Technical Study for Community Choice Aggregation Program in Alameda County

Appendices

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Appendix A. Loads and Forecast

Appendix B. Power Supply Cost

Appendix C. Forecast of PG&E's Generation Rates

Appendix D. Detailed Pro Forma and CCA Rates

Appendix E. Greenhouse Gas Emissions and Costs

Appendix F. Macroeconomic Analysis

Appendix G. Energy Efficiency

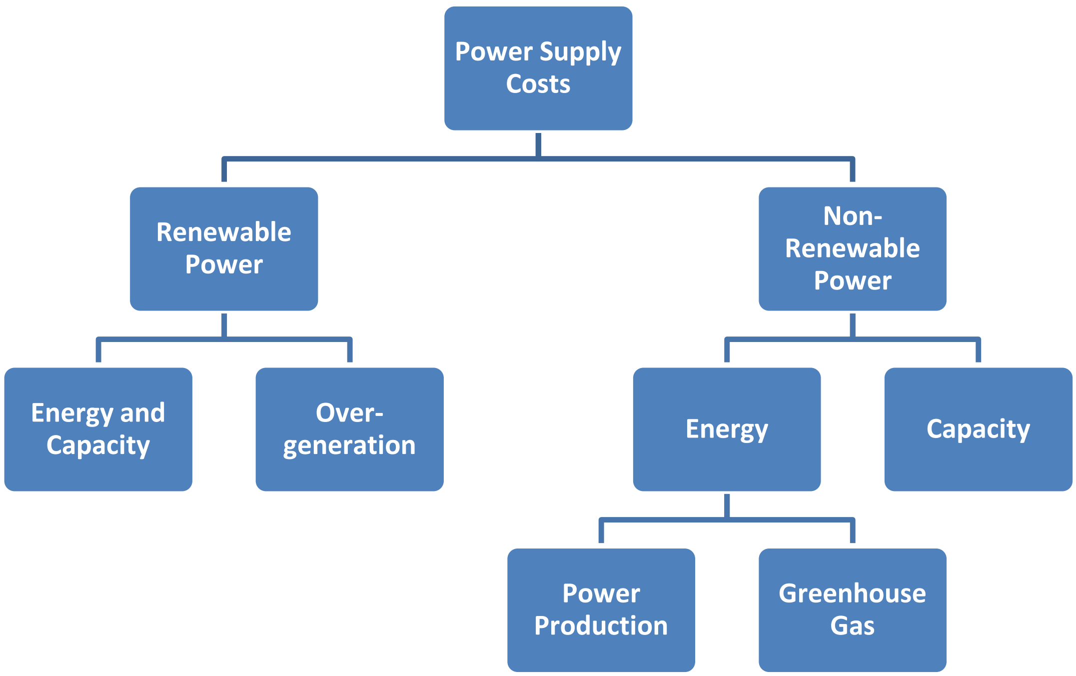
Appendix A. Loads and Forecast

2014 Load (MWh)	Residential	Commercial	Industrial	Public	Street lights + Pumping
OAKLAND	660,782	741,932	415,045	167,285	20,345
FREMONT	392,214	676,908	185,178	47,987	4,427
HAYWARD	240,909	444,599	71,270	30,672	25,598
BERKELEY	159,531	206,825	86,752	227,612	3,734
PLEASANTON	185,564	272,979	42,262	22,162	6,147
SAN LEANDRO	155,124	228,047	91,569	38,709	3,381
UNINCORPORATED	271,869	123,148	82,804	31,308	4,788
LIVERMORE	211,533	236,038	26,615	23,171	862
UNION CITY	114,258	175,482	6,194	54,684	5,401
DUBLIN	113,425	129,981	26,134	25,465	2,214
NEWARK	75,030	144,879	21,720	15,670	1,421
EMERYVILLE	21,608	132,815	44,507	3,637	1,024
ALBANY	23,494	13,997	15,602	2,855	1,778
PIEDMONT	27,774	1,622	0	3,044	328

Appendix B. Power Supply Cost

MRW has developed a bottoms-up calculation of Alameda CCA's power supply costs, separately forecasting the cost of each power supply element. These elements are renewable energy, non-renewable energy (including power production costs and greenhouse gas costs), resource adequacy (RA) capacity (both renewable and non-renewable supplies) and related costs (e.g., CAISO expenses and broker fees).[1] Figure 1 illustrates the components of Alameda CCA's expected supply costs.

Figure 1: Power Supply Cost Forecast



Renewable Power Cost Forecast

MRW developed a forecast of renewable generation prices starting from an assessment of the current market price for renewable power. For the current market price, MRW relied on wind and solar contract prices reported by California municipal utilities and Community Choice Aggregation (CCA) entities in 2015 and early 2016, finding an average price of $52 per MWh for these contracts.[2]

[1] MRW included a 5.5% adder in the power supply cost for CAISO costs (ancillary services, etc.), and a 5% premium for contracted supplies to reflect broker fees and similar expenses.

[2] MRW relied exclusively on prices from municipal utilities and CCAs because investor-owned utility contract prices from this period are not yet public. We included all reported wind and solar power purchase agreements, excluding local builds (which generally come at a price premium), as reported in California Energy Markets, an

To forecast the future price of renewable purchases, MRW considered a number of factors:

- Researchers from the National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Laboratory (LBNL) developed a set of forecasts of utility-scale solar costs based on market data and preliminary data from other research efforts.[3] Their base case forecast predicts a 3.8% annual decline in utility-scale solar capital costs on a nominal basis, from $1,932/kW-DC in 2016 to $1,652/kW-DC in 2020, with costs then remaining roughly constant in nominal dollars through 2030.[4] Additional scenarios predict even steeper price declines, with the most aggressive scenario predicting an 11% annual nominal decline through 2020, with increases at the rate of inflation after that.
- The federal Investment Tax Credit (ITC), which is commonly used by solar developers, is scheduled to remain at its current level of 30% through 2019 and then to fall over three years to 10%, where it is to remain.[5] The federal Production Tax Credit, which is commonly used by wind developers, is scheduled to be reduced for facilities commencing construction in 2017-2019 and eliminated for subsequent construction.[6] The loss of these credits would put upward pressure on prices.
- NREL and LBNL researchers predicted in 2015 that the cost increase associated with an ITC reduction would be roughly offset by other solar cost reductions even if the full reduction to 10% were to be implemented by 2018, rather than spread out through 2022 as is currently planned.[7]
- The production tax credit has been extended six times from 2000-2014,[8] and the solar ITC has been extended three times since 2007.[9] Further tax credit extensions are therefore plausible.
- The major California investor-owned utilities have significantly slowed their renewable procurement because lower-than-expected customer sales and higher-than-expected contracting success rates have led to procurement in excess of the RPS requirements

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independent news service from Energy Newsdata, from January 2015-January 2016 (see issues dated July 31, August 14, October 16, October 30, 2015, and January 15, 2016).

