



EAST BAY
COMMUNITY
ENERGY

Notes regarding submitting comments on this Draft Work Product:

Comments are Due June 20, 2018.

Comments shall be no longer than 5 pages.

Comments should be submitted to LDBPcomments@ebce.org

Job, Labor Income, and Financial Impact Analysis of Community Benefit Strategies

for
East Bay Community Energy

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I. INTRODUCTION

STUDY PURPOSE

The East Bay Community Energy (EBCE) Community Choice Aggregation (CCA) program was created by citizens of Alameda County to provide customers with a choice regarding their electricity provider, and to deliver a range of social, economic, and environmental benefits to the communities it serves. CCA's are government agencies that are established to provide electricity and energy services to residents and businesses in their service territory. Because they are nonprofit organizations run by elected officials, CCA's are designed to be responsive to community needs and goals. As one of California's largest CCA's, EBCE has made strong commitments to prioritizing local development of clean energy resources and to delivering significant community benefits in the form of lower or competitive electric rates, local economic development/job creation, greenhouse gas (GHG) reductions, and cost-saving energy efficiency investments.

A multi-faceted Consultant Team was retained by Alameda County and EBCE to formulate a Local Development Business Plan (LDBP) to inform and guide EBCE's actions in support of local energy development. This team, the LDBP Consultant Team, includes a number of consultants, each with specialized industry knowledge and experience. ALH Urban & Regional Economics (ALH Economics) is a member of the LDBP Consultant Team and was specifically charged with assessing the local economic and financial impacts of the program recommendations prepared by the Consultant Team. The purpose of this analysis is threefold, as follows:

- To evaluate the programs individually, to identify their job and labor income impacts in Alameda County and financial repercussions for EBCE;
- To provide a relative comparison of impacts among different program options; and
- To provide inputs to analysis evaluating scenarios for a mix of options or strategies pursued by EBCE in its service delivery program.

Ultimately, the study findings will provide a foundation for economic and financial impact findings incorporated into the LDBP prepared for EBCE as the culmination of project engagement.

STUDY OPTIONS/STRATEGIES

The LDBP Consultant Team has identified numerous community benefit investment options/strategies for EBCE Board consideration. In no particular order, the options/strategies are as follows:

1. Feed-in Tariff (FIT) programs for solar and wind electricity generation
2. Net Energy Metering (NEM) programs for solar and wind electricity generation
3. Direct Investment in solar/wind electricity production
4. Energy Efficiency programs for commercial/industrial, residential, and CARE customers
5. Energy Storage Systems (individual to utility scale investments)

6. Demand Response programs to reduce peak demand
7. Electric Vehicle Incentives (autos, buses, trucks, and charging infrastructure)
8. Natural Gas Fuel Switching programs to encourage electric appliance uses
9. Local Development Fund to subsidize local distributed energy resource (DER) deployment
10. Utility Scale Solar and Wind
11. Reduced Retail Electricity Rates for all customers

These 11 options/strategies can be grouped into four program typologies, each with different levels of impact on EBCE’s finances, and each achieving a different service goal. These typologies and the corresponding options/strategies are as follows:

Recommended LDBP Options/Strategies by Program Typology				
Option/Strategy	Program Typologies			
	Local Energy Generation	Energy Load Shift	Customer Savings	GHG Reduction
1. FIT (solar and wind)	X			
2. NEM (solar and wind)	X		X	
3. Direct Investment (solar and wind)	X			
4. Energy Efficiency		X	X	X
5. Energy Storage Systems		X	X	X
6. Demand Response		X	X	X
7. Electric Vehicle Incentives		X		X
8. Fuel Switching		X		X
9. Local Development Fund	X			
10. Utility Scale Solar and Wind	X			
11. Reduced Retail Electricity Rates			X	

Source: LDBP Consultant Team.

Notably, most options/strategies straddle two typologies.

This report summarizes the local economic benefits and EBCE financial costs/savings of illustrative investments for each option/strategy. Examples include the following: 5 MW of solar electricity FIT contract; \$5.0 million investment in Energy Storage; \$1.0 million annual investment in Electric Vehicle subsidy; Fuel Switching; Local Development Fund; and a 1.5% Reduction in Retail Electricity Rates as compared to PG&E. Other recommended program options are presented in each program section.

KEY STUDY RESOURCES

Baseline Pro Forma

Since the filing of East Bay Community Energy’s Implementation Plan, EBCE has been refining their financial projections to account for changes in energy prices, load forecast, and PG&E rates. In January, the EBCE team shared a draft of its pro forma financial statement with ALH Economics to better understand the key factors affecting future EBCE revenues and operating

expenses. For the purpose of this study, the Consultant Team used this January version of the pro forma financial model. With an initial EBCE operations start date of June 2018, it is expected that full phase-in will be completed by November 2018. During the 2017-2019 planning and startup phases, EBCE will need to incur \$30 million in debt.

With the expected customer transfer from PG&E completed, the proforma indicated that EBCE should be generating approximately \$440 million in annual revenue, based on an average retail price of \$0.072 per Kwh in 2018 dollars. EBCE will need to acquire approximately 6,200 GWh of electricity each year.¹ Based on the pro forma, the expected electricity supply will cost approximately \$370 million, or an average of approximately \$0.06 per Kwh, before implementation of the LDBP investment program recommendations. (For purposes of evaluating the marginal fiscal impact of energy investment options/strategies it is important to note that actual electricity costs vary significantly by source, time of day, and season).

EBCE administrative overhead, PG&E fees and data management is estimated at \$20 million per year, yielding a net annual operating surplus of approximately \$50 million, before LDBP recommendations, debt service and reserve fund contributions, as well as an expected 2-3% inflationary increase in retail rates and costs.

The proforma model assumes that during the first three full years of operation, EBCE will need to pay back the \$30 million in loans with interest and build a cash/credit reserve of \$75 million by 2021, thus reducing the available surplus to approximately \$38 million for the cumulative 2019-2021 period. By 2022, EBCE is expected to have an annual surplus in excess of \$50 million per year to invest in LDBP recommendations and rate reductions.

Analytic Approach

ALH Economics structured the financial analysis of each program to show the net change from the baseline pro forma. Therefore, a program that reduces electricity consumption and costs to customers is treated the same as a loss of revenue (or profits) to EBCE (compared to the baseline).

Key Assumptions

ALH Economics worked with LDBP Consultant Team members to develop key economic and financial assumptions related to capital costs, operating costs, and operational benefits from various levels of investment in the identified options and strategies. Internal Consultant Team collaboration was also critical to estimating local workforce benefits (jobs, wages) from one-time direct installation and ongoing maintenance, plus indirect benefits for Alameda County from economic multiplier effects. Both Consultant Team documents and in-depth discussions and interchanges with Consultant Team members provided additional information relevant to the options/strategies.

None of the inputs included in this analysis originated with ALH Economics. Instead, ALH Economics worked with exogenous inputs or illustrative examples provided by others, including

¹ This figure could increase substantially when Standby accounts are taken into consideration, with higher costs and revenues.

the magnitude and costs of the illustrative examples. Most notably, these members included the Consultant Team members Optony Inc., Clean Coalition, The Offset Project, and Special Team Advisors Betony Jones and Gary Calderon. In addition to individual consultation, the following background documents prepared by Consultant Team members were used as resource documents:

- East Bay Community Energy Feed-in Tariff Design Recommendations, Clean Coalition, August 2017
- Agency as Developer Strategy, Optony Inc., October 2017
- Net Energy Metering (NEM) Strategy, Optony Inc., January 2018
- Energy Efficiency Assessment, The Offset Project, January 2018
- Forthcoming document on Fuel Switching, The Offset Project, March 2018
- Levelized Cost of Energy Assessments, Optony Inc., October 2017 and March 2018

As of March 2018, these documents can all be found on the EBCE website under the Local Business Development Plan section and will ultimately be provided to EBCE as part of a complete package of Consultant Team LDBP work products.

OVERVIEW OF JOB AND LABOR INCOME IMPACT ANALYSIS

An important consideration of future EBCE investment decisions is the desire to increase local employment opportunities for skilled and unskilled labor. Notably, while the capital investment involved in new energy production and storage is substantial, the majority of the cost is attributable to capital equipment purchases that occur outside Alameda County and the State of California. Therefore, the local job benefits of a new PV solar system or windmill are limited to the installation costs, as well as on-going annual impacts related to energy generation and maintenance.

To conduct the analysis, an IMPLAN model was built specific to Alameda County. The resulting jobs and labor income estimates are local to Alameda County. The modeling program is not refined enough to identify the specific location of the jobs within Alameda County. Therefore, the jobs identified are countywide, with the geographical distribution to be determined based upon program implementation and labor availability. Further, the direct hourly wages presented reflect journey level prevailing wages for Alameda County from the California Department of Industrial Relations unless otherwise noted. In addition to wages, these prevailing wage workers typically receive benefits, which include health and welfare, pension, vacation and holiday pay, training, and other payments. Use of non-union labor would result in lower wage levels than are presented in the analysis. Different wages would not affect the total number of estimated direct jobs, but lower wages would likely reduce the number of induced jobs created.

For some options, there are on-going customer savings that translate into increased spending by customers at local vendors and thus increased induced employment, based upon IMPLAN household spending multipliers.

In general, job and labor income impacts can be expressed in the following ways:

- **Direct Impacts** – Jobs and labor income related to installation and maintenance refer to work that is generally performed on-site. For commercial, industrial, and utility-scale installations, these wages typically reflect prevailing wage levels in Alameda County. Installation jobs occur during the construction phase and maintenance jobs occur during ongoing operations.
- **Indirect and Induced Impacts** – Indirect jobs and labor income represent purchases from local suppliers within Alameda County of goods and services related to installation or on-going operations and maintenance. Induced jobs represent those created in the local economy when direct and indirect workers spend their earnings, or jobs related to customer savings.
- **Total Impacts** – Total job and labor income impacts comprise all direct, indirect, and induced impacts.

The job and labor income impact methodology is described in more detail in Section III. Labor income is defined as employee compensation (wages, salaries, and employer and employee contributions to social insurance) plus proprietor income (business owner income).

REPORT STRUCTURE

In addition to this Introduction, this report includes two other major sections. These include:

- II. Illustrative Job, Labor Income, and Financial Benefits; and
- III. Job and Labor Income Impact Methodology.

Section II includes the specific job, labor income, and financial impact findings for the 10 options/scenarios identified by the Consultant Team, while Section III provides support detail regarding the approach toward assessing the job and labor income impacts. All dollar figures included in the report comprise 2018 dollars.

This report is subject to the accompanying Assumptions and Limiting Conditions.

II. ILLUSTRATIVE JOB, LABOR INCOME, AND FINANCIAL BENEFITS

INTRODUCTION

This report section briefly describes the key EBCE LDBP Consultant Team recommended options/strategies and provides illustrative job, labor income, and financial impact analyses for standardized units of investment. The options/strategies were all identified and analyzed by other members of the Consultant Team in prepared background documents that have been submitted for EBCE and public review. More extensive discussions of each option or strategy are included in these background documents. Summaries of the options/strategies are included herein solely for the purpose of providing contextual background to the economic and financial impact analysis.

