of single-family residences are on CARE rates.

Based on a combination of utility data and parcel data, the Study Team estimates 5.5 – 6.0 GWh of annual electricity consumption and 27,000 – 33,000 MBtu of annual natural gas consumption in the Study Area. Using the ZNE definition outlined in *Section 1 Introduction*, one potential scenario that would offset the Study Area’s annual energy consumption (including natural gas consumption) is **a 5.0 – 5.7 Megawatt (MW) solar array**. To offset this amount of consumption, a solar project approximately 20 – 25 acres in size would be required.<sup>13</sup>

### 2.1.3 Water Infrastructure

The Study Area is adjacent to and partially within a flood zone that sustains significant and frequent flooding. There are regularly flooded areas, even in moderate rain, located in the Study Area near Highway 1.

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<sup>11</sup> More information available at: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30>

<sup>12</sup> The TRC Team requested and received anonymized utility data through the PG&E and SoCal Gas *Energy Data Request* Program portals.

<sup>13</sup> TRC (October 2018) Zero Net Energy Neighborhood Feasibility, Design, and Implementation Study: Existing Conditions Report. Prepared for the County of San Luis Obispo. Available at: [https://www.slocounty.ca.gov/Departments/Planning-Building/Energy-and-Climae/Energy-Climae-Reports/CoSLO\\_Zero-Net-Energy-Neighborhood\\_Existing-Conditi.aspx](https://www.slocounty.ca.gov/Departments/Planning-Building/Energy-and-Climae/Energy-Climae-Reports/CoSLO_Zero-Net-Energy-Neighborhood_Existing-Conditi.aspx)

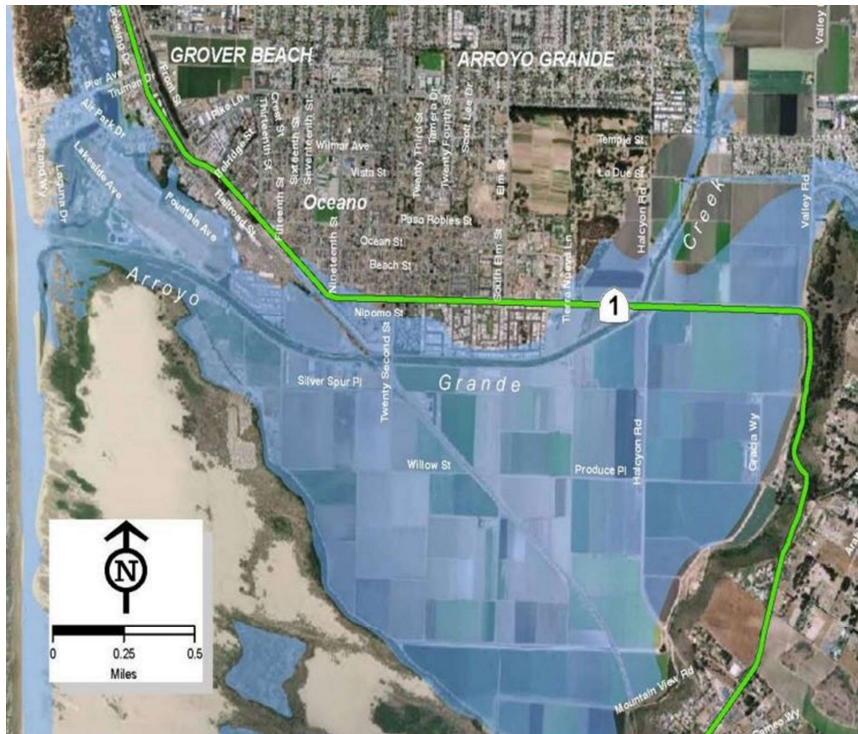


Figure 2. Oceano 100-Year Flood Plain

Over the years, Oceano has experienced levee system failures and flooding events that resulted in extensive property damage. For example, in 2001, a southern portion of the levee along the Arroyo Grande Creek was breached and there was extensive flooding of hundreds of acres of farmland. In December 2010, a storm caused over two million dollars in damages to private property and over one million dollars in damage to local government property.<sup>14</sup> Several water infrastructure and transportation programs and projects are currently underway in the Study Area - or planned for implementation in the near future. One program, the Arroyo Grande Creek Channel Waterway Management Program, includes multiple projects to be implemented in phases. Construction has begun and is expected to be completed in 2021. The first phase, being implemented by the County of San Luis Obispo Department of Public Works Utilities Division and the Flood Control District includes vegetation and sediment management to increase channel capacity, as well as erosion protection and streambank stabilization. A future phase will include raising and stabilizing levees to provide overtopping protection. A second project, the Oceano Drainage Improvements Project, began in July 2019 and will continue until February 2020. The project, being implemented by the Department of Public Works Transportation Division, includes the installation of a new storm drain system, utility relocations, road paving, and minor sidewalk improvements. These improvements will reduce the chronic flooding at the Highway 1 and 13<sup>th</sup> Street intersection, as well as reduce flooding potential to residents in the Meadow Creek Lagoon area. Runoff which has historically flooded the intersection will be routed to a new drainage basin southeast of the Oceano airport.

<sup>14</sup> More information on flooding available at:

<https://oceanocsd.org/wpcontent/uploads/2019/06/LHMP.MasterFINAL061219.pdf>

In addition, Oceano is vulnerable to dam failure. While highly unlikely, Oceano is also in the inundation area if the Lopez Dam were to fail. The inundation area includes the Oceano Elementary School, Oceano Airport, and adjacent areas. Some extreme weather and climate events have increased in recent decades and likely will exacerbate challenges faced by the Oceano community.<sup>15</sup> Due to a recent and nearly catastrophic dam failure in northern California, the State has mandated new inspections and the updating of emergency response plans for all dams in California. A new Dam and Levee Failure Emergency Response Plan is currently in development and will soon be released by the Office of Emergency Services. It will include the Lopez Dam, as well as an updated map of its hypothetical inundation area.

### 2.1.4 Needs Assessment

In summary, there are a variety of challenges within the Oceano community that will require a suite of interventions, many of which may be beyond the scope of the recommendations in this report. Based on data collection and County-led stakeholder engagement, the Study Team believes that the Study Area characteristics and challenges create the following needs that could be addressed by energy-related initiatives:

- ◆ **Reduce utility cost burdens**, as evidenced by the relatively high proportion of CARE program participants, and high housing costs and poverty ranking according to CES 3.0.
- ◆ **Institute resiliency and local control** to mitigate consequences from flooding and other natural disasters due to inadequate existing infrastructure.
- ◆ **Decarbonize buildings** to reduce exposure to indoor air pollution, decrease GHG emissions causing climate change, and comply with state regulation and goals.
- ◆ **Train workforce and economic development** to help address low levels of academic education, linguistic isolation, and high poverty ranking according to CES 3.0.

## 2.2 Key Stakeholders

This section outlines key stakeholders and engagement activities including utilities, local government, and community-based organizations.

### 2.2.1 Investor Owned Utilities

Oceano is in a dual-service utility territory, with electricity provided by PG&E and natural gas provided by the Southern California Gas Company (SoCalGas). Both PG&E and SoCalGas have portfolio wide energy programs striving to meet California climate goals (including involvement in several programs outlined later in this section) but do not offer targeted community ZNEN projects.

### 2.2.2 Local Governments

The **County of San Luis Obispo** (CoSLO) provides various public services to unincorporated areas of the county including law enforcement, social services, transportation planning and infrastructure, and energy efficiency programs. Residential and nonresidential energy efficiency programs are offered

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<sup>15</sup> More information available at: [https://earthobservatory.nasa.gov/features/RisingCost/rising\\_cost5.php](https://earthobservatory.nasa.gov/features/RisingCost/rising_cost5.php)

through the San Luis Obispo County Energy Watch Partnership (SLOEW) and the Tri-County Regional Energy Network (3C-REN):

- ◆ SLOEW is the county’s Local Government Partnership that offers a Regional Direct Install program for nonresidential customers and local government agencies. The SLOEW program is discussed further in *Section 3.1.1*.<sup>16</sup>
- ◆ 3C-REN is a portfolio of three regional energy efficiency programs including: Workforce Education and Training, Codes and Standards, and Residential Direct Install (RES DI) Programs. The 3C-REN RES DI program is discussed further in *Section 3.1.1*.