[3] National Renewable Energy Laboratory. Impact of Federal Tax Policy on Utility-Scale Solar Deployment Given Financing Interactions, September 28, 2015, Slide 16. http://www.nrel.gov/docs/fy16osti/65014.pdf

[4] Ibid. Costs converted to nominal dollars using the inflation forecast used throughout the rate forecast model (U.S. EIA's forecast of the Gross Domestic Product Implicit Price Deflator).

[5] U.S. Department of Energy. Business Energy Investment Tax Credit (ITC). http://energy.gov/savings/business-energy-investment-tax-credit-itc

[6] U.S. Department of Energy. Electricity Production Tax Credit (PTC). http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc

[7] National Renewable Energy Laboratory. Impact of Federal Tax Policy on Utility-Scale Solar Deployment Given Financing Interactions, September 28, 2015, Slide 28.

[8] Union of Concerned Scientists. Production Tax Credit for Renewable Energy. http://www.ucsusa.org/clean_energy/smart-energy-solutions/increase-renewables/production-tax-credit-for.html

[9] Solar Energy Industries Association. Solar Investment Tax Credit. http://www.seia.org/policy/finance-tax/solar-investment-tax-credit; and U.S. Department of Energy. Business Energy Investment Tax Credit (ITC). http://energy.gov/savings/business-energy-investment-tax-credit-itc

through 2020. When the utilities start ramping their procurement back up to meet the 50%-by-2030 RPS requirement, the supply-demand balance in the market may shift, resulting in higher-than-expected prices unless an increase in suppliers and development opportunities matches the increase in demand.

Given the potential upward price pressures from tax credits that are currently expected to expire and from higher demand for renewable power to meet the 50%-by-2030 requirement and the potential downward price pressures from falling renewable development costs, the possibility for lower cost procurement through the use of RECs, and the possibility that the expiry of the tax credits will be further delayed, it is unclear whether renewable prices will continue to fall (as NREL, LBNL, and others are predicting) or will start to stabilize and rise. MRW has addressed this uncertainty by considering two scenarios. In the base renewable cost forecast, MRW used the $52 per MWh average price of recent municipal utility and CCA wind and solar contracts as the price through 2022 (in nominal dollars), increasing the price with inflation in subsequent years. This results in a price of $59 per MWh in 2030. In the high renewable cost scenario, MRW increased the base case renewable prices to account for the expected expiration of the tax credits, resulting in a price of $77 per MWh in 2030. These scenarios provide a reasonable window of renewable price projections based on current market conditions and analysts' expectations.

MRW used these same renewable prices to calculate PG&E's renewable power costs. However, as described in Appendix B in the PG&E forecast, these renewable energy prices are used only for incremental power that is needed above PG&E's existing RPS contracts. For Alameda CCA, these prices are used as the basis for its entire RPS-eligible portfolio.

MRW additionally included a premium for the portion of Alameda CCA's RPS portfolio assumed in each scenario to be located in Alameda County. While solar energy is anticipated to provide the largest share of incremental supply located in-county, the solar resource in Alameda is not as strong as in the areas being developed to supply the contracts discussed above. As a result, the cost of solar generation in Alameda is expected to be higher than the contract prices we have assumed for non-Alameda supplies. Additionally, there are economies of scale in solar power development that mean small, local solar projects will cost more than the utility-scale projects upon which the average contract prices were derived. Based on information provided in the CPUC's current RPS calculator, which provides cost estimates for renewable energy projects located around California, large solar projects in Alameda are expected to have a 15% premium over projects in areas with the best solar resource. Generation from smaller projects (<3 MW) in Alameda are assumed to cost 55% more than the base contract price assumed in our forecast.

Given the high levels of renewable energy assumed in each of the scenarios, and the variable patterns of renewable energy production, there are likely to be periods during which the renewable energy projects with which the Alameda CCA has contracted are producing more than its customers require.[10] This excess supply must be managed by the Alameda CCA and will likely add to its overall supply costs. For the purpose of this assessment, MRW assumed that the excess renewable supply would be sold at 10% of the cost of additional renewable purchases

[10] The annual oversupply is equal to the sum of positive hourly differences between RPS generation and load.

made at other times to make up for the annual shortfall.[11] The cost of managing excess renewable energy supply could be reduced through the use of unbundled RECs. For example, in hours when the CCA is long on renewable energy, it could simply resell the energy in the spot market and keep the REC rather than selling the bundled REC at a discount in one hour when it has excess supply and purchasing a bundled REC in another hour.

Non-Renewable Energy Cost Forecast

MRW separated the costs of non-renewable energy generation into two components: power production costs and greenhouse gas costs. The forecast methodologies for these cost elements, described below, are consistent with the forecast methodologies used for these cost elements in the PG&E rate forecast.

Since natural gas generation is typically on the margin in the California wholesale power market, power production costs for market power are driven by the price for natural gas. MRW forecasted natural gas prices based on current NYMEX market futures prices for natural gas, projected long-term natural gas prices in the EIA's *2015 Annual Energy Outlook,*[12] and PG&E's tariffed natural gas transportation rates.[13] MRW used a standard methodology of multiplying the natural gas price by the expected heat rate for a gas-fired unit and adding in variable operations and maintenance costs to calculate total power production costs.