The capital and operating costs associated with each option/strategy were also provided by other Consultant Team members. The same is also true of the program articulation analyzed herein, such as the number of MW assumed to be provided through Net Energy Metering (NEM) or the level of investment assumed to fund Energy Efficiency programs. In all cases, none of these illustrative program assumptions originated with ALH Economics. If capital cost, operating cost, or other relevant information was not reflected in the background documents, then ALH Economics conferred with the respective Consultant Team members to obtain more detailed information relevant to the job, labor income, and financial impact analyses.

PRESENTATION STRUCTURE

This report section includes findings pertinent to each of the 10 options/strategies identified in the previous report section. A similar structure is provided for each option/strategy, which includes the following:

- **Summary Description** - brief summary description of each option/strategy for context
- **Typical Cost** - the typical cost for the Consultant Team program recommendation
- **Job and Labor Income Impact to Alameda County** – job and labor income impacts throughout Alameda County for installation and maintenance
- **Financial Impact to EBCE** – purchase price, savings, and net cost to EBCE
- **Summary Impact Measures** – job efficiency metrics and net cost to EBCE over 10 years

Select programs include additional or expanded impact information, such as job impacts associated with customer energy cost savings. This additional information is provided as warranted.

The job creation metrics referenced as **Summary Impact Measures** were developed specifically for this analysis, as a means of standardizing the direct, indirect, and induced job impact findings, facilitating comparative review. There are two such metrics presented for each option/strategy, as follows:

- The **Gross Job Creation Metric** is a rough approximation of the number of total jobs in Alameda County created over a 10-year period per \$1.0 million of gross capital investment, regardless of the entity making the investment.
- The **Net EBCE Investment Job Creation Metric** comprises a rough approximation of total Alameda County jobs created over a 10-year period per \$1.0 million of EBCE net investment.

In other words, the Gross measure provides a standardized measure for all program investment, while the Net measure provides a standardized measure relevant to only EBCE investment (or foregone revenue).

For purposes of the Job Creation Metrics, a loss of revenue (foregone income) is treated the same as an EBCE investment for purposes of understanding job creation. For example, in a reduced retail electricity rates program, EBCE gives up \$X million in annual revenues and the community gets XX jobs from the increased spending by customers.

To facilitate review of the findings, the presentation for each option/program begins at the top of the page of text.

APPLICATION OF FINDINGS

The illustrative findings are exactly that, illustrative findings. As LDBP programs are refined, the findings can be proportionally scaled to match the final program specifications. A key application of the economic and financial impact findings is to help guide EBCE's selection of program options once sufficient excess revenue is available to EBCE to fund more than mandatory customer service energy requirements and the generation of sufficient financial reserves to meet financial institution requirements for capital market funding purposes. Not all program options can be pursued simultaneously due to funding and other constraints. The findings, however, will help EBCE explore, evaluate, and understand the local economic and financial impacts associated with each program, enabling EBCE to choose how it most wants to deploy limited revenues to pursue the community goal of local development.

SUMMARY MATRIX

A summary matrix of the economic and financial impact findings is presented on the following page. This summary includes a distillation of the per option/strategy findings. Not all the findings are included in the summary matrix; however, key findings to facilitate comparison are included, such as illustrative program specifications, Alameda County job impacts (wages and number of jobs), Job Efficiency Metric, and net cost to EBCE over 10 years.

As the matrix findings indicate, the illustrative costs per strategy vary widely, both for private capital investors as well as EBCE. The illustrative example capital requirements range from \$0 to \$14.0 million in one-time costs for private investors to \$0 to \$9.9 million annually for EBCE. However, since these costs are illustrative, they are not a key basis for comparison, as the actual costs will depend upon program articulation and implementation plans.

More informative, especially from a local benefit perspective, are job impacts and the Job Efficiency Metrics, with local benefit defined as employment and spending occurring in Alameda County. The program/option with the greatest local job impacts per \$1.0 million in initial investment, regardless of the entity making the investment (i.e., Gross Job Creation Metric), is Demand Response Programs, with a significant number of jobs from both installation activity and induced jobs from annual customer savings, particularly for industrial customers. This is followed by Energy Efficiency Programs, which also has a high gross job creation metric resulting from installation activity. These are followed by Fuel Switching, Reduced Retail Rates, FIT (solar), NEM, Direct Investment, and Local Development Fund, all with 5.7 or more total local jobs created per \$1.0 million invested. The remaining programs all have 3.0 or lower estimated job generation rates per \$1.0 million invested. Notably, for many of these programs the total local job impacts are primarily one-time, whereas for Demand Response Programs and Reduced Retail Rates the impacts are ongoing for the duration of the programs.

From an operational perspective, the estimated local economic benefits, including direct job creation, need to be balanced by the estimated costs to EBCE. While the examples herein are illustrative, on a relative basis Reduced Retail Rates result in the greatest costs to EBCE, in the form of reduced profits. Providing competitive rates is necessary to EBCE's long-term success, but there is an inherent trade-off in doing so, as every retail rate reduction reduces the funding available for local programs and investment activities. The other options/strategies with the greatest financial cost impact to EBCE include FIT, Energy Storage Systems, NEM, and Electric Vehicle Incentives, with lesser financial impacts for Direct Investment, and Local Development Fund, although the actual financial impact to EBCE will depend on the design of programs and the cost share with consumers. For other recommended options/strategies, costs are anticipated to be recouped through savings, such as for Energy Efficiency Programs and Demand Response Programs. These recouped savings are assumed to occur through reduced peak hour demand, thus comprising energy savings for EBCE.

The intersection of local job, labor income, and financial impacts on EBCE will be further reviewed in a more meaningful manner when recommended program specifications are prepared and presented in the LDBP, for the purpose of optimizing investment EBCE's surplus revenues to support local development in Alameda County.

Exhibit 1
Summary Matrix of Economic and Financial Impacts
Recommended EBCE Local Development Business Plan Options and Strategies
Illustrative Scenarios
In 2018 Dollars

Program (1)	Illustrative Scenario (2)	Illustrative Capital Requirements (3)		Installation Impacts (4)				Annual Maintenance Impacts (4)		Annual Jobs From Cost Savings (5)	Job Creation Metric per \$1,000,000 Invested (6)		GHG Benefits	Net Cost to EBCE Over 10 Years (7)
		Private Capital	EBCE	Direct Jobs	Direct Job Hourly Wage	Total Jobs	Total Labor Income	Jobs	Labor Income		Gross Investment	Net EBCE Investment		
1. Feed-in Tariff Solar-Based	5 MW of power in 1 MW increments, installations ranging from 100kW to 1 MW	\$9,500,000	\$0	28.0	\$41.83	48.0	\$3,675,887	1.1	\$82,883	0	6.2	14.0	No Replaces other solar	\$4,200,000
Wind-Based	5 MW of power in 1 MW increments	\$12,300,000	\$0	14.2	\$39.63	23.0	\$1,874,812	0.8	\$66,313	0	2.5	4.2	No Replaces other solar	\$7,400,000
2. Net Energy Metering	5 MW of solar power capacity	\$14,000,000	\$0	38.0	\$25.00 - \$41.83 (8)	69.0	\$4,711,208	1.2	\$77,649	0	5.8	58.0	No Replaces other solar	\$1,400,000
3. Direct Investment in Solar/Wind Power Production	5 MW solar power capacity generating 10,000 MW hours of power/year	\$0	\$8,900,000	25.0	\$45.00	40.0	\$3,332,205	1.2	\$82,754	0	5.8	NA	No Replaces other solar	\$100,000 Cost recouped thru savings
4. Energy Efficiency Programs	0.5% reduction in energy demand	\$35,000,000 Split - Private capital & EBCE		204.0	\$25.00 - \$49.08 (8)	367.0	\$24,442,390	Unknown	Unknown	0	10.5	NA	Yes Reduces need for Gas peaker plants	Cost recouped thru peak hour procurement savings
5. Energy Storage Systems	EBCE purchases 20% to 25% share of 40 MW PG&E facility	\$0	\$5,000,000	5.0-6.0	\$25.00 - \$47.56 (8)	9.0	\$684,463 (8)	0.6-0.7	\$46,272	0	3.0	NA	Yes Reduces need for Gas peaker plants	\$1,500,000
6. Demand Response Programs (9)	Various concepts, such as providing discounts for new EV chargers, appliances, etc., or higher NEM rates	\$0	\$1,000,000	3.3-3.4	\$25.00 - \$47.56 (8)	5.9-6.0	\$468,425 (8)	0.0	NA	1.1 - 23.4	28.2 - 239.9	NA	Yes Reduces need for Gas peaker plants	Cost recouped thru savings
7. Electric Vehicle Incentives	Subsidy of \$2,500 each for up to 400 new electric vehicles applied to vehicle cost of \$37,200, charger install cost of \$200	\$15,000,000 rounded	\$1,000,000	18.4 (9)	\$34.11 - \$42.43	28.7 (10)	\$2,069,515	0.0	NA	0	1.9	28.7	Yes Replaces gas autos	\$1,000,000
8. Fuel Switching Programs	OFFGAS customers receive subsidy of \$800 each for 2,980 households to replace thermostat and water heater spread over 1-5 years. \$1,000 subsidy for 1,500 households to replace HVAC over following five years.	\$20,500,000	\$3,900,000 (~\$1 million peak outflow)	87 (9)	\$25.00	153 (10)	\$9,094,283	0.0	NA	NA	7.5	39.2	Yes Replaces gas appliances	\$200,000 annual profit after B/E Annual Program fees to customers offsets the costs of rebates within 10 years
9. Local Development Fund	1 MW system	\$0	\$2,100,000	6.0	\$41.83	10.0	\$845,032	0.2	\$17,246	0	5.7	24.0	No	\$500,000
10. Utility-Scale Solar and Wind	20MW Solar 50MW Wind	\$26,000,000 \$75,000,000	\$0 \$0	74.0 53.4	\$41.83 \$39.63	119.1 99.3	\$9,734,533 \$7,151,879	1.6 6.5	\$110,339 \$569,753	0 0	5.2 2.2	NA NA	No Replaces other solar	Breakeven Most cost effective system
11. Reduced Retail Electricity Rates	1.5% reduction in electric rates below PG&E	\$0	\$9.9 million per year	0.0	NA	0.0	\$0	0.0	NA	71.0	7.2	7.2	No	\$9,900,000 no carryover impacts

Sources: EBCE LDBP Consultant Team Members; and ALH Urban & Regional Economics.

Note: NA designates Not Applicable.

(1) These programs comprise options/strategies recommended by the LDBP Consultant Team. The programs are listed in no specific order.

(2) These scenarios are illustrative. They may or may not comprise the LDBP Consultant Team recommendations. In some cases the examples were selected to drive the economic and financial impact analysis to provide comparative findings. Recommended or optimal mixes will be included in the EBCE LDBP prepared by the Consultant Team.

(3) These are the estimated capital requirements to fund the illustrative programs. As these comprise capital funds they do not include EBCE payments to service providers, which are summarized in the final column under "Net Cost to EBCE Over 10 Years."