The **Oceano Community Services District (OCSD)** is a Special District that serves residents and businesses located in Oceano and Halcyon with fire protection, street lighting, and sewer and water services.<sup>17</sup> OCSD’s infrastructure and resiliency services include elements critical to the formation of a ZNEN; however, generating power and community economic development are not currently within OCSD’s charter or powers approved by the Local Agency Formation Commission (LAFCO).<sup>18</sup> A legislative amendment would need to be approved authorizing community service districts to do so.

The **Housing Authority of San Luis Obispo (HASLO)** assists the County’s lower income citizens to secure and maintain long-term housing. HASLO seeks to create safe neighborhoods by partnering with individuals and organizations to provide housing, education, and employment opportunities for families to become self-sufficient and improve their quality of life.<sup>19</sup>

A **Community Choice Aggregator (CCA)** is a program that allows local governments to procure or produce power on behalf of their residents, businesses, and municipal accounts from low or no-emission energy sources while receiving transmission and distribution services from the existing utility provider (PG&E in the Study Area).<sup>20</sup> CCAs are an attractive option for communities that want more flexible and local control over their electricity sources and less carbon intensive electricity at less expensive or similar prices to the existing utility provider.<sup>21</sup> By aggregating demand, communities have leverage to negotiate better rates with competitive suppliers and choose more renewable generation sources. Monterey Bay Community Power (MBCP) is a CCA that provides services to Monterey, Santa Cruz, and San Benito counties. In late 2018, the cities of San Luis Obispo and Morro Bay voted to join MBCP (starting in 2020) after dropping efforts to start a San Luis Obispo-based CCA. In addition, several cities within San Luis Obispo county are actively in the process of joining MBCP. If the County joins a CCA, unincorporated areas of the county, including the Study Area, will have access to CCA benefits in the future.

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<sup>16</sup> SLOEW is no longer implemented by the County of San Luis Obispo, it is implemented by the San Joaquin Valley Clean Energy Organization.

<sup>17</sup> More information on the Oceano Community Services District at: <https://oceanocsd.org/>

<sup>18</sup> More information available in State of California Government Code Section 61100.

<sup>19</sup> More information on the Housing Authority available at: <https://www.haslo.org>

<sup>20</sup> AB 117, passed in 2002, gave local governments the ability to procure power. More information available at: [https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill\\_id=200120020AB117](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200120020AB117)

<sup>21</sup> More information on Community Choice Aggregators at: <https://www.epa.gov/greenpower/community-choice-aggregation>

Local government bodies are uniquely positioned to advocate for ZNENs, but it may be politically challenging to support resource-intensive energy projects that concentrate on benefiting one neighborhood over others. However, a CCA can represent the interests of many local governments, can develop, own, manage, and administer DERs within and/or catering to the Study Area, and has expertise in power procurement. CCAs have the regulatory authority and operational flexibility to run programs covering a variety of technologies (e.g. rooftop solar, residential-scale battery storage, and electric vehicles) and achieve the goals of a ZNEN via its generation portfolio (e.g. community solar, utility-scale battery storage, and microgrids).

### 2.2.3 Community Based Organizations (CBOs)

Not for profit CBOs are critical in representing community motivations and needs. The CBOs below are active in the Study Area and have been engaged stakeholders in this ZNEN project. Their support has been critical and will continue to be necessary to ensure residents are aware of and benefit from potential projects within their community:

- ◆ **Habitat for Humanity for San Luis Obispo County (Habitat for Humanity)** is an affiliate of Habitat for Humanity International, a non-profit housing organization, and is actively working on a neighborhood revitalization initiative. The mission of this initiative is to serve more families by responding to community aspirations with an expanded array of products, services, and partnerships that empower residents to revive their neighborhoods and enhance their quality of life.<sup>22</sup> Habitat for Humanity selected the Study Area as a Focus Neighborhood as part of its Neighborhood Revitalization Program to address the variety of disadvantages within the community. Habitat for Humanity also partnered with CoSLO on another grant whose purpose was to analyze the feasibility of and help conduct outreach for establishing an EcoDistrict in the Study Area. The EcoDistrict is intended to improve the sustainability and quality of life within the Oceano Focus Neighborhood, one facet of which is energy.<sup>23</sup> In addition, HFHSLOCO will be focusing on ZNE building practices in its projects and programs, with a goal of greater energy efficiency and affordability for residents.
- ◆ The Center for Family Strengthening’s **Promotores Collaborative of San Luis Obispo County** program, which is active in the Oceano community<sup>24</sup>, is a prevention and health education model for the Hispanic community with neighbor-to-neighbor outreach activities. This program is dedicated to strengthening families through education and advocacy, and collaborates with the County to promote awareness about a variety of services for residents. The County is engaged with the Promotores Collaborative to build resident awareness of 3C-REN’s Residential Direct Install program, foster a relationship with the Oceano community, and explore opportunities for economic development and a ZNEN.
- ◆ The **Community Action Partnership San Luis Obispo (CAPSLO)** serves individuals and families through a variety of programs to achieve self-sufficiency and economic stability. These programs

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<sup>22</sup> More information on Habitat for Humanity for San Luis Obispo County at: <https://www.hfhsloco.org/building-communities-and-hope/neighborhood-revitalization/>

<sup>23</sup>Muscarella, M. (February 2018). Analysis Report for EcoDistrict Development in Oceano. Habitat for Humanity for San Luis Obispo County.

<sup>24</sup> More information on the Promotores Collaborative available at: <https://cfsslo.org/promotoreslo/>

focus on high-quality early childhood education, affordable housing, health services, education, affordable dependent care, and energy efficiency.<sup>25</sup> CAPSLO will be 3C-REN's contracted implementer of its Residential Direct Install Program.

- ◆ The **Boys & Girls Clubs of South San Luis Obispo County** was established in 1994 and serves youth ages 6-18 at three program sites, one of which is in the Study Area. The mission of The Boys & Girls Clubs is to inspire and enable young people to realize their full potential as productive, responsible, and caring citizens.<sup>26</sup>
- ◆ Oceano Elementary is in the **Lucia Mar Unified School District** and enrolls students from kindergarten to sixth grade. Oceano Elementary owns one of the largest contiguous parcels of land in the Study Area. The Oceano Community Center is owned and operated by the Lucia Mar Unified School District with the purpose of serving the members of the community. The facility hosts Parent Participation programs as well as offering rental space for a wide range of public and private events needs for community, education, business, athletic and social activities.<sup>27</sup>

## 2.2.4 Engagement Activities

The Study Team, led by County staff, conducted stakeholder engagement throughout the project period in an attempt to align recommendations with the community's needs and expectations. The Study Team participated in or conducted the following community and stakeholder engagement activities, many of which included multiple meetings over prolonged periods:

- ◆ Third Wednesday of every month - Oceano Community Coalition Meetings. Coalition members include Oceano residents, Habitat for Humanity, OCSLD, the Boys and Girls Club, CAPSLO, the Promotores Collaborative, Lucia Mar Unified School District, and CoSLO staff. This Coalition's Action Plan absorbed the recommendations provided in the "Analysis Report for EcoDistrict Development in Oceano."
- ◆ Monthly Project Management Meetings with Habitat for Humanity
- ◆ Several meetings with community residents advocating for economic development in Oceano through the use of Opportunity Zones and Enhanced Infrastructure Financing Districts
- ◆ Ongoing Technical Advisory Committee Meetings. Members consisting of local, regional, and state subject matter experts provide review and support of project deliverables
- ◆ 11/17/2018: Community Outreach Event to discuss and provide feedback regarding water, energy, infrastructure, and planning efforts in Oceano, and to provide information regarding programs and services offered by local governments and CBOs.<sup>28</sup> Nearly 100 people attended this event and over 20 organizations had booths and provided outreach materials to attendees
- ◆ 03/08/2019 and 05/02/2019: Two ZNEN Stakeholder Meetings with approximately 30 attendees each including subject matter experts, community leaders, and local government staff

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<sup>25</sup> More information on the Community Action Partnership available at: <https://www.capslo.org/index.html>

<sup>26</sup> More information on The Boys & Girls Clubs of South San Luis Obispo County at: <https://www.bgcslo.org/>

<sup>27</sup> More information on the Oceano Community Center available at: <https://www.luciamarschools.org/apps/pages/OCC>

<sup>28</sup> More information available at: <https://oceanocsd.org/calendar/oceano-community-outreach-event/>

- ◆ 06/04/2018 and Fall 2019 (TBD): Habitat for Humanity Board of Directors Presentations
- ◆ 07/24/2019: Promotores Collaborative of San Luis Obispo meeting, presentation, and beginning of on-going engagement

## 3 Foundational Strategies

Study Area residents have existing and new energy resources and opportunities available to them. Some of these resources and opportunities can be accessed or led by an individual stakeholder such as a builder owner or occupant. Others are best implemented through a collaborative effort between a variety of stakeholders including building-owners and/or occupants, community-based organizations, local governments, or utilities.