In addition to power production costs, the cost of energy generated in or delivered to California also includes the cost of greenhouse gas allowances that, per the state's cap-and-trade program, must be procured to cover the greenhouse gases emitted by the energy generation. MRW developed a forecast of the prices for these allowances based on the results of the California Air Resources Board's (ARB's) auctions for Vintage 2015 allowances,[14] increased annually in proportion to the auction floor price increases stipulated by the ARB's cap-and-trade regulation.[15] MRW estimated the emissions rate of Alameda CCA non-renewable power supply based on an estimated heat rate for market power multiplied by the emissions factor for natural gas combustion.[16]

Capacity Cost Forecast for Non-Renewable Power

[11] This is because it is likely that other potential buyers of renewable energy at times when Alameda has excess supply will also have lower need for additional renewable energy.

[12] U.S. Energy Information Administration. "2015 Annual Energy Outlook," Table 13.

[13] Pacific Gas & Electric, Burnertip Transporation Charges. Tariff G-EG, Advice Letter 3664-G, January 2016 and Tariff G-SUR, Advice Letter 3699-G, April 2016.

[14] Auction results available at http://www.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf.

[15] California Code of Regulations, Title 17, Article 5, Section 95911.

[16] U.S. EIA. Electric Power Annual (EPA), February 16, 2016, Table A.3. https://www.eia.gov/electricity/annual/html/epa_a_03.html

To estimate Alameda CCA's capacity requirements, MRW developed a forecast of Alameda CCA's peak demand in each year and subtracted the net qualifying capacity credits provided by Alameda CCA's renewable power purchases. This is appropriate because the renewable energy prices used in this analysis reflect prices for contracts that supply both energy and capacity. If Alameda CCA purchases renewable energy via energy-only contracts, Alameda CCA's need for capacity will be greater than forecasted here, but these higher costs will be fully offset by the lower costs for the renewable energy.

MRW estimated current peak demand for Alameda CCA's load using the 2013-2014 monthly bills for all the current PG&E clients in Alameda county[17] and PG&E's class-average load profiles. We forecasted changes to this peak demand based on the California Energy Commission's forecast of changes to peak demand in PG&E's planning area.[18] We calculated capacity requirements as 115% of the expected peak demand in order to include sufficient capacity to fulfill resource adequacy requirements. We applied a consistent methodology to obtain the peak demand growth rates and capacity requirements for PG&E.

To estimate the cost of Alameda CCA's capacity needs, MRW priced capacity purchases at the median price of recent Resource Adequacy purchases, escalated with inflation.[19]

[17] Monthly bills corresponding to 2013 and 2014 for all the clients in Alameda county provided by PG&E.

[18] California Energy Commission. Demand Forecast. PG&E Forecast Zone Results Mid Demand Case, Sales Forecast, Central Valley Region. December 14, 2015.

[19] CPUC 2013-2014 Resource Adequacy Report Final, August 5, 2015, page 23 Table 11.

Appendix C. Forecast of PG&E's Generation Rates

MRW developed a forecast of PG&E's generation rates for comparison with the rates that Alameda CCA will need to charge to cover its costs of service. MRW developed the forecast for the years 2017-2030 using publicly available inputs, including cost and procurement data from PG&E, market price data, and data from California state regulatory agencies and the U.S. Energy Information Administration. The structure of the rate forecast model and the basic assumptions and inputs used are described below.

Generation Charges

PG&E's generation costs fall into four broad categories: (1) renewable generation costs, (2) fixed costs of non-renewable utility-owned generation, (3) fuel and purchased power costs for non-renewable generation, and (4) capacity costs. Each of these categories is evaluated separately in the rate forecast model, and underlying these forecasts is a forecast of PG&E's generation sales.

Sales Forecast

PG&E's generation cost forecast is driven in large part by the amount of generation that PG&E will need to obtain to meet customer demand. To forecast PG&E's electricity sales, MRW started with the 2016-2030 sales forecast that PG&E provided in its January 2016 Renewable Energy Procurement Plan ("RPS Plan") filing with the CPUC.[20] This forecast predicts 4% annual sales reductions through 2020 and anemic sales growth of 0.2% per year from 2020-2025, before increasing to close to 1% per year from 2025-2030.[21]

Renewable Generation

The starting point for MRW's analysis is PG&E's "RPS Plan," in which PG&E discusses its plan for meeting California's Renewable Portfolio Standard (RPS) targets and provides the annual amount and cost of renewable generation currently under contract through 2030. PG&E's RPS Plan shows that PG&E's current renewable procurement is in excess of the RPS requirement in each year through 2022. After 2022, PG&E's renewable generation from current contracts falls below the RPS requirements, but PG&E is projected to have enough banked Renewable Energy Credits (RECs) from excess renewable procurement in prior years to meet the RPS requirements until 2025.

MRW adopted PG&E's RPS Plan forecast of the amount and cost of renewable generation that is currently under contract. For the period starting in 2026 when PG&E's RPS Plan shows a need

[20] Pacific Gas & Electric. *Renewables Portfolio Standard 2015 Renewable Energy Procurement Plan (Final Version)*. January 14, 2016. Appendix D.

[21] The near-term decline in sales in PG&E's forecast is likely attributable to the growth in CCA, in which a municipality procures electric power on behalf of its constituents instead of having them purchase their power from PG&E. While customers in the jurisdictions of these municipalities have the option to opt-out of CCA and to continue to procure power from PG&E, so far, most CCA-eligible customers have not elected for this option. CCA customers continue to procure electricity delivery services from PG&E; it is only generation services that they obtain through the CCA.

for incremental renewable procurement to meet RPS requirements, MRW added in the necessary renewable generation to meet current statutory requirements (i.e., 33% of procurement in 2020, increasing to 50% of procurement in 2030).[22] To project PG&E's cost of this incremental renewable generation, MRW used the same renewable prices used for Alameda CCA's renewable power cost forecast (see 0).

Fixed Cost of Non-Renewable Utility-Owned Generation

PG&E's rates include payment for the fixed costs of the PG&E-owned non-renewable generation facilities, which are primarily natural gas, nuclear, and hydroelectric power plants. Because these costs are not tied to the volume of electricity that PG&E sells, their annual escalation is not driven by the price of fuel and other variable inputs. Instead, they escalate at a rate that stems from a combination of cost increases and depreciation reductions. These escalation rates are determined in General Rate Case (GRC) proceedings, which occur roughly every three years.