(4) Jobs are presented as Full-Time Equivalent (FTE) positions. Benefits are in addition to hourly wages unless otherwise stated.

(5) These comprise the job impacts associated with customer savings on energy costs. The range provided for "6. Demand Response Programs" refers to the impacts for different types of customers. The low end of the range represents residential and small commercial customers, whereas the high end of the range represents industrial customers that are likely to see more cost savings per dollar invested in demand response, and hence more jobs, based on the types of program options included in the analysis.

(6) This is a metric unique to this analysis that measures direct and indirect jobs over 10 years created per \$1.0 million invested. The Gross Investment figure pertains to all investment, regardless of the entity, while the Net EBCE Investment figure pertains to EBCE only investment, be it capital investment or funds paid to energy service providers. In cases where only EBCE provides all the capital then the metrics are generally identical between the Gross Investment and the Net EBCE Investment figures.

(7) This measures EBCE's net cost or lost profit is attributable to program participation over the course of 10 years.

(8) These figures comprise averages across customer class, i.e., utility, commercial and industrial, and residential/CARE.

(9) The \$25.00 per hour average wage applies to residential and small commercial systems, with no benefits.

(10) This includes retail jobs from vehicle/appliance purchase as well as installation jobs.

1. FEED-IN TARIFF

Summary Description. If desired, EBCE can establish Feed-in Tariff (FIT) programs to solicit proposals from local Alameda County developers for the production of solar and wind electricity. This would entail no direct EBCE capital investment. For illustrative purposes, this analysis assumes 5 MW of electricity per energy source (e.g., solar and wind) in 1 MW capacity increments. For solar, these 1 MW increments may be a combination of installations ranging in size from 100 kW to 1 MW. For wind, development is assumed pursuant to five 1 MW capacity increments.

The LDBP Consultant Team program recommendation entails EBCE selection of developer proposals that best meet the specific goals identified by EBCE, and then entering into a 20-year fixed price contract to purchase all electricity generated. The price deemed necessary to be financially feasible and to attract developer participation is estimated from \$0.075 per kWh to \$0.09 per kWh (\$90 per MWh), with add-on pricing options (aka “Adders”) for locations in built environment, for small projects, and for community benefits, that can increase the cost up to \$0.13 per kWh. As the program is tested, and the level of interest is determined, the offering price may vary to incentive participation through an embedded Market Responsive Pricing (MRP) mechanism, i.e., if undersubscribed initially, the price could increase to incentivize participation. Since technology continues to reduce the cost of solar systems, Clean Coalition expects the average all-in rate for FIT procurement will average \$.09 per kWh over the next five years.

Following are estimated economic and financial impacts associated with 5 MW illustrative Solar-based and Wind-based FIT programs.

Solar-Based FIT Example

Typical Cost. The typical capital cost of a 1 MW Solar system is \$1.9 million. Annual electricity generation varies from 1,521 MWh in the Oakland area to 1,605 MWh near Livermore, due to weather conditions. Peak production occurs midday when electricity demand is minimal. A 5 MW contract for Solar would mean \$9.5 million in local capital investment, of which 50-60% represents installation costs. Note that installation impacts are one-time, while annual maintenance impacts are recurring.

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for a 5 MW Solar-Based FIT:²

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	28.0	48.0	\$2,645,533	\$3,675,887
Maintenance	0.6	1.1	\$59,781	\$82,883

² Job impacts assume five 1 MW rooftop solar installations. Job impacts would increase for a larger number of smaller solar installations totaling 5 MW.

- Direct installation and maintenance jobs include carpenters, laborers, roofers, and inside wiremen (electricians) at an average wage of \$41.83 per hour plus benefits.

Financial Impact to EBCE. Although there is no EBCE capital investment for the Solar-based FIT, EBCE is required to purchase all electricity generated. For this analysis, ALH Economics assumed the maximum average cost of \$90 per MWh, which is an estimated \$34 per MWh premium over renewable grid supplied energy (i.e., \$90 per MWh plus \$13 per MWh in CAISO and scheduling fees = \$103 per MWh, less an in-state renewable electricity acquisition cost of \$49 per MWh per the EBCE Business Plan model = \$54 per MWh).

Each 1 MW solar panel is estimated to generate 1,560 MW hours (an average of the estimated yield in Oakland and Livermore) in an average year. If a 5 MW system that generates 7,800 MW hours were developed under contract with EBCE, there would be the following financial impact:

- Annual purchase price to EBCE = \$800,000 (7,800 x \$103)
- Annual savings to EBCE = \$382,000 (7,800 x \$49)
- Net cost to EBCE = \$418,000 per year

Summary Impact Measures. In summary, over 10 years, investment in a Solar-based FIT program is estimated to have the following economic and financial impacts:

- Gross Investment Job Creation Metric = 6.2 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of total solar investment (59 jobs / \$9.5 million)
- Net Cost to EBCE over 10 years for a 5 MW system = \$4.2 million (\$54 per MWh)
- Net EBCE Investment Job Creation Metric: 14 FTE direct, indirect, and induced jobs created per \$1.0 million of EBCE net cost (59 jobs / \$4.2 million)

Wind-Based FIT Example

Typical Cost. The typical capital cost of a 1 MW Wind system is \$2.5 million. Unlike solar, wind electricity generation occurs throughout the afternoon and evening when demand is higher. Annual electricity generation varies significantly by geography, with annual production ranging from 1,500 MWh at lower wind coastal areas to 2,500 MWh at the highest wind areas. A 5 MW contract would mean \$12.3 million in local capital investment, of which 20-30% represents installation costs. Note that installation impacts are one-time while annual maintenance impacts are recurring.

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for a Wind-based FIT:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	14.2	23.0	\$1,359,164	\$1,874,812
Maintenance	0.4	0.8	\$43,178	\$66,313

- Direct installation and maintenance jobs include laborers, operating engineers, iron workers, and electricians at an average wage of \$39.63 per hour plus benefits.

Financial Impact to EBCE. Although there is no EBCE capital investment for the Wind-based FIT, EBCE is required to purchase all electricity generated at a premium cost to conventional grid supplied energy (\$90 to \$110 per MWh) vs. average renewable electricity acquisition cost of \$49 per MWh.

For this illustration, each 1 MW wind turbine in a medium to high yield area is estimated to generate 3,000 MW hours in average year. A 5 MW system developed under contract to EBCE generating 15,000 MW hours would have the following financial impact on EBCE:

- Annual purchase price to EBCE = \$1.55 million (15,000 x \$103)
- Annual savings to EBCE = \$0.74 million (15,000 x \$49)
- Net cost to EBCE = \$810,000 per year

Summary Impact Measures. In summary, over 10 years, investment in Wind-based FIT program is estimated to have the following economic and financial impacts:

- Gross Investment Job Creation Metric = 2.5 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of wind investment (31 jobs / \$12.3 million capital investment)
- Net Cost to EBCE over 10 years for a 5 MW system = \$7.4 million (\$54 per MWh)
- Net EBCE Investment Job Creation Matrix = 4.2 FTE direct, indirect, and induced jobs per \$1.0 million of EBCE net cost (31 jobs / \$7.4 million)

2. NET ENERGY METERING

Summary Description. In recent years, there have been approximately 20-30 MW of solar panel installations each year in Alameda County. Most systems were designed to produce just enough electricity to offset actual on-site demand. With the Net Energy Metering (NEM) program outlined in one of the earlier referenced LDBP Consultant Team reports, EBCE can encourage businesses/homeowners to invest in a system larger than necessary to meet individual needs. The form of this encouragement would be EBCE’s commitment to purchase excess electricity generation (aka “net exports”) at the retail rate + \$0.005 per kWh, increasing \$0.005 per kWh for community benefit adders, such as a skilled workforce adder and a supply-shift adder, increasing to a maximum total of \$0.09 per kWh. Although there is no EBCE capital investment, EBCE loses the normal profit margin on all electricity used by the individual businesses/homeowners and would be compensating NEM customers for all excess electricity generated at a premium cost to conventional grid supplied energy (i.e., \$75 to \$90 per MWh) vs. in-state renewable electricity acquisition cost of approximately \$69 per MWh in 2019.

To estimate the profit margin lost to new NEM installations, ALH Economics calculated the 10-year average cost of all electricity (assuming 80% Block cost and 20% Day Ahead Market cost estimates, as referenced in the E3 pro forma) to be \$56 per MWh versus the 10-year average forecast retail price of electricity of \$72 per MWh – resulting in an opportunity cost of \$16 per MWh (aka “preempted revenue”).

Illustrative Investment Example

Typical Cost. To achieve 5 MW of solar electricity would require dozens of smaller solar panel systems ranging in size from 5 kW to 1 MW. The estimated capital cost of achieving capacity in this manner is \$14.0 million, of which 55-65% comprises installation costs.³

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for each 5 MW solar electricity system of Net Energy Metering:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	38.0	69.0	\$2,872,269	\$4,711,208
Maintenance	0.6	1.2	\$48,053	\$77,649

- Direct installation and maintenance jobs include carpenters, laborers, roofers, and inside wiremen (electricians) at an average wage of \$41.83 per hour plus benefits, with the exception of 5 kW residential systems with an average wage of \$25.00 per hour and no benefits.

Financial Impact to EBCE. Each group of 5 MW systems for NEM will generate 7,800 MW hours per year. In the long run, 73% of the total electricity generated is assumed to be used behind the

³ Example assumes 60% 5kW systems, 30% 100kW systems, 4% 350kW systems, 2% 500kW systems, and 4% 1 MW systems, for a grand total of 5 MW.

meter and represent lost income to EBCE, while 27% of the electricity generated is estimated to be excess electricity purchased by EBCE.⁴

- Annual lost income to EBCE = \$91,000 (7,800 x 73% x \$16)
- Annual cost of electricity bought by EBCE = \$196,000 (7,800 x 27% x \$93)
- Annual electricity savings to EBCE = \$147,000 (7,800 x 27% x \$69)
- Net cost to EBCE = \$140,000 per year

Summary Impact Measures. In summary, over 10 years, investment in Net Energy Metering is estimated to have the following economic and financial impacts:

- Gross Job Creation Metric = 5.8 FTE direct, indirect, and induced jobs over 10 years per \$1,000,000 of solar investment (81 jobs / \$14.0 million capital investment)
- Net Cost to EBCE over 10 years for solar systems totaling 5 MW = \$1.4 million
- Net EBCE Investment Job Creation Metric = 58 FTE direct, indirect, and induced jobs per \$1.0 million of EBCE net cost (81 jobs / \$1.4 million)

⁴ Sourced to Optony Inc.

3. DIRECT INVESTMENT

Summary Description. Direct Investment in renewable electricity generation is a long-term strategy that can leverage EBCE’s future credit rating to allow EBCE to access low-cost capital and directly finance construction of new large scale solar electricity systems (typically 5 MW capacity) in Alameda County. An optimal system would be ground mounted with single axis turning that can generate 10,000 MW hours of electricity each year. The estimated capital cost of such a system is \$8.9 million, which amortized over a 20-year useful life at 5% interest results in an average cost of \$70 per MWh.