This section describes available energy opportunities – or foundational strategies - that can and should be leveraged for Study Area residents including energy efficiency, beneficial electrification, and rooftop solar programs.

### 3.1 Energy Efficiency

Energy efficiency is the priority foundational strategy from the perspective of providing energy affordability, reducing loads, improving occupant comfort, health, and safety, as well as reducing costs of other strategies such as solar, electrification, and resiliency. The Study Team reviewed existing and new energy efficiency programs available in the Study Area and assessed the energy efficiency and conservation potential of the Study Area.

#### 3.1.1 New Programs

The Tri-County Regional Energy Network (**3C-REN**) is a collaboration and joint venture among the Counties of San Luis Obispo, Santa Barbara, and Ventura. These local government agencies are partnering to design and deliver customized regional energy efficiency programs using ratepayer dollars. In June 2018, the California Public Utilities Commission authorized 3C-REN to administer three programs: Residential Direct Install (RES DI), Workforce Education and Training (WE&T), and Codes and Standards (C&S).

The RES DI program targets hard-to-reach customers including renters and multifamily properties, as well as residents who are income-qualified, live in Disadvantaged Communities (DACs), and speak English as a second language. Upon launch in late 2019, 3C-REN's RES DI program will be uniquely positioned to overcome barriers faced by previous programs and to help customers and their properties in the Study Area become ZNE-ready. The RES DI program will improve program outreach and marketing to address language and split incentive barriers for owners and residents. Recognizing that the whole-building approach is out of reach for many, the program is lowering the target to provide affordable or free installations, designed to build trust and a relationship with the participants. This strategy is intended to engage participants for a number of years and gradually lead to ZNE-ready buildings.

In addition, 3C-REN's WE&T program targeting building professionals including contractors and architects is well positioned to contribute to job creation and training, as well as economic development, within the ZNEN Study Area.



### 3.1.2 Existing Programs

In partnership with PG&E, **SLOEW** offers a regional, Direct Install Program for small and medium sized nonresidential customers and local government agencies. As of January 2019, SLOEW is no longer implemented by the County of San Luis Obispo and is now implemented by the San Joaquin Valley Clean Energy Organization. This program includes free site assessments to identify eligible measures, incentives and rebate coordination, on-bill financing, and installation. Historically, the most frequently installed measure is lighting, and a handful of projects have upgraded or repaired HVAC and refrigeration systems. Most nonresidential buildings in Oceano have low energy loads and are best served by SLOEW through its Regional Direct Install program.

Study-area multifamily residents are also eligible for electric incentives offered through **PG&E's Multifamily Upgrade Program (MUP)** implemented by TRC. MUP is utility-funded, whole-building retrofit program that requires at least 10 percent site energy improvement from installing multiple measures in different building categories (envelope, HVAC, water and appliances), for a scaling incentive to encourage deeper savings. The program opened in 2014 and has treated over 12,000 dwelling units to date. MUP is available to all PG&E customers, though no Oceano customers have participated to-date.

The **Energy Savings Assistance Program (ESA)** and **Moderate Income Direct Install Program (MIDI)** are statewide programs available for single-family and multifamily buildings and regionally implemented by CAPSLO. ESA and MIDI are utility-funded and exist to serve income-qualified customers. ESA and MIDI provide direct install upgrades such as lighting and appliances at low or no cost. Residents are eligible for the programs alone, or a multifamily property may enroll if at least 80 percent of the residents on site are eligible. If the entire property qualifies, a larger list of measures becomes available, including HVAC tune-ups and insulation. If only some of the residents qualify, individual qualifying residents are eligible for minor measures like weather stripping and appliances.

The **Low-Income Home Energy Assistance Program (LIHEAP)** is a federally funded program that weatherizes homes and is regionally implemented by CAPSLO. There are two energy efficiency offerings under LIHEAP: Energy Home Assistance (EHA) and weatherization. EHA funding is larger than weatherization, and repairs or replaces furnaces, water heaters, and cooling systems. LIHEAP's weatherization program provides site visits and tests to identify and repair safety hazards and building leaks. The program covers the cost of the site visits, the testing, permits, equipment, and post-installation inspections.

### 3.1.3 Energy Efficiency Potential

The Study Team determined the technical potential of energy savings in the Study Area by integrating simulation data into a Microsoft Excel-based Energy Profile and Conservation Potential Tool.<sup>29</sup> The Study Team then estimated realistic energy efficiency and conservation potential for the Study Area using

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<sup>29</sup> Energy Neighborhood Feasibility, Design, and Implementation Study: Energy Efficiency and Conservation Potential Report. Prepared for the County of San Luis Obispo.) Not only does this tool allow users to apply a variety of energy savings measures and penetration rates, it also allows users to apply efficiency and conservation estimates to the other communities in San Luis Obispo County and support replicability of this project.

measures from efficiency programs serving the County, building simulation software, and historical energy efficiency program penetration rates.

Based on this analysis, the Study Team made relatively conservative estimates for the efficiency potential within the Study Area. Given there are approximately 980 single-family and multifamily residential housing units in the Study Area, and **assuming that every year for five years approximately 50 units would participate in modest energy efficiency upgrades**, the Study Area would save approximately 367,000 kWh of electricity and 1.9 MBtu of natural gas annually.<sup>30</sup> **This results in an overall four percent reduction in energy consumption across the Study Area**, and 270 kW less renewable capacity required to achieve ZNE, aside from the many other benefits of efficiency programs. While the overall Study Area impacts are modest in this hypothetical scenario, the homes that would be enrolled in programs would save an estimated 20 percent of their energy (measured in kBtu). In addition to the individual benefits to the homeowners/renters of these homes, these efficiency gains also help bring down the overall cost of making a ZNEN feasible.

### 3.1.4 Recommendations

The presence of new and existing programs available to residents in the Study Area, coupled with the potential of significant energy consumption reduction on a home-by-home basis, generates an opportunity to lower energy bills, cut greenhouse gas emissions, and prepare the Study Area to become a ZNEN. It is recommended that 3C-REN and other program administrators and implementors continue to provide low-cost or free energy efficiency measures and target hard-to-reach customers in the Study Area by partnering with local community organizations to realize full potential of energy savings. In addition, the projected penetration rates and implementation period in the Energy Profile and Conservation Potential Tool can and should be revised to understand the reduction of DER assets realized through actual program penetration and influence.

To realize these savings, 3C-REN plans to and should partner with other local program implementors to leverage their existing relationships and marketing tactics and to ensure efforts are not redundant or overlapping. Because Oceano is economically disadvantaged, 3C-REN should collaborate with program implementors such as CAPSLO and TRC to combine site visits and package offerings to the residents and homeowners. They should also strategically target participants who have already worked with ESA and/or MIDI and might be interested in the bundles RES DI offers for a copay and incentive.

Additionally, property owners can be guided toward financing assistance programs for energy efficiency such as Property Assessed Clean Energy (PACE), Fannie Mae, and Residential Energy Efficiency Loans (REEL).

## 3.2 Beneficial Electrification

Electrification refers to the process of transitioning appliances, mechanical equipment, and vehicles that are fueled by fossil-fuels to instead be fueled by electricity. *Beneficial* electrification refers to a strategy

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<sup>30</sup> The energy efficiency upgrade assumptions included lighting upgrades, installation of high efficiency heating, ventilation, and air conditioning (HVAC) systems, and installation of Energy Star clothes washers, dishwashers, clothes dryers, microwaves, and refrigerators.

that implements electrification measures only when providing overall benefits to a particular community.

### 3.2.1 Measures and Benefits

Common electrification measures include heat pump space heating, heat pump water heating, electric stoves, electric clothes dryers, and plug-in electric vehicles. Electrifying these appliances could necessitate panel or branch circuit upgrades.