As a starting point for the forecast, MRW used the adopted 2016 fixed costs for these facilities.[23] For the period between 2017 and 2019, MRW estimated escalation rates based on PG&E's proposal in its 2017 GRC application,[24] estimating in the base case that PG&E would receive 2/3 of its requested GRC increases and in an alternate scenario that PG&E would receive 50% of its requested increases in order to evaluate a window of potential GRC outcomes. For subsequent years, MRW estimated in the base case that PG&E's generation fixed costs would increase by the 6.2% annual average growth rate approved and implemented for these cost over the last ten years. In the alternate scenarios, we instead applied a 4.9% annual average growth rate, calculated as 20% discount off the base case growth rate.[25] These escalation rates are in nominal dollars (i.e., some of the escalation is accounted for by inflation).

[22] MRW additionally allowed for the purchase of additional renewable generation when renewable prices are below market prices, subject to some purchase limits, including a 50% cap on renewable generation relative to the entire generation portfolio. This leads to additional renewable purchases from 2027-2029 in the Low Renewable Price scenario. Starting in 2030, the RPS requirement is 50%, and no additional renewable purchases are allowed, per the rules of the model, in order to maintain grid reliability.

[23] Pacific Gas & Electric. Annual Electric True-Ups for 2016. Advice Letter 4696 E-A. January 4, 2016. Table 2.

[24] Pacific Gas & Electric 2017 GRC Request, A.15-09-001, Exhibit PG&E-10, Tables E-3 and E-4.

[25] Historic growth rates calculated from Pacific Gas & Electric Advice Letters 2706-E-A, AL 3773-E, 4459-E, 4647-E, and 4755-E. New power plant costs were excluded from these calculations since costs of new plants are offset, at least in part, by a reduction in fuel and purchased power costs.

Table 1: PG&E's Generation Fixed Costs, 2011-2016[26]
(Nominal $ Million)

	2011	2012	2013	2014	2015	2016
Generation Fixed Costs	1,400	1,530	1,550	1,710	1,860	1,840
Annual Cost Increase		9%	1%	10%	9%	-1%

MRW made adjustments to this GRC forecast to account for the likely retirement of the Diablo Canyon nuclear units at the end of the units' current licenses in 2024 and 2025. As of April 2015, PG&E was undecided as to whether it would pursue a license extension for the Diablo Canyon units.[27] There is ample reason for this uncertainty. For example, the CPUC has stated that PG&E will be required to present a thorough assessment of the cost-effectiveness of relicensing, including a number of studies exploring reliability, security, and safety implications;[28] PG&E will also be required to undertake a massive cooling system modification project before operating the nuclear plant past 2024 (per state regulations implementing the Federal Clean Water Act, Section 316(b));[29] an independent panel of peer reviewers to recent federal- and state-required PG&E seismic studies has unresolved concerns over these studies;[30] and the U.S. Nuclear Regulatory Commission is requiring PG&E to conduct additional earthquake hazard analysis because initial post-Fukushima studies showed a hazard level above the original design basis for the plant.[31] Given the uncertainties surrounding the continued operation of the plant, MRW assumed in the base case that the Diablo Canyon units would be shut down at the end of their current licenses.

In an alternate relicensing scenario, MRW included costs for the cooling system modification project that would be required.[32] To estimate annual ratepayer costs from this project, we conservatively used PG&E's $4,489 million cost estimate for a closed cycle cooling system,[33]

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[26] 2011-2013: CPUC Decision 11-05-018, pages 2 and 15; and 2014-2016: CPUC Decision 14-08-032, Appendix C, Table 1 and Appendix D, Table 1.

[27] California Energy Commission. "2015 Integrated Energy Policy Report," February 24, 2016 ("2015 IEPR"), pages 177-178. http://www.energy.ca.gov/2015_energypolicy/

[28] 2015 IEPR, page 178.

[29] California State Water Resources Control Board. "Fact Sheet: Once-Through Cooling Policy Protects Marine Life And Insures Electric Grid Reliability," http://www.swrcb.ca.gov/publications_forms/publications/factsheets/docs/oncethroughcooling.pdf

[30] 2015 IEPR, pages 180-183.

[31] 2015 IEPR, page 184.

[32] California State Water Resources Control Board. "Fact Sheet: Once-Through Cooling Policy Protects Marine Life And Insures Electric Grid Reliability,"

[33] Subcommittee Comments on Bechtel's Assessment of Alternatives to Once-Through-Cooling for Diablo Canyon Power Plant. November 18, 2014, page 10.

depreciated over a 20-year period. MRW did not include costs for the CPUC-required cost-effectiveness study or for the investments that, based on the finding of the study, may be required to shore up the safety and reliability of the plant and its spent fuel management program because these costs are not well defined at this point.

Fuel and Purchased Power Costs for Non-Renewable Generation

Each spring, PG&E files a forecast with the CPUC of its fuel and purchased power costs for the upcoming year in its "ERRA" filing, which PG&E updates and finalizes in November. MRW relied on PG&E's November 2015 ERRA testimony,[34] adjusted to remove renewable generation costs, as the starting point for the forecast of fuel and purchased power costs for PG&E's non-renewable generation.

To escalate these costs through the forecast period, MRW forecasted changes to natural gas prices and greenhouse gas cap-and-trade program compliance costs, which are the major drivers of change to these costs. The natural gas price forecast is based on current NYMEX market futures prices for natural gas, forecasted natural gas prices in the U.S. EIA's *2015 Annual Energy Outlook*, and PG&E's tariffed natural gas transportation rates. This forecast is the same forecast used in the forecast of Alameda CCA's wholesale power costs (see 0).

Cap-and-trade program compliance costs are estimated based on (1) PG&E's forecast of carbon dioxide emissions in 2016;[35] (2) a forecast of PG&E's fossil generation supply, developed by subtracting expected renewable, hydroelectric, and nuclear generation from PG&E's projected wholesale power requirement; and (3) a forecast of greenhouse gas allowance prices. The greenhouse gas allowance price forecast is the same as used in the forecast of Alameda CCA wholesale power costs and is based on the results of the California Air Resources Board's (ARB's) most recent allowance auctions, increased annually in proportion to the auction floor price increases stipulated by the ARB's cap-and-trade regulation (see 0).