Typical Cost. According to the E3 pro forma, the prevailing average cost of renewable electricity as of early 2018 is \$69 per MWh. Hence, at an average estimated cost of \$70 per MWh, EBCE would be able to replace other in-state renewable contracts at a similar net cost, assuming current interest rates.

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for EBCE Direct Investment in renewable electricity generation resulting in 10,000 MW hours of electricity per year:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	25.0	40.0	\$2,418,744	\$3,332,205
Maintenance	0.7	1.2	\$50,658	\$82,754

- Direct installation and maintenance jobs laborers, carpenters, iron workers, operating engineers, and electricians at an average wage of \$45.00 per hour plus benefits.

Financial Impact to EBCE. The following financial impact metrics are estimated for EBCE Direct Investment in renewable electricity generation resulting in 10,000 MW hours of electricity per year:

- Annual lost revenue to EBCE = \$0
- Annual savings to EBCE = \$690,000 (10,000 x \$69)
- Amortized cost of investment 20-year life = \$700,000 per year
- Net cost to EBCE = \$10,000 per year

Summary Impact Measures. In summary, over 10 years, Direct Investment in renewable electricity generation is estimated to have the following economic and financial impacts:

- Gross Job Creation Metric = 5.8 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of investment (52 jobs / \$8.9 million capital investment)
- Net Cost to EBCE over 10 years = \$100,000
- Net EBCE Investment Job Creation Metric = Direct Investment yields similar job creation as NEM and FIT programs, but at close to zero net cost

4. ENERGY EFFICIENCY PROGRAMS

Summary Description. Investment in Energy Efficiency programs for commercial/industrial and residential customers is designed to help customers reduce their overall electricity consumption. The Consultant Team’s Energy Efficiency recommendations are focused on reducing on-peak demand, which requires CCAs to purchase more expensive electricity, typically costing \$100 to \$150 per MWh versus \$40 to \$50 per MWh in normal time periods. EBCE can choose to support existing energy efficiency programs that use funds collected through public goods surcharges or utilize EBCE’s revenues to invest in new programs designed to address Alameda County’s unique needs.

Typical Cost. For the purpose of illustrative analysis, ALH Economics examined the impacts associated with a hypothetical goal to reduce overall annual electric demand by 0.5% (34,600 MWh). This conservative level of reduction is estimated to require investment of \$35.0 million. The actual capital investment may vary significantly pursuant to the level of reduction desired.

Based upon experience elsewhere, commercial customers, industrial customers, and public institutions can be expected to contribute 75% of the capital cost required to fund their respective Energy Efficiency Programs, with the balance funded by their utility. In contrast, residential customers and CARE customers can be expected to contribute 20-50% of the capital cost required to fund their respective Energy Efficiency Programs, with the remaining 50-80% funded by their utility. EBCE. Applying these general guidelines in the mix of individual and utility investments could result in a net Energy Efficiency Program investment of \$16.0 million by EBCE.

This analysis assumes that EBCE’s investment will be in the form of “pay for performance” RFP’s, soliciting proposals for the most up-to-date and effective hardware/software investments, providing the greatest return to EBCE.

Job and Labor Income Impacts to Alameda County. In estimating job and labor impacts of Energy Efficiency programs, the impacts are based on total installation costs, whether paid by EBCE or the customer. The number of maintenance jobs would depend on the specific Energy Efficiency program and are not included here. Following are the estimated job and labor income impacts for a \$35.0 million investment in Energy Efficiency programs.

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	204	367	\$14,865,811	\$24,442,390
Maintenance	Unknown	Unknown	Unknown	Unknown

- Direct installation jobs include sheet metal workers, inside wiremen (electricians), laborers, and plumbers/pipefitters/steamfitters at an average wage of \$49.08 per hour plus benefits for commercial, industrial, and MUSH (Municipal, University, School, and Hospital) programs and \$25.00 per hour for residential programs.⁵

⁵ For this analysis an Energy Efficiency program investment of \$35 million (EBCE and customer investment combined) assumes \$1.1 million industrial investment, \$10.9 million MUSH (Municipal, University, School,

Financial Impact to EBCE. The following financial impact metrics are estimated for a \$35.0 million investment in Energy Efficiency programs:

- Annual lost revenue to EBCE = \$2.5 million (34,600 x \$72)
- Annual electricity saving to EBCE = \$3.8 million (34,600 x \$100 to \$120)
- Amortized cost of investment 20-year life = \$1.3 million per year
- Net benefit to EBCE = Breakeven

Summary Impact Measures. In summary, over 10 years, the investment in Energy Efficiency programs is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric = 10.5 FTE direct, indirect, and induced jobs created per \$1,000,000 of initial EBCE investment (367 jobs / \$35.0 million)
- Net Benefit to EBCE over 10 years = Breakeven assuming debt funding amortization
- Net EBCE Investment Job Creation Metric = Energy Efficiency investments yield job creation that requires little or no EBCE long term cost.

and Hospital) investment, \$8.5 million commercial investment, \$6.0 million residential investment, and \$8.6 million CARE customer investment.

5. ENERGY STORAGE

Summary Description. Peak photovoltaic (PV) electricity generation occurs around midday, which is among the lowest periods of electric electricity demand. With massive installations of new solar electricity systems annually throughout California, there is an increasing imbalance in the demand and supply of electricity. On many days there is more solar electricity generated statewide from 11:00 am to 1:00 pm than total demand. When this occurs, CAISO has no choice but to give away, or even pay neighboring state utilities to take the excess electricity.

To help combat electricity outages during peak demand days and other emergencies, Energy Storage has been mandated by AB 2514 (Skinner), which passed in 2010. AB 2514 requires load-serving entities (LSE's) like EBCE to have an estimated 1% of their annual peak demand under contract by 2020 and installed by 2022. Based on EBCE's annual load demand, this will require EBCE to contract for approximately 14 MW of storage capacity by 2020.

Typical Cost. Given the high cost of small scale energy storage (\$1,000+ per kWh total installed cost), EBCE could consider a wide range of investments to meet and exceed the AB 2514 goal. On a large scale, EBCE could agree to partner with PG&E or another company to purchase a 20-25% interest in a large 40 MW storage facility on former gas electricity plant sites. At the 20-25% share, the capital investment required for such a purchase is estimated in the range of \$5.0+ million.

NEM and FIT adders (\$0.005 per kWh) are recommended by the LDBP Consultant Team to be adopted to incentivize local producers to install onsite storage systems. According to projections by Optony Inc. (January 2018 Net Energy Metering Strategy), the use of \$0.005 adders to NEM producers could result in more than 30 MW of new storage capacity by 2023, at an initial cost of \$1.0 million and an annual cost of \$350,000 thereafter.

Job and Labor Income Impacts to Alameda County. The following job and labor income impact metrics are estimated per \$5.0 million total investment in Energy Storage by each class of customer. In actuality, capital investment is projected to be \$5.0 million total for all customer classes combined, but at this juncture of EBCE's programming, the distribution by customer class is undetermined. Therefore, these figures are provided for illustrative purposes only.

Utility Scale Investment of \$5 million

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	6.0	9.0	\$554,640	\$764,105
Maintenance	0.4	0.6	\$33,278	\$48,112

Commercial and Industrial Customer Investment of \$5 million

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	5.0	9.0	\$497,510	\$718,924
Maintenance	0.4	0.6	\$33,167	\$47,928

Residential/CARE Customer Investment of \$5 million

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	5.0	9.0	\$318,176	\$570,360
Maintenance	0.4	0.7	\$23,863	\$42,777

- Direct installation and maintenance jobs include inside wiremen (electricians) and laborers at an average wage of \$47.56 per hour plus benefits for utility-scale, commercial and industrial customers, and \$25.00 per hour for residential and CARE customers.

Financial Impact to EBCE. While there are numerous strategies for energy storage, this analysis provides an illustration of potential financial impact metrics for a \$5.0 million Utility Scale investment in Energy Storage. It is assumed that 10 MWh of electricity are drawn down daily during peak demand periods where supply costs average over \$100 MWh and can spike tot as high as \$1,000 per MWh (Used \$150 per MWh average savings).

Utility Scale 10MWh at \$5,000,000

- Annual electricity cost to EBCE = \$175,000 (3,500 MWh x \$50)
- Annual savings to EBCE = \$525,000 (3,500 MWh x \$150)
- Amortized cost of investment 15-year life = \$500,000 per year
- Net cost to EBCE = \$150,000 per year

Summary Impact Measures. In summary, over 10 years, the investment in energy storage programs is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric = 3.0 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of investment (15 jobs / \$5.0 million)
- Net Cost to EBCE over 10 years per \$5.0 million invested = \$1.5 million (It is important to remember that the State of California requires EBCE to contract for at least 14 MW of Energy Storage by 2022)

6. DEMAND RESPONSE

Summary Description. Demand Response programs are important to EBCE since electricity demand rises throughout the day – peaking in early evening hours after the sun has set. The cost of purchasing electricity rises along with demand. Since not all equipment needs to be running at peak demand periods, utilities have effectively used Demand Response controllers to limit consumption during peak hours.

The LDBP Consultant Team recommends that EBCE consider alternative Demand Response concepts such as providing discounts to homeowners/businesses for new EV chargers, HVAC units, water heaters, etc., as well as higher incentives for NEM projects, in exchange for participation in EBCE Demand Response programs.

Typical Cost. For residential customers, the additional cost of direct load control installation is estimated at \$1,200 per customer. For small commercial customers, the additional cost of direct load control is estimated at \$5,000 per customer. For large commercial customers, Demand Response would be in the form of a Scheduled Load Reduction program. This cost is estimated at \$5,000 per customer. For industrial customers, Demand Response would be in the form of a Base Interruptible Program. This cost is estimated at \$10,000 per customer

Peak hour electricity costs typically average \$100 per MWh, and during periods of extreme weather, electricity costs can spike upwards of \$1,000 per MWh. Assuming 5% of the supply shift occurs during extreme periods, the weighted average cost of electricity savings to EBCE would be \$145 per MWh ($\$100 \times 95\% + \$1,000 \times 5\% = \145).

Job and Labor Income Impacts to Alameda County. The job and labor income impacts of Demand Response programs that rely on energy storage exclude the impacts of installing an energy storage device, which were accounted for in the Energy Storage section. Demand Response impacts show job creation related to installing direct load control only. The job and labor income impacts illustrated hereby type of installation reflect \$1.0 million of capital investment for each customer type.

Installation	Participating Customers	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Residential	833	3.3	6.0	\$309,755	\$472,500
Small Commercial	200	3.4	5.9	\$323,220	\$467,067
Large Commercial	200	3.4	5.9	\$323,220	\$467,067
Industrial	100	3.4	5.9	\$323,220	\$467,067
Average		3.4	5.9	\$319,854	\$468,425

- Direct installation and maintenance jobs include inside wiremen (electricians) and laborers at an average wage of \$47.56 per hour plus benefits for utility-scale, commercial and industrial customers and \$25.00 per hour for residential and CARE customers.