Transitioning the Study Area from fossil fuel appliances to electric appliances is likely to have the following benefits:

- ◆ **Decarbonization:** Carbon emissions reductions resulting from electrification assume that the electricity grid will continue to become less carbon intensive due to utility power portfolios increasing in renewable energy generation, in response to Renewable Portfolio Standards goals.<sup>31</sup> This benefit will also occur if the Study Area and its residents were part of a CCA, since CCAs typically supply more renewable generation sources. Decarbonization due to electrification is also based on the assumption that the supply of renewable natural gas is insufficient, necessitating fuel-switching to transition to all renewable sources of energy.<sup>32</sup> Currently, there are periods on the electric grid (i.e., evenings and overnight) when renewable generation sources are insufficient and electricity cannot be fully carbon-free, however these issues are mitigated by the rapid increase of renewables on California's grid and the proliferation of battery storage technology.<sup>33</sup>
- ◆ **Health and Safety:** Reducing gas combustion in buildings reduces harmful indoor air pollution, particularly in homes that do not have range vent hoods.<sup>34</sup> For example, higher indoor NO<sub>2</sub> concentrations associated with the presence of gas appliances increase asthma symptoms in children.<sup>35</sup> A recent California Energy Commission study found significant improvements in air quality due to electrification, which lead to substantial health benefits.<sup>36</sup> Furthermore, natural gas has been shown to be a major risk factor during earthquakes, causing 20-50 percent of post-

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<sup>31</sup> For more information on Renewable Portfolio Standards, visit: <http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>

<sup>32</sup> Naomi Wentworth: "Natural Gas Methane Leakage and the Potential of Renewable Natural Gas" Presentation at Redwood Energy's ZNE Conference July 2018. Available at: <https://www.youtube.com/watch?v=3tcBhaoL7Uo>

<sup>33</sup> A recent example of solar plus storage power supply comes from Los Angeles Department of Water and Power, who completed a 25-year deal with developer 8minute Solar Energy, priced at 3.3 cents per kilowatt-hour. Roth, S. (September 10, 2019). "Los Angeles OKs a deal for record-cheap solar power and battery storage." Los Angeles Times. Available at: <https://www.latimes.com/environment/story/2019-09-10/ladwp-votes-on-eland-solar-contract>

<sup>34</sup> Logue, Jennifer M., et al. "Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California", Environmental Health Perspectives, January 1, 2014. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3888569/>

<sup>35</sup> Hansel, N. et al. (October 2008). "A Longitudinal Study of Indoor Nitrogen Dioxide Levels and Respiratory Symptoms in Inner-City Children with Asthma" Environmental Health Perspectives, Volume 116, Number 10.

<sup>36</sup> Alexander, M. et al. (2019) Air Quality Implications of an Energy Scenario for California Using High Levels of Electrification. California Energy Commission. Publication Number: CEC-500-2019-049.

earthquake fire ignitions.<sup>37</sup> There are hundreds of documented gas pipeline explosions across the nation that have resulted in destroyed buildings, homelessness, and fatalities.<sup>38</sup>

- ◆ **Cost Effective:** Electric heat pump appliances can achieve much higher efficiencies than gas equipment, greater than 300 percent compared to approximately 80-90 percent for gas equipment. In many retrofit scenarios that include homes that would have installed air-conditioning, electrification of HVAC and water heating is cost effective on a lifecycle basis.<sup>39</sup> There is uncertainty in long-term electric and gas utility rates. Over time, as utility customers reduce natural gas service, gas utility rates may increase for the remaining customers who must cover a disproportionate amount of fixed costs associated with delivery and maintenance. Nonetheless, there is also potential for time of use rates to increase electricity energy costs for the customer without rate regulation as well as demand shifting. Energy efficiency and education is critical to making electrification cost-effective and beneficial, since energy efficiency can reduce the energy loads thereby minimizing any energy cost impacts on the customer.

### 3.2.2 Recommendations

Electrification of existing homes may carry high up-front costs primarily associated with electrical upgrades at the panel and branch circuits to adequately serve electric appliances. There are newer technological options for electric water heating, space heating, and cooking that can work with limited electrical capacity which can help address this issue. There is not currently an administrative vehicle supporting beneficial electrification efforts in the Study Area. The Study Team recommends the following next steps:

- ◆ **Programmatic offerings by 3C-REN and IOUs:** 3C-REN or IOU programs may be able cover a portion of these costs. A relevant program model by Sacramento Municipal Utility District (SMUD), a publicly owned utility, offers up to \$13,500 in rebates to electrify existing homes in their service territory, leveraging anticipated future revenues from customers increasing their electricity usage.<sup>40</sup> Incentive programs must be paired with workforce education and training programs to ensure appropriate implementation. Through its RES DI and WE&T program, 3C-REN will offer and incentivize electrification measures including heat pump water heaters, and train and certify contractors to sell, install, and maintain various heat pump technologies.
- ◆ **Programmatic Offerings by CCA:** CCAs have the regulatory authority and operational flexibility to run programs covering a variety of technologies (e.g. rooftop solar, residential-scale battery

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<sup>37</sup> ASCE-25 Task Committee on Earthquake Safety Issues for Gas Systems. (July 2002). SSC-02-03: Improving Natural Gas Safety in Earthquakes. California Seismic Safety Commission, State of California. Available at: [https://ssc.ca.gov/forms\\_pubs/cssc\\_2002-03\\_natural\\_gas\\_safety.pdf](https://ssc.ca.gov/forms_pubs/cssc_2002-03_natural_gas_safety.pdf)

<sup>38</sup> Korte, G. (November 2018). Pipeline Peril: Natural Gas Explosions Reveal Silent Danger Lurking in Old Cast Iron Pipes. USA Today. Available at: <https://www.usatoday.com/in-depth/news/nation/2018/11/01/natural-gas-cast-iron-pipeline-explosion-fire-leak-safety-phmsa/1362595002/>

<sup>39</sup> Energy + Environmental Economics (April 2019) Residential Building Electrification in California: Consumer Economics, Greenhouse Gases and Grid Impacts. Prepared for SCE, SMUD, and LADWP. Available at: [https://www.ethree.com/wp-content/uploads/2019/04/E3\\_Residential\\_Building\\_Electrification\\_in\\_California\\_April\\_2019.pdf](https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf)

<sup>40</sup> More information on SMUD's Home Performance Program available at: <https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency/Go-Electric-Bonus-Package>

storage, electric vehicles, etc.) and/or achieve the goals of a ZNEN via its generation portfolio (e.g. community solar, utility-scale battery storage, microgrids, etc.). Stakeholders have also expressed interest in a CCA being able to provide electrification related offerings in addition to the 3C-REN. Peninsula Clean Energy and Silicon Valley Clean Energy, for example, provide programmatic offerings for electric vehicles and heat pump water heaters, respectively.<sup>41</sup>

- ◆ **Reach Code Adoption by the County:** Reach codes are local energy ordinances that exceed state requirements. Over 50 cities and counties across the state of California are considering or have adopted reach codes encouraging electrification in new construction, including San Luis Obispo, San Jose, and Gilroy.<sup>42</sup> Preliminary research on the electrification of existing residential buildings suggests that, at a minimum, heat pump space heating would be a cost-effective code requirement in when replacing furnace plus air-conditioner systems.<sup>43</sup>

### 3.3 Rooftop Solar Photovoltaics

Rooftop solar photovoltaics (PV) are a common and easily scalable renewable energy technology. Rooftop solar provides direct utility bill reductions to energy consumers through net energy metering and is a highly cost-effective investment.<sup>44</sup> Initial PV installation costs are approximately \$3.90/W-DC installed, including an inverter replacement and excluding potential solar federal investment tax credit (ITC) savings.<sup>45,46</sup> A standard 3-kilowatt array would cost approximately \$11,700 over the next 30 years.

However, rooftop solar has some limitations. Interconnection rules limiting over generation, solar access due to roof exposure or shading, and the structural reliability of roofs in the Study Area constrain the viable amount of solar. **Even if all roofs in the Study Area were covered in solar PV, it is unlikely that they would have sufficient capacity to achieve the energy generation requirements for a ZNEN.** If 3 kilowatt arrays were installed on the approximate 800 buildings in the Study Area, that would amount to a 2.5 MW array, less than half of the total necessary array size estimated in *Section 2.1.2*. This is before any electrification efforts that will increase electricity usage beyond these estimates.