The MRW rate model calculates total fuel and purchased power costs by escalating natural gas prices based on the natural gas price forecast described above, escalating nuclear fuel prices based on the EIA forecast of fuel costs for nuclear plants, escalating water costs for hydroelectric projects and the capacity costs of power purchase contracts with inflation, and pricing market power at the same market power price used for Alameda CCA's purchases. The model then sums the cost for each of these resources and adds in projected cap-and-trade compliance costs to this total cost.

[34] PG&E Update To Prepared 2016 Energy Resource Recovery Account and Generation Non-Bypassable Charges Forecast and Greenhouse Gas Forecast Revenue and Reconciliation, filed with the CPUC in proceeding A.15-06-001 on Nov 5, 2015, pages 14 and 24.

[35] PG&E Update To Prepared 2016 Energy Resource Recovery Account and Generation Non-Bypassable Charges Forecast and Greenhouse Gas Forecast Revenue and Reconciliation, filed with the CPUC in proceeding A.15-06-001 on Nov 5, 2015, Table 11-2.

Capacity Costs

PG&E must procure capacity to meet 115% of its anticipated peak demand in order to fulfill its resource adequacy requirement. PG&E's own power plants can be used to meet this requirement, as can power plants with which PG&E has contracts.

To estimate PG&E's capacity requirements, MRW started with the Capacity Supply Plan that PG&E submitted to the California Energy Commission in 2015,[36] which forecasts PG&E's peak demand and existing capacity resources for each of the years 2013-2024. With limited exception,[37] MRW used PG&E's data where publicly available and extended the forecasts to 2030. In extending these forecasts, we used assumptions that are consistent with those used in our assessments of energy sales and costs, including load growth escalation and the projected retirement of PG&E's nuclear plant. We also added in anticipated capacity from new renewable procurement and from new energy storage and adjusted the calculation to account for the portion of Resource Adequacy credits that is allocated to non-bundled customers.

As with the Alameda CCA's capacity cost forecast, MRW priced capacity at the median price of recent Resource Adequacy capacity sales, escalated with inflation.[38]

Rate Development

Following the methodologies described above, MRW developed a forecast of PG&E's generation revenue requirement and divided these expenses by the expected PG&E sales in order to obtain a forecast of the system-average generation rate. We calculated annual escalators based on these system-average rates and applied them to the generation rates that are currently in effect for each customer class.[39]

[36] California Energy Commission, Energy Almanac, Utility Capacity Supply Plans from 2015. September 4, 2015

[37] The main exception is that we increased energy efficiency and demand response growth to comply with SB 350 requirements to double energy efficiency by 2030 and the anticipated continuation of CPUC demand response initiatives.

[38] CPUC 2013-2014 Resource Adequacy Report Final, August 5, 2015, page 23 Table 11.

[39] PG&E Advice Letter AL-4805-E, effective March 24, 2016.

Appendix D. Detailed Pro Forma and CCA Rates

Case-Legend	
Base	B
High natural gas price	G
High PCIA	P
Diablo Canyon relicensed	D
High renewable prices	R
Low PG&E portfolio costs	L
Stress Scenario	S

Scenario	Case	Rates ($/MWh)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	B	CCA generation	6.0	6.2	6.1	6.2	6.4	6.6	6.6	6.8	7.0	7.2	7.4	7.7	7.9	8.1
1	B	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
1	B	CCA Reserve Fund	0.9	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	B	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
1	G	CCA generation	6.8	7.2	7.3	7.7	7.9	8.0	8.1	8.2	8.4	8.7	8.9	9.0	9.2	9.4
1	G	Exit fees	2.0	2.0	1.9	1.9	1.5	1.5	1.5	1.5	1.3	1.2	1.1	1.0	0.9	0.8
1	G	CCA Reserve Fund	1.0	0.6	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	G	PG&E generation	9.9	10.2	10.2	10.7	10.9	11.1	11.2	10.9	10.6	10.7	10.9	11.2	11.4	11.7
1	P	CCA generation	6.0	6.2	6.1	6.2	6.4	6.6	6.6	6.8	7.0	7.2	7.4	7.7	7.9	8.1
1	P	Exit fees	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
1	P	CCA Reserve Fund	0.9	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	P	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
1	D	CCA generation	6.0	6.2	6.1	6.2	6.4	6.6	6.6	6.8	7.0	7.2	7.4	7.7	7.9	8.1
1	D	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.3	1.2	1.3	1.2	1.1	1.0	0.9
1	D	CCA Reserve Fund	0.9	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	D	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	11.2	12.8	13.1	13.3	13.7	14.0	14.3
1	R	CCA generation	6.0	6.2	6.2	6.4	6.8	7.0	7.2	7.5	7.7	8.0	8.2	8.5	8.8	9.0
1	R	Exit fees	2.1	2.1	2.0	1.9	1.5	1.4	1.3	1.1	0.9	1.0	1.0	0.9	0.8	0.7
1	R	CCA Reserve Fund	0.9	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	R	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	11.0	10.8	10.2	10.2	10.5	10.8	11.0	11.3
1	L	CCA generation	6.0	6.2	6.1	6.2	6.4	6.6	6.6	6.8	7.0	7.2	7.4	7.7	7.9	8.1
1	L	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
1	L	CCA Reserve Fund	0.6	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	L	PG&E generation	8.7	8.8	8.9	9.3	9.5	9.8	9.8	9.7	9.2	8.9	9.1	9.4	9.6	9.8
1	S	CCA generation	6.8	7.3	7.4	7.8	8.2	8.4	8.7	8.9	9.1	9.5	9.7	9.9	10.1	10.4