Economic Impact to Customers. There are also cost savings to customers that are associated with Demand Response programs. The reduction in spending on electricity translates into increased spending potential for other goods and services. This increased spending potential could impact households, businesses, and business owners, depending on the types of customers participating in Demand Response programs. It is important to note that customer savings occur on an annual basis, while installation impacts are one-time only.

Customer Savings	Participating Customers	Annual Savings ⁶		Total Induced Jobs	Total Labor Income
		Per Participant	Total		
Residential	1,000	\$225	\$225,000	1.1	\$52,796
Small Commercial	200	\$2,250	\$450,000	3.5	\$229,798
Large Commercial	200	\$1,330	\$266,000	2.1	\$135,836
Industrial	100	\$30,000	\$3,000,000	23.4	\$1,529,435

Financial Impact to EBCE. The following financial impact metrics are estimated for investment in residential Demand Response programs:

- Capital investment by EBCE = \$1.0 million increment
- Annual loss in revenue to EBCE = \$117,000 (2 MWh x 833 x \$70)
- Annual cost of electricity saved by EBCE = \$242,000 (2 MWh x 833 x \$145)
- Amortized cost of capital investment = \$120,000 over 10-year life
- Net Benefit to EBCE = \$5,000 per year

Summary Impact Measures. In summary, over 10 years, the investment in Demand Response programs is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric (residential, small commercial, large commercial) = 28.2 FTE direct, indirect, and induced jobs created per \$1,000,000 of EBCE investment
- Gross Job Creation Metric (industrial) = 239.9 FTE direct, indirect, and induced customer savings jobs created per \$1,000,000 of EBCE investment
- Net Cost to EBCE over 10 years = Zero
- Net EBCE Investment Job Creation Metric = Demand Response Investment yields job creation with little or no long-term net cost to EBCE.

⁶ These figures were estimated by Consultant Team Member The Offset Project.

7. ELECTRIC VEHICLE INCENTIVES

Summary Description. Another option for EBCE to consider is to provide Electric Vehicle Incentives by subsidizing electric vehicles and chargers. Similar to what Sonoma County has done, EBCE could offer a \$2,500 subsidy to residents of Alameda County who purchase/lease electric vehicles from qualified dealerships in Alameda County. EBCE could also offer discounts for electric charging service equipment (EVSE, aka EV Chargers) in exchange for participation in EBCE Demand Response programs designed to limit electricity demand during times of need (i.e., extreme load spikes, extreme CAISO market pricing spikes, etc.).

Typical Cost. An Electric Vehicle Incentive program targeting 400 new vehicles would require a capital investment of \$1,000,000. For every electric vehicle sold/leased, EBCE would earn revenue from 3-4 MW of electric demand per year.

Job and Labor Income Impacts to Alameda County. The job and labor income impacts associated with Electric Vehicles Incentives include the impacts to auto dealers where the vehicles are purchased, as well as one-time impacts associated with charger installation. For this example, it is assumed that the total cost per vehicle is \$37,220. There would be an additional \$200 installation cost for the charger. This results in a total capital investment of \$15.0 million before EBCE subsidies. The following job and labor income impact metrics are estimated for investment in Electric Vehicle Incentives:

Expense Type	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Vehicle Purchase	18.0	28.0	\$1,409,169	\$2,026,179
Charger Install	0.4	0.7	\$25,454	\$43,336
Total	18.4	28.7	\$1,434,623	\$2,069,515

- Local Jobs from vehicle purchases include auto dealership sales, administration, and maintenance employees at an average wage of \$34.11 per hour.
- Local Jobs from charger installation include inside wiremen (electricians) at an average wage of \$42.43.

Customer Savings Impact. There may be additional Electric Vehicle Incentives impacts from cost savings to customers of approximately \$900 per year from the difference in gas costs versus electricity costs. However, these costs are offset in the short term by the higher cost of an electric vehicle versus a gas vehicle. As a result, the job impacts of increased spending are relatively small and are therefore not estimated.

Financial Impact to EBCE. The following financial impact metrics are estimated for a \$1.0 million investment in Electric Vehicle Incentives:

- Annual increased revenue to EBCE = \$98,000 (400 x 3.5 x \$70)
- Annual cost of electricity bought by EBCE = \$70,000 (400 x 3.5 x \$50)
- Amortized cost of car subsidy 10-year life = \$130,000 per year
- Net annual cost to EBCE = \$102,000 per year (average)

Summary Impact Measures. In summary, over 10 years, each annual investment in Electric Vehicle Incentives is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric = 1.9 FTE direct, indirect, and induced jobs created per \$1,000,000 of capital investment (28.7 jobs/\$14,968,000 of capital investment)
- Net Cost to EBCE over 10 years = \$1,000,000 over 10 years (\$2,500 per vehicle)
- Net EBCE Investment Job Creation Metric = 28.7 FTE direct, indirect, and induced jobs per \$1,000,000 of EBCE net investment

This analysis indicates that there is no significant economic benefit to EBCE of a subsidy program for electric cars. This is attributable to the following: 1) The net margin on electricity sales is minimal; and 2) there is no way to measure whether the EBCE incentives were a deciding factor in the decision to acquire an electric vehicle.

The actual benefit could be negative if the car buyers do not acquire a battery storage system or participate in Demand Response programs to avoid drawing electricity during periods where electricity costs spike.

8. FUEL SWITCHING

Summary Description. A Fuel Switching program is designed to encourage homeowners and small businesses to switch from natural gas appliances to new energy efficient electric appliances. This will increase EBCE revenues and result in GHG reductions. EBCE would also seek to get Demand Response controllers to limit peak demand electricity usage, creating financial savings by eliminating peak hour electricity costs, simultaneously reducing local GHG emissions.

The basic structure recommended for EBCE is a two-step process called the Off Gas program. EBCE could offer an opt-up Gas Service Product for which a small group of customers pay a monthly fee. This fee, plus any retail markup on natural gas, gets collected into a fund for future rebates to switch out their gas appliances for high efficiency heat pump electric models.

These customers would be immediately eligible for a rebate (e.g., \$50 to \$100) on a smart thermostat, which provides load control. After one year of enrollment in the program, Off Gas customers would be eligible for up to \$700 rebate on a heat pump water heater, depending on how soon they switch out their water heater. Off Gas customers would be eligible for up to a \$1,000 rebate on a heat pump HVAC upgrade after 3 years.

Typical Cost. This analysis includes an illustrative program where 2,980 residential customers select the Off Gas program. It is estimated that each Off Gas customer will generate approximately \$60 per year in net income to EBCE, plus they will pay a program fee of \$90 per year. As the appliances are switched over to electric, the loss of natural gas revenue will be partially offset by a profit margin on new electricity demand.

The one-time cost of replacing the appliances is \$5,500 per home, with EBCE contributing up to \$1,800 per home. Installation costs are estimated at \$6,900 per home for the thermostat, heat pump water heater and heat pump HVAC combined. The EBCE rebate will cover almost all of the thermostat cost and half of the water heater cost, but only a small portion of the HVAC cost, which is the most expensive part of the upgrade, thus it is assumed that only half of the 2,980 customers will purchase a new HVAC unit. This example results in a total capital investment of \$20.5 million for purchase and installation combined for 2,980 customers. The EBCE total rebates are estimated at \$3.9 million, however the peak cash shortfall is estimated at \$1.0 million by year 6, as EBCE will have been collecting approximately \$450,000 per year in fees and profits. Following the last rebates, net revenue from fees and profits will be an estimated \$200,000 per year, allowing full payback within 5 years.

Job and Labor Income Impacts to Alameda County. The following job and labor income impact metrics are estimated for a Fuel Switching program with 2,980 participating households:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Appliance Purchase	23	35	\$1,146,544	\$1,862,224
Installation	64	118	\$4,026,778	\$7,232,059
Total	87	153	\$5,173,322	\$9,094,283

- Local Jobs from appliance purchases include retail sales and management employees at an average wage of \$23.97 per hour.
- Local Jobs from installation include inside wiremen (electricians) at an average wage of \$25.00.

Financial Impact to EBCE. The following financial impact metrics are estimated for investment in an Off Gas Fuel Switching program:

- Capital investment by EBCE = \$1.0 million peak investment
- Annual increase in net revenue to EBCE = \$ 200,000

Summary Impact Measures. In summary, over 10 years, the investment in an Off Gas Fuel Switching program is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric = 7.5 FTE direct, indirect, and induced jobs created per \$1,000,000 of investment (153 jobs / \$20.5 million of capital investment)
- Net Cost to EBCE over 10 years = Breakeven
- Net EBCE Investment Job Creation Metric = 39.2 FTE direct, indirect, and induced jobs created per \$1,000,000 of EBCE net investment (153 jobs / \$3.9 million of investment)⁷

⁷ This net investment does not account for additional electric purchases from EBCE.

9. LOCAL DEVELOPMENT FUND

Summary Description. The creation of a Local Development Fund comprises a proactive strategy that can be used by EBCE for a wide variety of investments, such as 1) build a loan loss reserve fund to accelerate the credit rating process, allowing access to 3rd party financing at a lower cost, 2) create a fund for providing grant opportunities that allow EBCE to directly support innovative local projects and efforts by customers, entrepreneurs and government agencies in EBCE’s service territory that yield community benefits that are aligned with EBCE goals; and 3) to make direct investment in local community solar systems.

This last option could prototypically include 1 MW capacity PV system on a commercial rooftop, assuming use of union labor, the capital investment needed is \$2.1 million for each 1 MW system.

Job and Labor Income Impact to Alameda County. The following job and labor income impact metrics are estimated for a Local Development Fund at a cost of \$2.1 million:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	6.0	10.0	\$584,780	\$845,032
Maintenance	0.1	0.2	\$11,934	\$17,246

- Direct installation and maintenance jobs include carpenters, roofers, laborers, and electricians at an average wage of \$41.83 per hour plus benefits.

Financial Impact to EBCE. The following financial impact metrics are estimated for a \$2.1 million investment in a Local Development Fund.

- Annual electricity supply savings to EBCE = \$78,000 (1,563 MWh x \$50)
- Amortized cost of capital investment⁸ = \$130,000 over 20-year life
- Net annualized cost to EBCE = \$52,000 per year

Summary Impact Measures. In summary, over 10 years, the investment in a Local Development Fund program is estimated to have the following labor and financial impacts:

- Gross Job Creation Metric = 5.7 FTE direct, indirect, and induced jobs created over 10 years per \$1,000,000 of investment (12 jobs / \$2.1 million)
- Net Cost to EBCE over 10 years for a \$2.1 million program investment = \$0.5 million
- Net EBCE Investment Job Creation Metric = 24.0 FTE direct, indirect, and induced jobs per \$1,000,000 of net EBCE investment (12 jobs / \$0.5 million)

⁸ The equipment’s useful life is 20 years, so the analysis assumes a mortgage simulation to avoid overburdening EBCE in the early years.

10. UTILITY SCALE SOLAR AND WIND

Summary Description. EBCE can also induce local renewable energy development through competitive procurement processes such as auction mechanisms, Request for Offers (RFO), and/or Request for Proposals (RFP) that lead to long-term Power Purchase Agreements (PPA). The resulting PPA’s may include buyout provisions, as recommended by the LDBP Consulting Team. This approach may yield lower costs for EBCE on a per kWh basis, while still being an effective means of delivering local economic benefits.