#### 3.3.1 Existing Programs

There are two state programs incentivizing rooftop solar installation:

<sup>41</sup> More information available at: <https://www.peninsulacleanenergy.com/electric-vehicles/> and <http://www.siliconvalleypower.com/for-residents/rebates/electric-heat-pump-water-heater>

<sup>42</sup> The City of San Luis Obispo is adopting a reach code that requires high efficiency thresholds for mixed-fuel buildings, thus incentivizing all-electric new construction. More information available at: <https://www.slocity.org/government/department-directory/city-administration/office-of-sustainability/climate-action/carbon-neutral-buildings>. The City of San Jose has also adopted a reach code similar to the City of San Luis Obispo's: <https://www.nrdc.org/experts/maria-stamas/san-jose-adopts-strongest-building-code-among-large-cities>

<sup>43</sup> TRC has developed this cost effectiveness analysis for East Bay Community Energy. Further information can be provided upon request.

<sup>44</sup> Frontier Energy, Inc. (July 2019) 2019 Cost-effectiveness Study: Low-Rise Residential New Construction. Prepared for Pacific Gas and Electric Company. Available at: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

<sup>45</sup> National and California solar costs available at: [https://emp.lbl.gov/sites/default/files/tracking\\_the\\_sun\\_2018\\_edition\\_final\\_0.pdf](https://emp.lbl.gov/sites/default/files/tracking_the_sun_2018_edition_final_0.pdf)

<sup>46</sup> The ITC gradually drops to 0 percent for residential projects in 2022, so projects applying sooner will receive greater benefit.

- ◆ The California Solar Initiative’s **Single-family Affordable Solar Housing (SASH)** caters to affordable single-family housing with applicants who own and live in their home with a household income that is less than 80 percent of the area median income. Many Study Area residents may qualify for this funding, as the Existing Conditions report found that the median household income of the Study Area resident was approximately 72 percent of the County median household income.<sup>47</sup> SASH offers one incentive level of \$3/W.<sup>48</sup>
- ◆ **Solar on Multifamily Affordable Housing (SOMAH)** is a new statewide program administered by Grid Alternatives that will offset the cost of solar projects on qualifying deed-restricted affordable housing properties in a DAC. All PV systems must be interconnected through virtual net metering, and residential units must be individually metered. While the Study Area is not considered to be in a DAC per CES 3.0, properties located outside of a DAC are eligible to participate if they show greater than 80 percent units that have incomes less than 60 percent of the area median income. The maximum incentive level for the portion of the PV system serving tenant units is \$3.20/W.<sup>49</sup>

### 3.3.2 Recommendations

For the most economically disadvantaged Study Area residents, SASH and SOMAH will cover a substantial portion of the upfront costs of solar PV systems and deliver direct bill benefits to residents. The Study Team recommends that these solar programs be leveraged to the fullest extent possible. Coordination between HASLO, other affordable housing organizations, Grid Alternatives, and the investor-owned utility program implementers could quickly identify eligible properties to target outreach.

However, these programs also leave implementation gaps that need to be filled to achieve wider penetration in the Study Area.

- ◆ Single-family rental properties do not currently have an applicable incentive program; any future program would need to incentivize property owners to act, particularly if they pass down utility costs to renters.
- ◆ The SOMAH program income requirements are only applicable to individually metered and very low-income residents; future programs could consider expanding offerings to higher income thresholds or master-metered properties.
- ◆ Many existing buildings in Oceano have aged considerably and may have roofs that are structurally unsuitable to accommodate solar PV. Any new program eligibility criteria should gather roof replacement information and/or include site-visits to assess roof condition.

These gaps may be addressed in future programs developed by IOUs, 3C-REN, or a potential CCA if and when they become available in San Luis Obispo county. Of the potential implementers, a CCA may be most likely to add these program offerings because they are not necessarily subject to the same state

<sup>47</sup> Existing Conditions Report, Figures 2 and 3, note that the median household income for census block group B is \$46,527 and the County of San Luis Obispo median household income is \$64,014.

<sup>48</sup> More information available at: <https://www.cpuc.ca.gov/General.aspx?id=3043>

<sup>49</sup>U.S. Department of Energy. (February 2019). Better Buildings Issue Brief: Reducing Energy Burden for Low-income Residents in Multifamily Housing with Solar Energy. Available at: [https://www.energy.gov/sites/prod/files/2019/02/f60/Issue\\_Brief\\_Low-income-multi-family-solar\\_final\\_02.26.19.pdf](https://www.energy.gov/sites/prod/files/2019/02/f60/Issue_Brief_Low-income-multi-family-solar_final_02.26.19.pdf)

cost effectiveness tests as IOUs or RENs, and thus have more flexibility in program design and benefits criteria.

## 4 Aspirational Strategies

This section outlines three potential strategies to address needs identified in *Section 2 Existing Conditions* that are not fully met with the foundational strategies explained above. The primary goal of this project is to develop replicable strategies to achieve ZNENs, however as outlined in Section 1.1, the ZNEN has an expanded set of objectives to inform a broader set of future resource allocation decisions and associated impacts.

Energy efficiency, beneficial electrification, and rooftop solar strategies, outlined in *Section 3 Foundational Strategies*, will by themselves not achieve a ZNEN community. They are intended to be combined with one or more aspirational strategies to achieve the ZNEN goal, and additional study objectives benefiting residents. The following aspirational strategies are listed in a general order of priority:

1. Community-Owned Solar PV Array
2. Storage and Microgrid
3. Fuel Cells and the Advanced Energy Community

The direct economic impacts of each of these strategies have not been surmised as part of this study. However, a recent CEC study demonstrates that the benefits of lasting, committed public and private investments in a new generation of energy production and use technologies can significantly outweigh the costs.<sup>50</sup> Furthermore, benefits are greater in DACs than in non-disadvantaged communities because of direct job stimulus in the construction and services sectors. The report states that climate policy benefits are not only inclusive to all communities but can contribute to reducing inequality.

These aspirational strategies are likely best achieved by developing community and regional partnerships by representative organizations such as the entities listed in *Section 2.2 Key Stakeholders*. Given the wide scope of income, language, and housing challenges the community is facing, support from entities that can provide expertise or other resources is necessary to rapidly realize any potential aspirational strategy.

### 4.1 Community-Owned Solar PV Array

In the DER Optimization report, the Study Team identified community solar PV as a replicable and market-ready approach to achieve ZNEN, in addition to rooftop solar.<sup>51</sup> When compared to on-shore or off-shore wind and biomass industries, the solar PV industry is well-established to enable scalable, community-led DER deployment.<sup>52</sup> Community solar arrays larger than 500 kW have a median price of \$2.10/W in California, and a median of \$17/kW per year in fixed operation and maintenance costs. To

<sup>50</sup>Berkeley Economic Advising and Research. (June 2018) Exploring Economic Impacts in Long-Term California Energy Scenarios. Prepared for the California Energy Commission. Available at: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=223754>

<sup>51</sup> For the purposes of this project, the Study Team defines a Community Solar PV System as a centralized solar PV generation facility that is grid connected and allows multiple customers to share the output from the facility.