1	S	Exit fees	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
1	S	CCA Reserve Fund	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	S	PG&E generation	9.0	9.2	9.3	9.7	9.9	10.3	10.4	10.4	10.1	10.1	10.3	10.5	10.7	10.9
2	B	CCA generation	6.5	6.6	6.4	6.5	6.7	6.8	6.8	6.9	7.1	7.3	7.5	7.7	7.9	8.1
2	B	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
2	B	CCA Reserve Fund	1.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	B	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
2	G	CCA generation	7.1	7.4	7.3	7.6	7.8	7.9	7.9	8.1	8.3	8.6	8.8	9.0	9.2	9.4
2	G	Exit fees	2.0	2.0	1.9	1.9	1.5	1.5	1.5	1.5	1.3	1.2	1.1	1.0	0.9	0.8
2	G	CCA Reserve Fund	0.9	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	G	PG&E generation	9.9	10.2	10.2	10.7	10.9	11.1	11.2	10.9	10.6	10.7	10.9	11.2	11.4	11.7
2	P	CCA generation	6.5	6.6	6.4	6.5	6.7	6.8	6.8	6.9	7.1	7.3	7.5	7.7	7.9	8.1
2	P	Exit fees	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
2	P	CCA Reserve Fund	1.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	P	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
2	D	CCA generation	6.5	6.6	6.4	6.5	6.7	6.8	6.8	6.9	7.1	7.3	7.5	7.7	7.9	8.1
2	D	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.3	1.2	1.3	1.2	1.1	1.0	0.9
2	D	CCA Reserve Fund	1.0	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	D	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	11.2	12.8	13.1	13.3	13.7	14.0	14.3
2	R	CCA generation	6.5	6.7	6.6	6.8	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0
2	R	Exit fees	2.1	2.1	2.0	1.9	1.5	1.4	1.3	1.1	0.9	1.0	1.0	0.9	0.8	0.7
2	R	CCA Reserve Fund	1.0	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	R	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	11.0	10.8	10.2	10.2	10.5	10.8	11.0	11.3
2	L	CCA generation	6.5	6.6	6.4	6.5	6.7	6.8	6.8	6.9	7.1	7.3	7.5	7.7	7.9	8.1
2	L	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
2	L	CCA Reserve Fund	0.1	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	L	PG&E generation	8.7	8.8	8.9	9.3	9.5	9.8	9.8	9.7	9.2	8.9	9.1	9.4	9.6	9.8
2	S	CCA generation	7.1	7.4	7.5	7.9	8.3	8.5	8.8	9.0	9.2	9.5	9.7	9.9	10.1	10.4
2	S	Exit fees	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2	S	CCA Reserve Fund	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	S	PG&E generation	9.0	9.2	9.3	9.7	9.9	10.3	10.4	10.4	10.1	10.1	10.3	10.5	10.7	10.9
3	B	CCA generation	6.5	6.9	7.0	7.4	7.9	8.0	8.0	8.2	8.3	8.5	8.7	8.9	9.1	9.2
3	B	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
3	B	CCA Reserve Fund	1.0	0.5	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	B	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
3	G	CCA generation	7.1	7.5	7.6	8.0	8.4	8.5	8.5	8.6	8.8	9.0	9.2	9.4	9.6	9.8
3	G	Exit fees	2.0	2.0	1.9	1.9	1.5	1.5	1.5	1.5	1.3	1.2	1.1	1.0	0.9	0.8
3	G	CCA Reserve Fund	0.9	0.7	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	G	PG&E generation	9.9	10.2	10.2	10.7	10.9	11.1	11.2	10.9	10.6	10.7	10.9	11.2	11.4	11.7
3	P	CCA generation	6.5	6.9	7.0	7.4	7.9	8.0	8.0	8.2	8.3	8.5	8.7	8.9	9.1	9.2
3	P	Exit fees	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

3	P	CCA Reserve Fund	1.0	0.5	0.4	0.1	0.1	0.0	0.0	0.0	-0.2	-0.7	-0.3	0.0	0.0	0.0
3	P	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	10.8	10.2	9.9	10.1	10.4	10.6	10.9
3	D	CCA generation	6.5	6.9	7.0	7.4	7.9	8.0	8.0	8.2	8.3	8.5	8.7	8.9	9.1	9.2
3	D	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.3	1.2	1.3	1.2	1.1	1.0	0.9
3	D	CCA Reserve Fund	1.0	0.5	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	D	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	10.9	11.2	12.8	13.1	13.3	13.7	14.0	14.3
3	R	CCA generation	6.5	7.0	7.2	7.8	8.8	9.0	9.3	9.5	9.7	9.9	10.1	10.3	10.5	10.7
3	R	Exit fees	2.1	2.1	2.0	1.9	1.5	1.4	1.3	1.1	0.9	1.0	1.0	0.9	0.8	0.7
3	R	CCA Reserve Fund	1.0	0.6	0.4	0.1	0.1	0.0	0.1	0.0	-0.4	-0.8	-0.3	0.0	0.0	0.0
3	R	PG&E generation	9.7	9.8	9.9	10.3	10.6	10.9	11.0	10.8	10.2	10.2	10.5	10.8	11.0	11.3
3	L	CCA generation	6.5	6.9	7.0	7.4	7.9	8.0	8.0	8.2	8.3	8.5	8.7	8.9	9.1	9.2
3	L	Exit fees	2.1	2.1	2.0	1.9	1.5	1.5	1.4	1.2	1.1	1.2	1.1	1.0	0.9	0.8
3	L	CCA Reserve Fund	0.1	-0.1	0.0	0.0	1.2	0.0	0.0	0.0	-0.2	-0.7	-0.3	0.0	0.0	0.0
3	L	PG&E generation	8.7	8.8	8.9	9.3	9.5	9.8	9.8	9.7	9.2	8.9	9.1	9.4	9.6	9.8
3	S	CCA generation	7.1	7.6	7.8	8.4	9.2	9.4	9.8	10.0	10.2	10.4	10.6	10.8	11.1	11.3
3	S	Exit fees	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
3	S	CCA Reserve Fund	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	S	PG&E generation	9.0	9.2	9.3	9.7	9.9	10.3	10.4	10.4	10.1	10.1	10.3	10.5	10.7	10.9

Appendix E. Greenhouse Gas Emissions and Costs

In Chapter 3 of the report, MRW provided an estimate of Alameda CCA's annual Greenhouse Gas (GHG) emissions and compared these with the emissions for the same load under the PG&E supply portfolio. The methodology used to calculate both figures is included in this appendix, along with an estimate of Alameda CCA's cost of emissions from purchased power ("indirect emissions").