Following are estimated economic and financial impacts associated with a 20 MW illustrative Solar Photovoltaic installation and a 50 MW Wind energy system installation. For both examples it was assumed that the systems are installed in the eastern part of Alameda County (where the wind and solar resources are highest), using prevailing wage labor rates (i.e., through Project Labor Agreements), and that the solar array is a ground-mounted system with single axis tracking.

Solar-Based Example

Typical Cost. The typical capital cost of a 20 MW Solar system is \$26.0 million. Annual electricity generation is estimated to be 2,024 MW hours per MW of installed capacity. Peak production occurs midday when electricity demand is minimal. A 20 MW contract for Solar would mean \$26.0 million in local capital investment, of which 50% represents installation costs. Note that installation impacts are one-time, while annual maintenance impacts are recurring.

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for a 20 MW Solar-Based system:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	74.0	119.1	\$7,065,995	\$9,734,533
Maintenance	0.9	1.6	\$67,543	\$110,339

- Direct installation and maintenance jobs include carpenters, roofers, laborers, and electricians at an average wage of \$41.83 per hour plus benefits.

Financial Impact to EBCE. The following financial impact metrics are estimated for a \$26 million investment in a 20 MW Solar system.

Although there is no EBCE capital investment for the Solar-based system, a typical PPA arrangement would require EBCE to purchase all electricity generated by the system on an “as available” basis. For this analysis, ALH Economics assumed the maximum average cost of \$50 per MWh plus \$13 per MWh in CAISO and Scheduling fees = \$63 per MWh.

Each 1 MW of installed capacity is estimated to generate 2,024 MW hours in an average year. Assuming a 20 MW system that generates 40,480 MW hours were developed under contract with EBCE, there would be the following financial impact:

- Annual cost to EBCE = \$2,550,240 (40,480 x \$63)
- Annual savings to EBCE = \$2,550,240 (40,480 x \$63)
- Net savings to EBCE = Breakeven

Summary Impact Measures. In summary, over the first 10 years of operations, investment in a solar-based system is estimated to have the following economic and financial impacts:

- Gross Investment Job Creation Metric = 5.2 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of total solar investment (135 jobs / \$26.0 million)
- Net cost to EBCE over 10 years for a 20 MW system is estimated to breakeven versus other renewable power contracts.
- Net EBCE Investment Job Creation Metric: Utility scale solar power investments yield job creation that requires little or no EBCE long term cost.

Wind-Based Example

Typical Cost. The typical capital cost of a 50 MW Wind system is \$75.0 million. Unlike solar, wind electricity generation occurs throughout the afternoon and evening when demand is higher. Annual electricity generation varies significantly by geography, with annual production ranging from 1,500 MWh at lower wind coastal areas to 2,500 MWh at the highest wind areas. A 50 MW contract would mean \$75.0 million in local capital investment, of which 20-30% represents installation costs. Note that installation impacts are one-time while annual maintenance impacts are recurring.

Job and Labor Income Impacts to Alameda County. The following job and labor impact metrics are estimated for a Wind-based system:

Type of Job	Direct Jobs	Total Jobs	Direct Labor Income	Total Labor Income
Installation	53.4	99.3	\$4,350,762	\$7,151,879
Maintenance	3.4	6.5	\$371,254	\$569,753

- Direct installation and maintenance jobs include laborers, operating engineers, iron workers, and electricians at an average wage of \$39.63 per hour plus benefits.

Financial Impact to EBCE. Although there is no EBCE capital investment for the Wind-based system, a typical PPA arrangement would require EBCE to purchase all electricity generated by the system on an “as available” basis. For this analysis, ALH Economics assumed an average cost of \$59 per MWh plus \$13 per MWh in CAISO and Scheduling fees = \$72 per MWh. Alternative renewable power contracts are available at a cost of \$50 per MWh, but those are solar systems that do not provide power in the peak late afternoon and evening hours. Assuming 20% of the wind generated power will be delivered in peak evening hours, there should be offset power costs of \$100 per MWh. The net result is a weighted average displacement cost of approximately \$59 per MWh, resulting in no incremental cost to EBCE.

For this illustration, each 1 MW wind turbine in a medium to high yield area is estimated to generate 2,500 MW hours in average year. A 50 MW system developed under contract to EBCE generating 125,000 MW hours would have the following financial impact on EBCE:

- Annual cost to EBCE = \$9.1 million (125,000 x \$72)
- Annual savings to EBCE = \$9.1 million (125,000 x \$72)
- Net cost to EBCE = Breakeven

Summary Impact Measures. Over 10 years of operations, investment in a Wind-based system is estimated to have the following economic and financial impacts:

- Gross Investment Job Creation Metric = 2.2 FTE direct, indirect, and induced jobs over 10 years created per \$1,000,000 of wind investment (165 jobs / \$75.0 million capital investment)
- Net Cost to EBCE over 10 years for a 50 MW system is estimated to breakeven versus other renewable power contracts adjusted for peak hour savings
- Net EBCE Investment Job Creation Metric) Utility scale wind power investments yield job creation that requires little or no incremental long term cost

11. REDUCED RETAIL ELECTRICITY RATES

Summary Description. A major goal for the formation of the EBCE is to provide customers with lower electric rates than they would pay under PG&E control. This strategy is predicated upon uniform rate reduction for all EBCE customers relative to existing PG&E rates.

Estimated Cost Savings. For a 1.5% overall rate reduction over PG&E rates, and based on prevailing consumption levels, the residents and businesses in Alameda County would realize \$9.9 million (rounded) in annual savings as summarized below:

- Residential - \$3.3 million
- Commercial - \$2.9 million
- Industrial - \$3.6 million
- Agriculture - \$36,000
- Municipal-owned Street Lights - \$72,000

The annual savings for each class of customer is assumed to be spent on goods and services in the local economy creating new induced jobs in a wide range of industries. This increased spending potential would impact households, business operations, and business owners. The impacts of additional spending due to cost savings on electricity create recurring annual jobs and wages based on increased demand in the local economy.

Job and Labor Income Impacts to Alameda County. The following job and labor income annual job and labor income impact metrics are estimated for Reduced Retail Rates:

Customer Type	Annual Savings ⁹	Total Induced Jobs	Total Labor Income
Residential and CARE	\$3,267,964	15.96	\$917,443
Commercial	\$2,927,104	24.54	\$1,597,808
Industrial	\$3,553,573	29.79	\$1,939,777
Street Lights & Ag	\$107,879	0.70	\$46,681
Total	\$9,856,520	70.99	\$4,501,709

- Jobs related to customer savings include impacts in retail and consumer services from resident spending and impacts in a wide range of industries that represent local suppliers to commercial and industrial customers such as wholesale trade, transportation, computer systems design, insurance, management consulting, R&D, and management of companies.

Financial Impact to EBCE. The following financial impact metrics are estimated for the provision of Reduced Retail Rates, with lost revenue to EBCE comprising lost profits compared to the base case for the good of the community pursuant to EBCE’s mission to provide energy at Reduced Rates as compared to PG&E:

⁹ These figures were estimated by Consultant Team Member The Offset Project.

- Annual lost revenue to EBCE = \$9.9 million
- Annual cost savings by EBCE = \$0
- Annual net cost to EBCE = \$9.9 million

Summary Impact Measures. In summary, over 10 years, the provision of Reduced Retail Rates is estimated to have the following labor and financial impacts:

- Gross Job Efficiency Metric = 7.2 FTE induced jobs created per \$1,000,000 of investment (i.e., reduced revenues)
- Net Cost to EBCE over 10 years = \$99.0 million assuming the rate reduction stays in place for the full 10-year period. If there is only a one-time rate reduction the benefits would stop.
- Net EBCE Investment Job Efficiency Metric = 7.2 FTE induced jobs created per \$1,000,000 of net investment

III. ILLUSTRATIVE SCENARIO ANALYSIS

INTRODUCTION

This illustrative scenario analysis is intended to provide an example of the potential cumulative community benefits of incorporating different levels of EBCE investment into the various proposed options and strategies discussed in the previous chapter. It is not intended as a prescriptive recommendation, but simply one example of how EBCE net operating surplus could be invested, and the community benefits that could be generated. The scenario analysis shown here uses projections of annual EBCE surplus revenues and illustrates a possible allocation of those revenues to various investment options and strategies that are available for EBCE Board consideration. These investments are then translated into economic benefits in terms of jobs and labor income impacts in Alameda County that could be associated with the LDBP over the first seven years of implementation.

FINANCIAL PLAN OVERVIEW

Preliminary EBCE budgets indicated a potential net annual operating surplus of approximately \$12 million in 2019 and 2020, increasing up to \$50 million by 2022 before LDBP investments. The LDBP envisions a major financial commitment by EBCE within the first five years for a wide range of local energy investments including collaborative procurement, renewable power, energy efficiency, demand response, and other programs. This investment would be in addition to a 1.5% rate reduction planned for all customers, accumulation of a \$175-\$200 million reserve fund, and repayment of all debt obligations that funded startup operations.

While specific dollar commitments for various programs have not been identified, or presented as recommendations, the LDBP Consulting Team prepared an illustrative example of the total public and private investment, direct jobs, total jobs (includes indirect/induced), and total labor income that could accrue over the initial seven-year plan period, based on the following example:

- 5 MW FIT contracts quarterly from 2019-2021 (50MW total)
- 25 MW of Net Energy Metering installations annually
- 150 MW of utility scale solar and wind power contracts by 2023
- \$10 million investment in transportation electrification
- Up to \$3 million annual investment in local community projects
- \$5 - \$10 million investment in off-gas fuel switching program
- \$15 million investment in energy storage (up to 30 MW)
- \$15 - \$20 million investment in energy efficiency programs
- \$15 - \$20 million in demand response programs

The estimated annual and cumulative EBCE investments in these programs follow. Over the seven-year period, this illustrative scenario results in a total investment of \$162 million, excluding the \$10 million annual cost of a 1.5% rate reduction. For some programs, these investments by EBCE are supplemented by private or customer investments.