<sup>52</sup> TRC (December 2018). The Role of Community Distributed Energy in Zero Net Energy Compliance. Prepared for PG&E. Available at: [http://www.calmac.org/publications/PGE\\_ZNE\\_DER\\_Phase\\_1\\_Project\\_Report\\_FINAL\\_CALMAC-PGE0409.01.pdf](http://www.calmac.org/publications/PGE_ZNE_DER_Phase_1_Project_Report_FINAL_CALMAC-PGE0409.01.pdf)



generate enough electricity to offset the energy consumption of the Study Area, the Study Team determined that a 5.0 – 5.7 MW array will be necessary to offset energy use (without accounting for electrification). This array will need to be sited on roughly 20 – 25 acres and will cost roughly \$11.5 million for construction. There are several considerations associated with developing a community solar PV array:

- ◆ **Limited Economic Impact in the Traditional Regulatory Framework:** A California Public Utilities Commission Green Tariff Shared Renewables (GTSR) bill, passed on September 28, 2013, required utilities to provide renewable energy power options for their customers.<sup>53</sup> In response, PG&E has provided PG&E’s Solar Choice program and the Regional Renewable Choice program, but the Study Team found that both of these rate choices would result in more expensive utility bills for the Study Area residents and that the latter program is not currently available. Furthermore, PG&E’s current tariffs require that the customer size their solar generation to not exceed their annual electric consumption; therefore, sizing to account for gas consumption would generally not be permitted.<sup>54</sup> The Study Team did not find a traditional regulatory framework for a community scale renewable resource to deliver on-bill economic benefits for community members and enable ZNEN.<sup>55</sup>
- ◆ **Siting:** In the DER Optimization report, the Study Team identified hard constraints and suitability criteria for accommodating community solar PV arrays, analyzed Oceano-area parcels for suitability, and identified over 130 parcels of land and over 1,000 acres of potentially viable land. These sites must be evaluated further for suitability, including but not limited to value proposition discussions with the land owner, distance from the Study Area, infrastructure upgrades necessary to interconnect, and permitting. The navigation of these complex suitability criteria may require further guidance from siting experts.
- ◆ **Role of CCAs:** CCAs present options to supply 100 percent carbon free power (supplied by a mix of renewable and non-renewable sources), and 100 percent renewable power (which is also carbon free) to the Study Area in the near future if the County joins MBCP. Current MBCP rates for 100 percent renewable electricity would result in a small rate increase (\$0.01/kWh) for Study Area residents who are currently on PG&E’s base rate.<sup>56</sup> However, it is important to note that MBCP’s 100 percent carbon-free power would not currently result in a rate increase compared to PG&E’s base rate.

#### 4.1.1 Traditional Ownership and Financing

The DER Optimization report outlined several financing and ownership models common in community solar development, such as power purchase agreements and opportunity zones, only a few of which

<sup>53</sup> More information on the GTSR bill available at: [http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140SB43](http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB43)

<sup>54</sup> Based on the Existing Conditions Report findings, the Study Team estimates that 30 percent of the necessary renewable generation to achieve ZNE would offset natural gas consumption.

<sup>55</sup> TRC (December 2018). The Role of Community Distributed Energy in Zero Net Energy Compliance. Prepared for PG&E. Available at: [http://www.calmac.org/publications/PGE\\_ZNE\\_DER\\_Phase\\_1\\_Project\\_Report\\_FINAL\\_CALMAC-PGE0409.01.pdf](http://www.calmac.org/publications/PGE_ZNE_DER_Phase_1_Project_Report_FINAL_CALMAC-PGE0409.01.pdf)

<sup>56</sup> PG&E / MBCP Joint Rate Comparisons. Available at: [https://www.pge.com/pge\\_global/common/pdfs/customer-service/other-services/alternative-energy-providers/community-choice-aggregation/mbcprateclasscomparison.pdf](https://www.pge.com/pge_global/common/pdfs/customer-service/other-services/alternative-energy-providers/community-choice-aggregation/mbcprateclasscomparison.pdf)

were ideally suited to serve the needs of this project. Privately-owned large solar arrays or utility-scale arrays owned by wholesale developers have a high potential for cost effectiveness when paired with currently available utility tariffs and/or power purchase agreements that appropriately compensate for energy production. However, as a result of regulatory barriers, California currently lacks many successful examples of large community-owned solar, although there are many in other states.<sup>57</sup> The few examples of community-scale solar are present in publicly owned utilities such as Palo Alto Utilities, Los Angeles Department of Water and Power, and Sacramento Municipal Utility District (SMUD). SMUD’s Solar Shares program has been expanded to include nearly 11 MW of additional local shared solar capacity for commercial customers.<sup>58</sup>

#### 4.1.2 Cooperative Ownership and Financing

One potential cooperative has emerged from the Sustainable Economies Law Center (SELC), a California-based organization that provides legal tools for community resilience, known as People Power Solar Cooperative (“People Power”).<sup>59</sup> The mission of People Power is to create a just and inclusive transition to renewable energy by enabling everyone to own and shape our energy future. This model is designed to be decentralized and allows a variety of implementation approaches appropriate to specific community and/or project needs, but generally involves owner-members acquiring shares of the cooperative in return for dividends, encouraging that a portion of the dividends are reserved for parallel efforts to build community resilience.

Many types of financing sources could be available with this model, including institutional finance (e.g., credit unions or philanthropies) or tax equity financing. People Power illustrates the potential communities possess when working outside of traditional regulatory frameworks to participate in the transition toward the clean energy economy and broader empowerment. Figure 3 depicts the various types of owners in the People Power model. It is possible to have more than one type of owner, and while all types of owners receive dividends, the flow of resources to the Anchor Owners are intended to be higher to support parallel efforts for a just transition to clean energy.

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<sup>57</sup> Other states in the U.S. do offer tariffs that allow off-site solar to serve multiple customers that could also enable the Study Area to benefit from a community solar system easily. Colorado, Maine, Massachusetts, Washington, Vermont, and Virginia currently have two metering options for community solar projects: group billing and virtual net metering. More information available at NREL’s report “Emerging State Policies to Support Community Solar:” <https://www.nrel.gov/docs/fy11osti/49930.pdf>

<sup>58</sup> TRC (December 2018). The Role of Community Distributed Energy in Zero Net Energy Compliance. Prepared for PG&E. Available at: [http://www.calmac.org/publications/PGE\\_ZNE\\_DER\\_Phase\\_1\\_Project\\_Report\\_FINAL\\_CALMAC-PGE0409.01.pdf](http://www.calmac.org/publications/PGE_ZNE_DER_Phase_1_Project_Report_FINAL_CALMAC-PGE0409.01.pdf)

<sup>59</sup> More information on People Power Solar Cooperative available at: <https://www.peoplepowersolar.org/>. As of March 2019, People Power launched the first cooperatively owned residential solar PV array in California, a 7-kW array on the roof of a homeowner who earns revenue in the form of bill payments and generates dividends to cooperative owner-members. The Sustainable Economies Law Center is currently focusing resources on making People Power successful in the East Bay Area but hope to expand beyond in the future and support others in their efforts. With the support of legal experts such as those at SELC, local leaders and organizations may be able to identify pilot projects that build community connections, foster expertise, and build momentum towards a community-led community solar PV array.



Figure 3. Different Types of Owners under People Power Model (courtesy: People Power Bylaws)

### 4.1.3 Recommendations

A community solar PV array represents the most technically feasible solution to achieving ZNEN for the Study Area and direct economic benefits to community members. However, the economic details of the community solar solution depend on several factors including the ownership structure, alternative sources of carbon free electricity, and the scale and adoption rate of electrification.

The Study Team recommends that Oceano-area residents and community leaders, including CBOs and the County, examine the feasibility of the People Power model for implementation in the Study Area and nearby region. Based on the Study Team’s knowledge, a well-established CBO such as Habitat for Humanity may serve fittingly as Anchor Owners in the People Power model. Residents are very likely to have on-bill benefits when compared to 100 percent renewable energy delivered by CCAs or PG&E (via the GTSR program).

In a context where a CCA could supply 100 percent carbon free electricity to the Study Area, the community’s motivation for achieving ZNEN may be diminished, since carbon neutral power has many of the same environmental benefits as renewable power. However, even 100 percent carbon free electricity will not be able to offset natural gas usage in the community, so if carbon neutrality is the goal for the community, community solar PV array would be required to offset natural gas usage even with the CCA (assuming insufficient renewable natural gas distribution). The size of this array may be further diminished by future electrification (*Section 3.2*) and/or rooftop solar penetration (*Section 3.3*).

## 4.2 Battery Storage and Microgrid

Given that flooding occurs in the Study Area even during light rainstorms, it is likely that major rainstorm events will cause substantial flooding again in the future. Combined with an ever-present risk of earthquakes and aging building structures, there is a possibility that major weather and/or catastrophic events may leave Study Area residents without a home for an extended period.

Oceano Elementary and the Oceano Community Center are located on relatively higher ground than the remainder of the Study Area, have newer construction, and have adequate space to accommodate hundreds of people in an emergency. These two buildings would be ideal critical facilities and/or crisis mediation centers, particularly if children are at school during a natural disaster.