Methodology for calculating Alameda CCA's indirect GHG emissions

GHG emissions for Alameda CCA will be indirect since the CCA does not plan to generate its own power (*i.e.,* the emissions are embedded in fossil-fuel power that the CCA purchases). These emissions are estimated based on (1) a forecast of the emissions rate for Alameda CCA's fossil generation supply and (2) a forecast of the amount of Alameda CCA's fossil generation supply, developed by subtracting expected renewable and hydroelectric generation from the projected wholesale power requirement to serve the CCA's load.[40]

MRW calculated the emissions rate for Alameda CCA's fossil generation supply by estimating the amount of natural gas that will need to be burned to generate the CCA's fossil generation and the GHG emissions rate for natural gas combustion.[41] The amount of natural gas needed was estimated based on the average heat rate for the marginal generation plants on the CAISO system. MRW used public data from CAISO's OASIS platform and Platt's Gas Daily reports to calculate this average heat rate for 2015.[42] MRW extended the forecast to 2030 using the expected changes to the average heat rate in California from the EIA's *2015 Annual Energy Outlook.*[43]

MRW estimated the total annual GHG emissions for the Alameda CCA program as a product of the total energy purchased at wholesale electric market (kWh) and the rate of GHG emissions (tonnes $CO_{2\text{-equivalent}}$/kWh).

[40] MRW assumed no GHG emissions for the renewable and hydroelectric supply.

[41] The GHG emissions rate for natural gas combustion is obtained from U.S. EIA. Electric Power Annual (EPA), February 16, 2016, Table A.3. https://www.eia.gov/electricity/annual/html/epa_a_03.html

[42] MRW calculated the average heat rate of the marginal generation plants in 2015 by dividing the monthly average wholesale electric market price, net of operations and maintenance costs and GHG emissions costs, by the monthly average natural gas price. For the electricity prices, we used the average of the 2015 hourly locational marginal price for node TH_NP15_GEN-APND; for the natural gas prices, we used the average of burnertip natural gas price for PG&E.

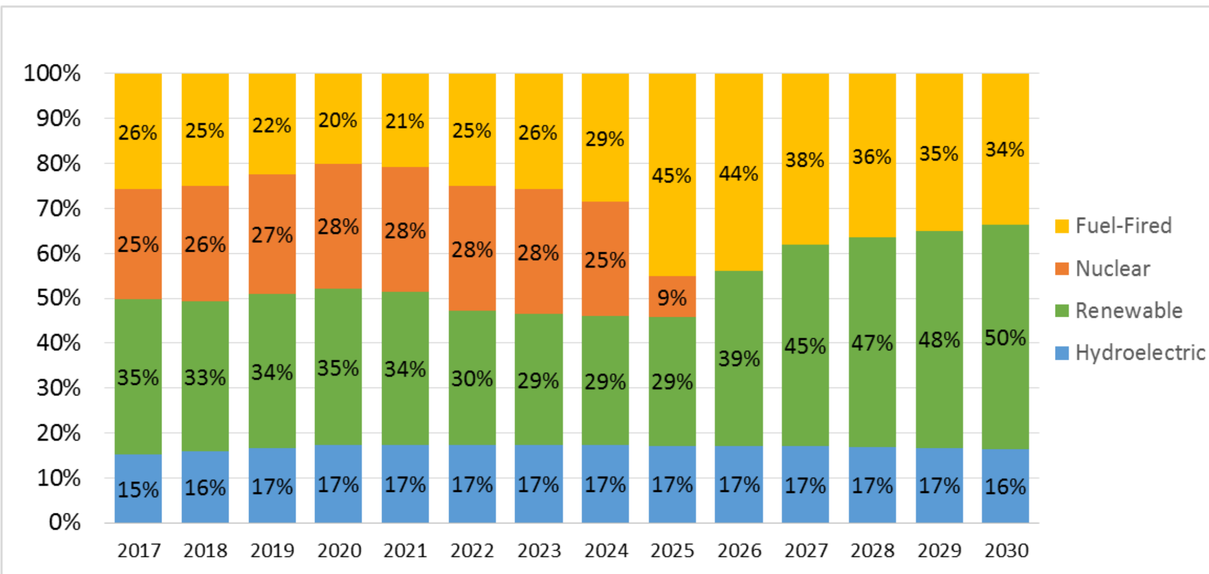
[43] U.S. Energy Information Administration. "2015 Annual Energy Outlook," Table 55.20, Western Electricity Coordinating Council. (Note that EIA does not provide a forecast of the marginal heat rate.)

Methodology for calculating GHG emissions under PG&E's supply portfolio

MRW calculated the GHG emissions for the Alameda CCA load under the PG&E supply portfolio by summing the emissions from all resources in PG&E's portfolio. MRW assumed no GHG emissions from renewable power, hydroelectric power, or nuclear generation. In order to maintain a consistent comparison, MRW used the same emissions rate to calculate the emissions from PG&E's fossil-fuel power as used for the Alameda CCA wholesale market purchases.

In order to support the analysis on Chapter 3 of the report, Figure 2 shows the PG&E portfolio. Before the closure of the Diablo Canyon, MRW estimated more than 70% of PG&E's generation portfolio based on non-fuel-fired resources. After 2025, the non-fuel-fired resources share falls to 65% according MRW estimates.

Figure 2 PG&E's generation portfolio



GHG allowance prices and GHG indirect costs

MRW developed a forecast of the prices for GHG allowances based on the results of the California Air Resources Board's (ARB's) auctions for Vintage 2015 allowances,[44] increased annually in proportion to the auction floor price increases stipulated by the ARB's cap-and-trade regulation.[45]

[44] Auction results available at http://www.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf.

[45] California Code of Regulations, Title 17, Article 5, Section 95911.