EBCE Annual Investment (millions of dollars)

Investment Option	2019	2020	2021	2022	2023	2024	2025
Rate Reduction (1.5%)	\$10.0	\$10.0	\$10.0	\$10.0	\$10.0	\$10.0	\$10.0
FIT	\$0.0	\$1.0	\$3.0	\$5.0	\$5.0	\$5.0	\$5.0
NEM	\$0.8	\$1.5	\$2.3	\$3.0	\$3.8	\$4.5	\$5.3
Utility Scale Wind/Solar	\$0.0	\$0.5	\$0.5	\$1.0	\$1.0	\$1.5	\$1.5
Electric Vehicles	\$0.0	\$0.5	\$2.5	\$2.5	\$2.5	\$2.5	\$2.5
Fuel Switching	\$0.0	\$0.0	\$0.0	\$2.0	\$4.0	\$3.0	\$1.0
Energy Storage	\$0.0	\$3.8	\$3.8	\$0.8	\$3.8	\$3.0	\$0.0
Demand Response	\$0.5	\$0.5	\$4.0	\$6.0	\$6.0	\$6.0	\$6.0
Energy Efficiency	\$0.5	\$1.1	\$2.4	\$4.0	\$8.0	\$4.0	\$4.0
Community Investment	\$1.0	\$1.5	\$2.0	\$3.0	\$4.0	\$4.0	\$4.0
Total Investment	\$12.7	\$20.4	\$30.4	\$37.3	\$48.0	\$43.5	\$39.3
Excluding Rate Reduction	\$2.7	\$10.4	\$20.4	\$27.3	\$38.0	\$33.5	\$29.3
Cumulative EBCE Investment	\$2.7	\$13.1	\$33.5	\$60.8	\$98.8	\$132.3	\$161.5

COMMUNITY BENEFITS

The LDBP Consulting Team assessed the local economic and financial impacts of this scenario example, including the per program job and labor income impacts in Alameda County, and financial implications for EBCE. Most of the investment strategies have one-time impacts associated with installation or construction, or with an initial purchase such as for electric vehicles or fuel switching. In addition, some of the projects such as FIT, NEM, utility scale solar and wind, and community investment also have on-going annual maintenance impacts that continue into future years. The following table shows the sum of annual job impacts, both one-time and on-going. The first set of numbers shown for each program by year represents the direct jobs and the second number represents total (direct+indirect+induced) jobs. The level of job and labor income impacts is the result of not only direct investment by EBCE, but also the level of private investment.

The largest job impacts in this illustrative scenario come from NEM, utility scale wind and solar, fuel switching, and demand response. For NEM, the job impact is higher due to the relatively high level of annual investment that is assumed in this scenario. Utility scale solar and wind also generates a sizeable number of direct and indirect jobs due to the relative size of the installations. Fuel switching generates a large number of one-time jobs related to appliance purchase and installation, while demand response generates increasing cumulative impacts based on on-going annual increases in consumer spending resulting from lower electricity bills. As more customers participate in demand response, the amount of income that is freed up for other types of consumer spending cumulates. All total over the seven-year period, the scenario illustrated here results in 5,400 total (direct+indirect+induced) one-time jobs related to installation, and 244 on-going jobs related to maintenance or increased consumer spending.¹⁰

¹⁰ One-time jobs related to installation are summed over the seven-year period, while on-going jobs are only counted once at their maximum level in year seven.

Direct and Total Job Impacts

Investment Option	2019	2020	2021	2022	2023	2024	2025
Rate Reduction (1.5%)	0/71	0/71	0/71	0/71	0/71	0/71	0/71
FIT							
Installation	56/96	112/192	112/192	0/0	0/0	0/0	0/0
Maintenance	0/0	1/2	4/7	4/7	4/7	4/7	4/7
NEM							
Installation	195/351	195/351	195/351	195/351	195/351	195/351	195/351
Maintenance	0/0	3/5	6/11	9/17	12/23	15/29	18/35
Utility Scale Wind/Solar							
Installation	119/198	0/0	119/198	0/0	119/198	0/0	119/198
Maintenance	0/0	3/8	3/8	6/16	6/16	9/24	9/24
Electric Vehicles	1/1	5/7	5/7	5/7	5/7	5/7	0/0
Fuel Switching	0/0	0/0	0/0	87/154	174/307	131/230	44/77
Energy Storage	0/0	4/7	4/7	1/1	4/7	4/6	0/0
Demand Response	2/5	2/7	14/41	20/74	20/95	20/116	20/139
Energy Efficiency	6/10	14/25	30/53	50/89	99/178	50/89	50/89
Community Investment							
Installation	3/5	4/8	6/10	9/15	12/21	12/21	12/21
Maintenance	<1/<1	<1/<1	<1/<1	<1/<1	<1/1	<1/1	<1/2
Total Jobs (FTE)	382/737	343/683	498/956	386/802	650/1282	445/952	471/1014

The next table shows annual labor income impacts associated with the total (direct, indirect, and induced) jobs for each investment option. This is another measure of community benefits. Labor income includes employee compensation (wages, salaries, and employer and employee contributions to social insurance) plus proprietor income (business owner income). Labor income impacts are proportional to the total number of jobs, but also reflect average wage levels as a measure of job quality. Some strategies such as FIT, larger NEM installations, utility scale wind and solar, energy efficiency improvements for commercial, industrial and MUSH customers, utility-scale and industrial energy storage, industrial and large commercial demand response programs, and community investments that involve larger installation projects will generally result in the use of union labor at prevailing wages. These higher wage levels are reflected in the labor income impacts.

Total Annual Labor Income Impacts (millions of dollars)

Investment Option	2019	2020	2021	2022	2023	2024	2025
Rate Reduction (1.5%)	\$4.5	\$4.5	\$4.5	\$4.5	\$4.5	\$4.5	\$4.5
FIT	\$7.3	\$14.9	\$15.2	\$0.8	\$0.8	\$0.8	\$0.8
NEM	\$24.0	\$24.3	\$24.7	\$25.1	\$25.4	\$25.8	\$26.2
Utility Scale Wind/Solar	\$15.3	\$0.9	\$16.2	\$1.9	\$17.1	\$2.8	\$18.1
Electric Vehicles	\$0.1	\$0.5	\$0.5	\$0.5	\$0.5	\$0.5	\$0.0
Fuel Switching	\$0.0	\$0.0	\$0.0	\$9.1	\$18.3	\$13.7	\$4.6
Energy Storage	\$0.0	\$0.6	\$0.6	\$0.1	\$0.6	\$0.5	\$0.0
Demand Response	\$0.3	\$0.5	\$3.0	\$5.3	\$6.7	\$8.1	\$9.6
Energy Efficiency	\$0.7	\$1.7	\$3.6	\$5.9	\$11.9	\$5.9	\$5.9
Community Investment	\$0.4	\$0.6	\$0.9	\$1.3	\$1.8	\$1.8	\$1.8
Total Annual Labor Income	\$52.7	\$48.5	\$69.1	\$54.6	\$87.6	\$64.4	\$71.5
Cumulative Labor Income	\$52.7	\$101.2	\$170.3	\$224.9	\$312.5	\$376.9	\$448.4

The local economic benefits generated by this illustrative scenario within the first seven years of EBCE operations are summarized below:

EBCE investment	\$160 million
Total investment	\$600 million (estimated)
Direct jobs (FTE)	450 jobs/year average
Total jobs (FTE)	900 jobs/year average
Total labor income	\$450 million (\$64 million/year average)

IV. JOB AND LABOR INCOME IMPACT METHODOLOGY

APPROACH

The job and labor impact analysis of the identified EBCE options and strategies relies primarily on multipliers from IMPLAN for Alameda County. IMPLAN is a national vendor of input-output software and data used to create economic impact models and is widely used in government, higher education and in the private sector to evaluate economic impacts. IMPLAN is an input-output model. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical formulas allow for examination of the effects of a change in one or several economic activities on an entire economy (impact analysis).

The National Renewable Energy Lab has created a series of economic impact models using IMPLAN state-level multipliers that are specific to solar and wind energy called JEDI (Jobs and Economic Development Impacts). The JEDI models for photovoltaic solar, distributed wind, and land-based wind were used as a basis for the assumptions regarding the share of total cost of wind and solar systems that could be attributed to installation. Data on different sizes of solar and wind projects were entered into the JEDI model. The job impacts from JEDI were not used in the economic impact analysis because they represent jobs throughout the state, not just local jobs in Alameda County. However, JEDI results on the share of total project costs that should be allocated to installation were extracted from the JEDI model, as this is the portion of the total capital investment that actually generates jobs. In addition, the IMPLAN results for direct jobs, which are always at the site of the project, were compared to JEDI to confirm general consistency.

The IMPLAN model begins with the most current national transactions matrix developed by the National Bureau of Economic Analysis Benchmark Input-Output Model. The model breaks down the U.S. economy into over 500 separate economic sectors in agriculture, manufacturing, commercial services, and government. Next, IMPLAN creates state- and county-level values by adjusting the national level data, such as removing industries that are not present in a particular state or region. These economic sector data are updated annually by IMPLAN. The most current available sectoral data are for 2016, which was used in this analysis.

Economic impacts are typically estimated using multipliers. IMPLAN proprietary software combined with data files purchased from IMPLAN for a particular geographic region can be used to create multipliers. In this case, county-level data for Alameda County were used to create the multipliers in order to focus the analysis on local job creation within the EBCE service area. These multipliers quantify the total production requirements for each industry within the selected study area for every unit of production sold to final demand. Multipliers may be constructed for output, employment, and labor income. Multipliers can be used to measure the impact of industries in the region buying goods and services from other regional industries. The cycle of spending works its way backward through the supply chain until all money leaks from the regional economy, either through imports or by payments to value added.

Multipliers are also used to measure how payroll from the subject business results in additional consumer purchases by employees. This money is recirculated through their household spending patterns causing further economic activity in the region and supporting additional jobs and labor income. These are the induced impacts discussed above. Direct, indirect, and induced impacts are summed to generate total impacts.

OPTION OR STRATEGY DETAILS

The following sections provide details on the modeling assumptions and methodology used with regard to each type of program being considered by EBCE. There are generally three categories of job and labor income impacts. First, most of the programs have economic impacts related to installation of equipment. Second, there are generally on-going annual maintenance jobs and labor income associated with the new equipment. Finally, for Demand Response and Reduced Retail Rates there are induced jobs and income associated with customer savings, in that consumers and businesses are able to re-direct money they were previously spending on electricity toward other types of purchases.

The economic impact methodology specific to each option/strategy is presented below. The numbers noted per option/strategy (e.g., 1 through 10) match the number references throughout this report, in the text as well as the summary matrix.

1. FIT 2. NEM

In order to estimate the direct installation economic impacts for the FIT and NEM strategies, IMPLAN employment and labor income multipliers for Maintenance and Repair Construction of Residential Structures (IMPLAN industry 63) were used for residential scale systems (5 kW solar and 10 kW and 50 kW wind installations). Multipliers for Maintenance and Repair Construction of Non-residential Structures (IMPLAN industry 62) were used for commercial scale installations (100 kW to 1 MW solar and 1 MW wind). For on-going annual maintenance impacts, the same multipliers were applied to annual costs of \$25 per MW per year.

The FIT and NEM hourly wage information pertains to journey level prevailing wages for Alameda County from the California Department of Industrial Relations and reflects the combination of trades required including carpenters, laborers, roofers, and electricians for solar installations, and electricians, laborers, operating engineers, and iron workers for wind installations.

3. Direct Investment

The Direct Investment scenario assumes a single 5 MW ground mount, single axis solar installation. Installation costs are estimated at 49% of total costs based on ratios from the JEDI model. IMPLAN employment and labor income multipliers for Construction of Other New Nonresidential Structures (IMPLAN industry 58) were used to estimate the job impacts. For on-going annual maintenance impacts, employment and labor income multipliers for Electric Power Generation Solar (IMPLAN industry 44) were applied to annual operating costs.