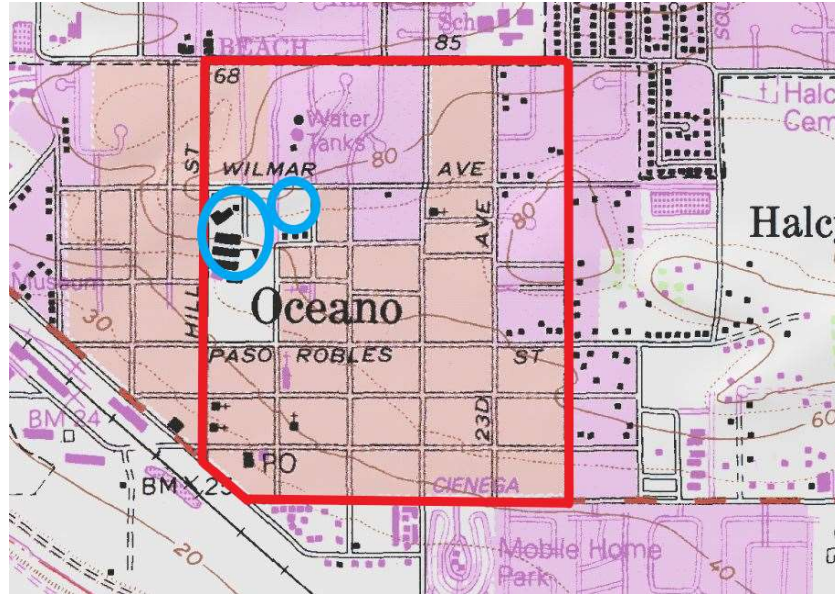


Figure 4. Oceano Elementary School and Oceano Community Center are approximately at 60-80 feet elevation while other areas in the Study Area are lower as low as 30 feet elevation (courtesy: TOPOZONE)

#### 4.2.1 Measures and Benefits

Flooding, earthquakes, and public safety power shutoff (PSPS) events could eliminate power supply to the Study Area.<sup>60</sup> A resilient critical facility or crisis mediation center ensures building services, such as space heating, water heating, and refrigeration, are available during a long-term power outage. Energy resiliency involves two technology solutions:

- ◆ **Battery Storage:** Batteries can be supplied by a large variety of possible technologies and vendors, though the overarching intent is to store electrical energy from a renewable generation facility (e.g., rooftop solar PV) or the grid for use at a later time. Generally, batteries are about 90-95 percent efficient, experiencing efficiency losses during both charging and discharging. Appropriate battery sizing for the school application would likely gang several residential-scale systems together (e.g., Tesla or Sonnen products, typically in sizes from 3 – 15 kWh). The overall cost of batteries is declining and currently costs approximately \$656/kWh, including replacements and incentives.<sup>61</sup> Battery prices vary widely depending on system technology, design, installer, and customer characteristics.
- ◆ **Microgrid Control:** Once solar PV and energy storage are installed, additional microgrid controls can allow for autonomous operation, even during utility grid outages. Microgrids serve as a resiliency measure particularly suitable for critical operations facilities because they allow buildings operators to “island” a facility thereby maintaining power during grid outages and guaranteeing the ability to provide critical services. ZNE stakeholder feedback has suggested

<sup>60</sup> More information on PSPS available at: [https://www.pge.com/en\\_US/safety/emergency-preparedness/natural-disaster/wildfires/public-safety-power-shutoff-faq.page](https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/public-safety-power-shutoff-faq.page)

<sup>61</sup> Frontier Energy, Inc. (August 2019) 2019 Cost-effectiveness Study: Low-Rise Residential New Construction. Prepared for Pacific Gas and Electric Company. Available at: <https://localenergycodes.com/content/2019-local-energy-ordinances/>

that microgrid controls add about 25 percent to the cost of a community solar PV plus battery storage project.

Resiliency benefits are challenging to quantify. Nonetheless, many commercial and public entities are electing to install solar plus battery storage as well as microgrids – especially those prone to power outages and/or wildfire risks. In Monterey County, the Santa Rita Union School District was able to implement battery solutions through a power purchase agreement on several school sites. The school district changed utility rates as a result of rooftop solar being added onto the sites, thereby lowering demand charges and providing sufficient cost effectiveness justification to proceed with the project.<sup>62</sup>

#### 4.2.2 Recommendations

The Study Team recommends that Lucia Mar Unified School District review the Santa Rita Union School District approach and determine applicability to the Oceano Elementary School or Community Center sites. As necessary, expert support from the County or local utilities could help Lucia Mar navigate the financing and technical challenges of realizing a resilient school campus or community building that doubles as critical facility and/or crisis mediation center.

### 4.3 Fuel Cells and the Advanced Energy Community

Fuel cells are a proven technology that has not yet achieved commercial scale adoption. A long-term and idealized vision of the Study Area could involve new technologies, such as fuel cells, to support local economic development while delivering a ZNEN and various energy and non-energy related benefits. The proximity of California Polytechnic State University in San Luis Obispo may provide the on-site technical services necessary to support an advanced energy community.

#### 4.3.1 Measures and Benefits

Fuel cells are devices that generate electricity by means of a chemical reaction fueled typically by hydrogen or natural gas. Because of the modular nature of fuel cells, they can be stacked into arrays that allow for scalable power outputs, enabling them to power anything from a single lightbulb to a whole community. Fuel cells work well in tandem with renewable energy sources like solar and wind because energy overproduction can be used to produce hydrogen, which can be stored and, in turn, reconverted into electricity and be used to offset peak energy demand.

The most important consideration for the deployment of a fuel cell system, is the availability of a reliable fuel source:

- ◆ **Hydrogen:** Hydrogen can be bought on the market or produced on site using an electrolysis hydrogen generator. The hydrogen is stored in pressurized tanks and pumped through the fuel cell array whenever electricity production is required. Because hydrogen has a low global warming potential (GWP) and the only output from their electricity production is water, fuel cells are a clean energy technology.
- ◆ **Natural Gas:** Natural gas is readily available through existing utility infrastructure and can be easily procured. Natural gas can also be stored in pressurized tanks and pumped through the

<sup>62</sup>Ecomotion (September 2018). Creating and Financing Six, Carbon-Free Microgrids for Santa Rita Union School District. Available at: <https://ecomotion.us/creating-and-financing-six-carbon-free-microgrids-for-santa-rita-union-school-district/>

fuel cell array whenever electricity production is required. However, natural gas has a high GWP, and to produce electricity, natural gas-powered fuel cells undergo a steam reformation process that, in addition to water, emits carbon dioxide. To mitigate or offset carbon emissions, renewable natural gas would need to be procured in order to meet California's long-term emissions reduction goals.

The Huntington Beach Advanced Energy Community (AEC) case study is a CEC grant-funded research project partnership involving University of California Irvine (UCI) Advanced Power and Energy Program and the City of Huntington Beach, as well as consultants and local utilities.<sup>63</sup> The community selected for the project is disadvantaged and low income, and it is located in the Oak View neighborhood, which contains residential, commercial, industrial, public facility buildings.

The AEC vision incorporates solar PV, energy efficiency measures, battery, thermal and hydrogen storage, electric vehicle car-sharing, and microgrid energy management. Key goals of the project are to identify how advanced energy technologies that minimize cost and carbon emissions can be replicable throughout California. The research team found that commercial and industrial buildings within the Oak View neighborhood generally require net-import of electricity, while residential buildings would generally net-export. An advanced energy community, including solar-powered microgrid, hydrogen fuel cells, and an in-depth grid capacity analysis to minimize interconnection fees, will be constructed over the next six years.

### 4.3.2 Recommendations

The Huntington Beach AEC model has many similarities to this project, both in terms of neighborhood profile and in energy goals. Fuel cells and/or other emerging energy technologies require customized design engineering and manufacturing services and are thus anticipated to be higher cost than community-scale solar. However, additional grant funding and financing opportunities are available for innovative, early development technologies, especially in low-income and disadvantaged communities. The Study Team recommends that research teams at Cal Poly San Luis Obispo seek potential siting opportunities and grant funding, likely with support of consultants, local utilities, and local government. Given the relative geographic proximity of the AEC research team, the Study Team recommends that interested parties contact project managers at the UCI to understand what information may be leveraged to foster an AEC within the Study Area to achieve a ZNEN.