The Direct Investment hourly wage information reflects journey level prevailing wages for Alameda County from the California Department of Industrial Relations and reflects the combination of trades required including carpenters, laborers, roofers, and electricians for solar installations.

4. Energy Efficiency

Energy Efficiency programs are modeled based on the annual load reduction by customer type for industrial, MUSH, large commercial, small and medium commercial, residential, and CARE customers. The levelized cost of saved energy for each type of customer is applied to the target annual load reduction to estimate total cost. Jobs per \$1.0 million dollars of investment are based on research and modeling conducted by LDBP Consultant Team Member Betony Jones, LDBP Labor and Workforce Advisor. These assumptions include 4.7 jobs per million dollars of investment for industrial, 2.5 for MUSH, 6.1 for commercial, and 8.2 for residential and CARE customers. IMPLAN employment multipliers for industries 62 and 63 were used to estimate the ratio of indirect to direct jobs. IMPLAN labor income multipliers for industries 62 and 63 were used to estimate labor income impacts.

5. Energy Storage

Energy Storage economic impacts include the one-time installation costs for storage systems. There are no on-going annual jobs supported by Energy Storage. Annual costs range from \$5.0 million for 10 MWh utility-scale systems to \$75,000 for 100 kWh commercial/industrial systems, and to \$10,000 for residential 10 kWh systems and \$6,000 for residential 5 kWh systems. Installation costs are assumed to be 65% of total cost.¹¹

In order to estimate the installation impacts, IMPLAN employment and labor income multipliers for Maintenance and Repair Construction of Residential Structures (IMPLAN industry 63) were used for residential scale systems. Multipliers for Maintenance and Repair Construction of Non-residential Structures (IMPLAN industry 62) were used for commercial scale installations. Multipliers for Construction of Other New Nonresidential Structures (IMPLAN industry 58) were used for utility scale systems. For on-going annual maintenance impacts, the same multipliers were applied to annual costs of \$6 per kWh per year for utility scale investments, \$10 per kWh per year for commercial/industrial investments, and \$15 per kWh per year for residential investments.

6. Demand Response

The economic impacts of Demand Response include two components: installation and annual customer savings. The impacts of Demand Response assume an energy storage device has already been installed and only reflect the additional cost of load control equipment. Annual installation costs range from \$1,200 for residential customers to \$5,000 for commercial customers and \$10,000 for industrial customers. Installation is assumed to be 65% of total cost.¹²

¹¹ Percentage installation costs provided by Optony Inc.

¹² Percentage installation costs provided by Optony Inc.

In order to estimate the installation impacts, IMPLAN employment and labor income multipliers for Maintenance and Repair Construction of Residential Structures (IMPLAN industry 63) were used for residential scale systems. Multipliers for Maintenance and Repair Construction of Non-residential Structures (IMPLAN industry 62) were used for commercial scale installations.

In order to estimate the economic impacts of cost savings, different methodologies were used for residential customers versus commercial and industrial customers. For residential customers, the annual cost savings per customer is estimated at \$225.¹³ For these customer savings, IMPLAN multipliers for household spending for Alameda County were used. Cost savings of \$225 translates into increased output of \$155 and generates 3.04 direct jobs and 1.83 indirect and induced jobs per \$1.0 million dollars of savings.

For commercial and industrial customers, the cost savings is allocated based on the production functions of major industries in the region including wholesale trade, management of companies, computer systems design and programming, truck transportation, insurance carriers, management consulting, and research and development. This production function information was obtained from IMPLAN. It is assumed that commercial and industrial customers allocate their costs as follows: 70% for employee compensation; 5% of proprietor income; and 25% for indirect costs.¹⁴ Assuming that 75% of the cost savings will translate into increases in employee compensation and proprietor income, the impacts to these households are estimated using the same multipliers as for residential customer savings. The remaining 25% of the savings to commercial and industrial customers is allocated to supplying industries in the form of an increase in output. Based on the economic base of the region, and the makeup of typical supplier industries, this results in 4.78 additional direct jobs and 5.17 indirect jobs per \$1.0 million dollars of increased output in these supplier industries, defined as the share of cost savings that goes to indirect cost.

7. Electric Vehicle Incentives

Electric Vehicle impacts include the vehicle purchase as well as charger installation. The average vehicle cost (MSRP) is estimated at \$37,220. All vehicles would be purchased from participating dealers in Alameda County. Expenditures in the retail sector are margined to account for the fact that the vehicle is not produced in Alameda County and the impact to the retail sector only reflects the retail markup. In this case, a margin of 19% is applied to the vehicle cost of \$37,220 and then employment and labor income multipliers for Motor Vehicles and Parts Dealers (IMPLAN industry 396) were applied.

For installation, a cost of \$200 per charger is used. IMPLAN employment and labor income multipliers for Maintenance and Repair Construction of Residential Structures (IMPLAN industry 63) were used for installation impacts.

¹³ Annual cost savings information provided by Optony Inc.

¹⁴ Betony Jones, Kevin Duncan, Ethan Elkind, and Marilee Hanson, "The Net Economic Impacts of California's Major Climate Programs in The Inland Empire," August 2017.

8. Fuel Switching

Job impacts related to fuel switching include one-time purchases and installation costs for electric appliances/devices including thermostats, water heaters, and heat pump HVAC. Fuel switching is typically not considered a customer cost savings program, but rather a climate and public health protection program. Therefore, there are no job impacts related to customer savings.

Total installation costs per year can be estimated based on the number of customers that switch each type of appliance or device. In this illustrative example, it is assumed that 1,490 households participate in switching all three appliances/devices and an additional 1,490 participate in switching only their thermostat and water heater. Installation costs are estimated at \$126 for thermostats, \$1,389 for water heaters (plus an \$80 disposal/removal fee), and \$4,804 for HVAC systems (plus a \$500 disposal/removal fee).¹⁵ Economic multipliers for Maintenance and Repair Construction of Residential Structures (IMPLAN industry 63) were applied to total installation costs.

There are also impacts in the retail sector related to the purchase of these items. The assumption is that all appliances/devices would be purchased from retailers in Alameda County. Expenditures in the retail sector are margined to account for the fact that the appliances are not produced in Alameda County and the impact to the retail sector only reflects the retail markup. In this case, a margin of 35% is applied to the retail price of each item and then employment and labor income multipliers for Retail Building Materials and Garden Equipment (IMPLAN industry 399) were applied.

9. Local Development Fund

The Local Development Fund program assumes a 1 MW community solar installation. In order to estimate the direct installation impacts, IMPLAN employment and labor income multipliers for Maintenance and Repair Construction of Non-residential Structures (IMPLAN industry 62) were applied to estimated costs of \$2.1 million. For on-going annual maintenance impacts, the same multipliers were applied to annual costs of \$25 per MW per year.

Hourly wage information reflects journey level prevailing wages for Alameda County from the California Department of Industrial Relations and reflects the combination of trades required including carpenters, laborers, roofers, and electricians for solar installations.

10. Utility-Scale Solar and Wind

The utility-scale solar example assumes a 20 MW ground mount, single axis solar installation. Installation costs are estimated at 49% of total costs based on ratios from the JEDI model. IMPLAN employment and labor income multipliers for Construction of Other New Nonresidential Structures (IMPLAN industry 58) were used to estimate the job impacts. For on-going annual maintenance impacts, employment and labor income multipliers for Electric Power Generation Solar (IMPLAN industry 44) were applied to annual operating costs.

¹⁵ Homeadvisor.com installation costs for San Francisco Bay Area.

The hourly wage information reflects journey level prevailing wages for Alameda County from the California Department of Industrial Relations and reflects the combination of trades required including carpenters, laborers, operating engineers, iron workers, and electricians for solar installations.

The utility-scale wind example assumes a 50MW land-based wind farm. Installation costs are estimated at 24 percent of total costs based on ratios from the JEDI model. IMPLAN employment and labor income multipliers for Construction of New Power and Communication Structures (IMPLAN industry 54) were used to estimate the job impacts. For on-going annual maintenance impacts, employment and labor income multipliers for Electric Power Generation Wind (IMPLAN industry 45) were applied to annual operating costs.

The hourly wage information reflects journey level prevailing wages for Alameda County from the California Department of Industrial Relations and reflects the combination of trades required including operating engineers, laborers, iron workers, and electricians for wind installations.

11. Reduced Retail Electricity Rates

The cost savings to customers by customer class resulting from Reduced Retail Rates were estimated based on estimated revenues from EBCE customers at current (PG&E) levels less estimated revenues for a 1.5% rate reduction, or \$9.9 million in reduced revenues. Based on the projected EBCE revenues by customer class, this translates into \$3.3 million of annual savings for residential and CARE customers and \$6.6 million of annual savings for commercial, industrial, and government customers.

In order to estimate the impacts of costs savings, different methodologies were used for residential customers versus commercial and industrial customers. For residential customers, the annual cost savings per customer is estimated at \$225. For these impacts, IMPLAN multipliers for household spending for Alameda County were used. Annual cost savings of \$225 per residential customer translates into \$3.3 million in increased household spending and generates 4.8 induced jobs per \$1.0 million dollars.

For commercial and industrial customers, the cost savings is allocated based on the production functions of major industries in the region. These production functions were obtained from IMPLAN. It is assumed that commercial and industrial customers allocate their costs as follows:

- 50% for employee compensation;
- 5% for proprietor income; and
- 45% for indirect costs.

Assuming that 55% of the commercial and industrial customer cost savings will translate into increases in employee compensation and proprietor income, the impacts to these households are estimated using the same multipliers as for residential customer savings. The remaining 45% of the savings to commercial and industrial customers is allocated to supplying industries in the form of an increase in output. Supplier industries include the largest industries in Alameda County, as follows:

- wholesale trade;
- management of companies;
- computer systems design;
- computer programming;
- truck transportation;
- insurance carriers;
- management consulting; and
- R&D.

This results in about 8.4 induced jobs per \$1.0 million of commercial and industrial customer cost savings.

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ASSUMPTIONS AND GENERAL LIMITING CONDITIONS

ALH Urban & Regional Economics has made extensive efforts to confirm the accuracy and timeliness of the information contained in this study. Such information was compiled from a variety of sources, including interviews with government officials, review of City and County documents, and other third parties deemed to be reliable. Although ALH Urban & Regional Economics believes all information in this study is correct, it does not warrant the accuracy of such information and assumes no responsibility for inaccuracies in the information by third parties. We have no responsibility to update this report for events and circumstances occurring after the date of this report. Further, no guarantee is made as to the possible effect on development of present or future federal, state, or local legislation, including any regarding environmental or ecological matters.

The accompanying projections and analyses are based on estimates and assumptions developed in connection with the study. In turn, these assumptions, and their relation to the projections, were developed using currently available economic data and other relevant information. It is the nature of forecasting, however, that some assumptions may not materialize, and unanticipated events and circumstances may occur. Therefore, actual results achieved during the projection period will likely vary from the projections, and some of the variations may be material to the conclusions of the analysis.

Contractual obligations do not include access to or ownership transfer of any electronic data processing files, programs or models completed directly for or as by-products of this research effort, unless explicitly so agreed as part of the contract.