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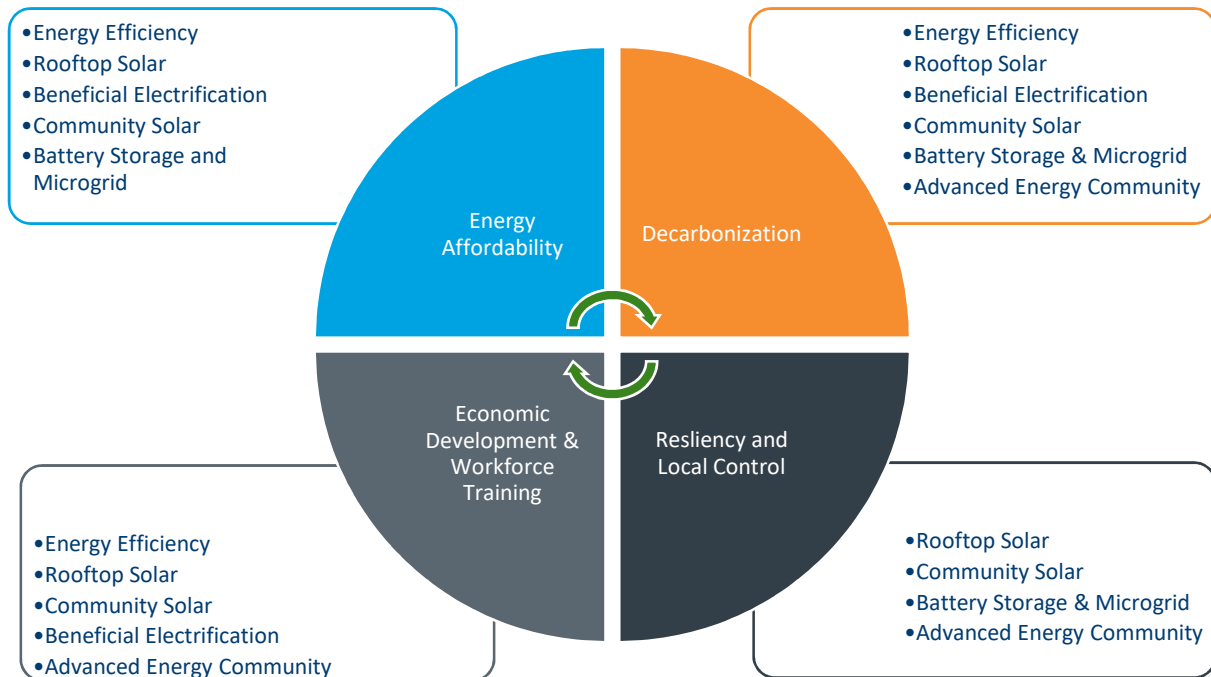
<sup>63</sup> The project is divided into two phases. Phase 1 involves \$1.9M in CEC grant funding to determine the feasibility of developing a solar powered microgrid within the low-income community of Oak View. Phase 2 includes construction of the advanced energy community with \$8M in CEC grant funding and \$8M cost-sharing. More information available at: <https://huntingtonbeachca.gov/residents/sustainable-hb/advanced-energy-community/> and <https://www.lgc.org/wordpress/wp-content/uploads/2017/06/Huntington-Beach-Advanced-Energy-Community.pdf>

## 5 Key Takeaways and Next Steps

As outlined both in *Sections 1.2* and *2.1.4*, the Study Team believes that residents in the Oceano Study Area need support in energy affordability, instituting a resiliency plan including local control of power generation assets, decarbonization, and economic development including workforce training. This ZNEN study originally intended to address these objectives primarily by developing recommendations focused on energy efficiency and renewable generation strategies. During the study, several other strategies have been identified as necessary to meet the objectives of the community and support the ZNEN effort. This section serves to underline how the strategies support the objectives and highlight next steps.

An illustration of how the fundamental and aspirational strategies can address the Study Area’s energy-related needs is included in in Figure 4, followed by further description.

Figure 4. Strategy Summary



These strategies are not mutually exclusive and should be considered in combination. Note that while there is currently no CCA serving the Study Area, the Study Team has included them as a potential stakeholder based on feedback from stakeholders.

**Energy Efficiency** programs can leverage existing low and no-cost measures as well as future improvements to existing programs run through 3C-REN. Coordinating 3C-REN with other regional program implementers can expand the reach of 3C-REN and produce sustained energy load reductions. 3C-REN’s WE&T program targeting building professionals is well positioned to contribute to job creation, training, and economic development.

- ➔ **Objectives Supported:** Energy Affordability, Decarbonization, Economic Development.
- ➔ **Next Steps:** Coordinate 3C-REN with regional program implementers, targeting program offerings to the Study Area.

**Beneficial Electrification** has been proven to be cost effective in homes with existing air conditioning, particularly when paired with energy efficiency and rooftop solar. Cost effectiveness will improve long-term if and when natural gas usage is reduced at a societal level. Beneficial electrification offers direct carbon reduction and tangible health benefits by reducing indoor air pollutants. The 3C-REN program will offer training and certification for contractors to sell, install, and maintain heat pumps.

- ➔ Objectives Supported: Energy Affordability, Decarbonization, Economic Development.
- ➔ Next Steps: 3C-REN in coordination with any potential CCA should explore programmatic offerings that combine beneficial electrification with energy load reduction measures. The County should explore options to support this through researching and adopting local reach codes that promote energy efficiency, electrification, and renewables.

**Rooftop Solar** is the most direct measure for property owners to reduce energy bills, subject to economic and technical feasibility. Currently available incentives for rooftop solar can be leveraged to reduce utility costs. In lieu of CCA availability, rooftop solar would be the most economical approach for building owners to reduce carbon emissions. With the potential for future storage and microgrid controls at the building level, rooftop solar enables a measure of resilience for individual buildings as well as potential for local economic development for installers.

- ➔ Objectives Supported: Energy Affordability, Decarbonization, Resiliency and Local Control, Economic Development.
- ➔ Next Steps: HASLO, affordable housing organizations, Grid Alternatives, and the investor-owned utility program implementers should coordinate to quickly identify eligible properties and target outreach. IOUs, RENs, or potential CCAs could design new programs to address implementation gaps.

**Community Solar** addresses energy affordability and local control by providing a community owned asset that has the potential to be more cost-effective due to economies of scale. If a co-operative approach is implemented with worker owners a community solar array will support local economic development.

- ➔ Objectives Supported: Energy Affordability, Decarbonization, Resiliency and Local Control, Economic Development.
- ➔ Next Steps: The County should coordinate with community leaders and CBOs operating in Oceano to evaluate the feasibility and suitability of the People Power community solar model. Interested parties should identify leadership roles and engage legal counsel.

**Battery Storage and Microgrid** strategies address safe shelter in case of disaster and manage utility costs. When grid services are disrupted due to natural or other disasters, backup options can mitigate economic losses or even loss of life. Solar plus storage has been demonstrated to improve bill outcomes at the Santa Rita Union School District. Storage can significantly support decarbonization by using stored energy during times when renewables are not available, making electricity is carbon intensive.

- ➔ Objectives Supported: Energy Affordability, Decarbonization, Resiliency and Local Control.
- ➔ Next Steps: The Oceano community includes the Oceano Elementary and the Oceano Community Center which are potential sites for a solar plus battery plus microgrid solution to address resiliency. The Lucia Mar Unified School District should review the model used by the



Santa Rita Union School District to determine applicability to Oceano Elementary or Community Center.

**Fuel Cells and the Advanced Energy Community** represent an idealized vision for the Study Area that spurs economic development by coupling a research entity with Study Area community members to testbed emerging technologies that deliver energy benefits. Fuel cells can deliver many of the same benefits of energy storage by reducing utility costs, reducing energy consumption during carbon intensive periods, and providing a local, stable, and long-term energy generation capability.

- ➔ **Objectives Supported:** Decarbonization, Resiliency and Local Control, Economic Development and Workforce Training.
- ➔ **Next Steps:** The Study Team recommends that the County coordinate with research teams at Cal Poly San Luis Obispo and other project partners to seek grant funding. Interested parties can contact project managers at the UCI to understand what information may be leveraged to foster an AEC within the Study Area. Community leadership must be engaged to seek potential siting opportunities.

The future vision for the community, whether it is a Zero Net Energy Neighborhood or any other energy initiative, should comprehensively address the key objectives outlined in *Section 1.2*. This report has outlined how the ZNEN initiative can address these objectives by detailing a broad scope of strategies, related stakeholders, and suggested next steps. While any strategy employed should have the blessing and integration of the community itself, the Study Area would greatly benefit from the broader action of committed regional stakeholders to address current socioeconomic challenges.