Table 2 GHG Allowances price, $ per allowance

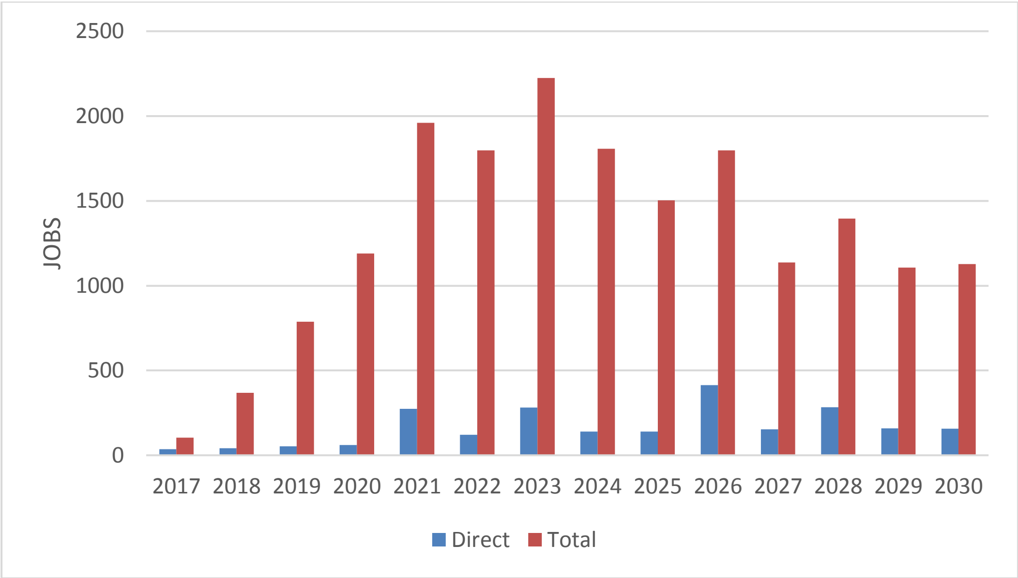
2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
14.0	15.0	16.0	17.2	18.4	19.6	21.0	22.4	24.0	25.6	27.4	29.3	31.3	33.5

MRW used these GHG allowances prices to calculate both PG&E's GHG allowances costs (direct and indirect), which are included in the PG&E rate forecast, and Alameda CCA's indirect GHG costs. The indirect GHG costs for Alameda CCA will be included in the cost of the wholesale market energy purchases. MRW estimated that these costs will be, on average, $5 per MWh delivered over the 2017-2030 period.

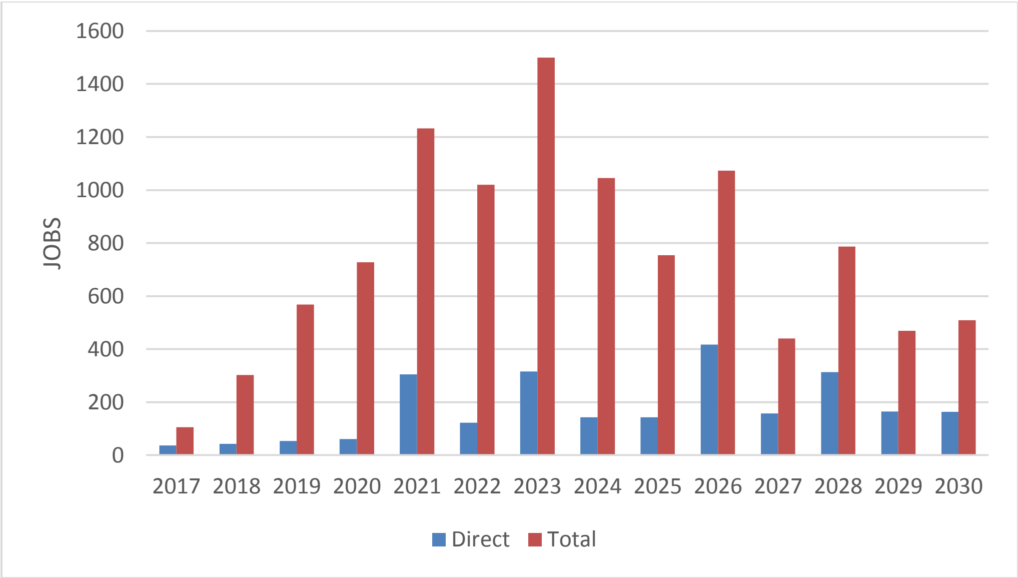
Appendix F. Macroeconomic Analysis

Additional results are provided for scenario 2 and 3 to match those presented in Chapter 5 for scenario 1. High-level results are provided for the *rest of California* region. Overview information on the REMI Policy Insight model is provided in the last section.

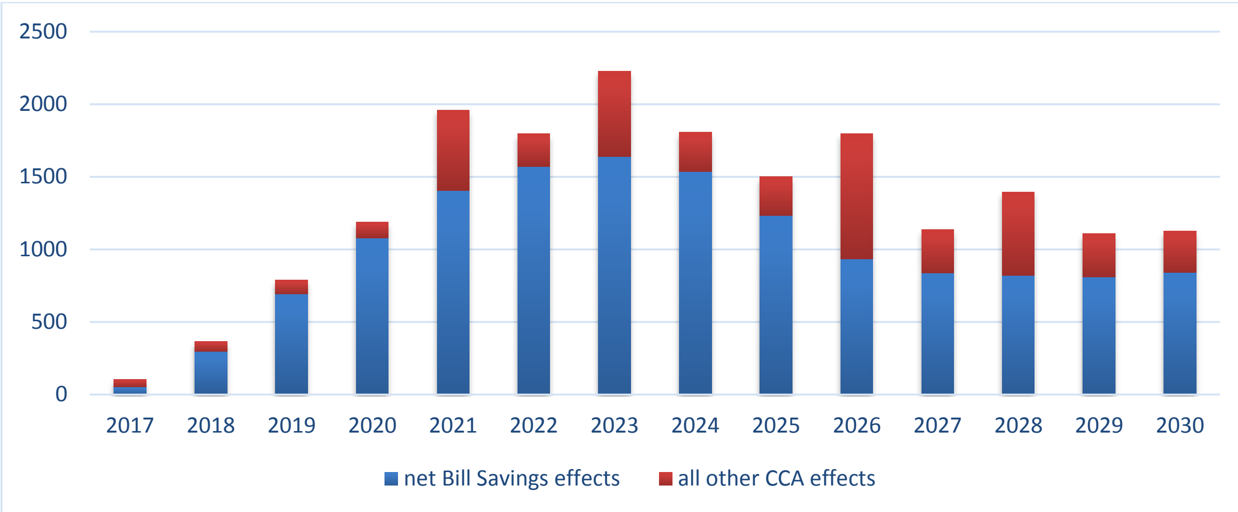
CCA Scenario 2 County Job Impacts



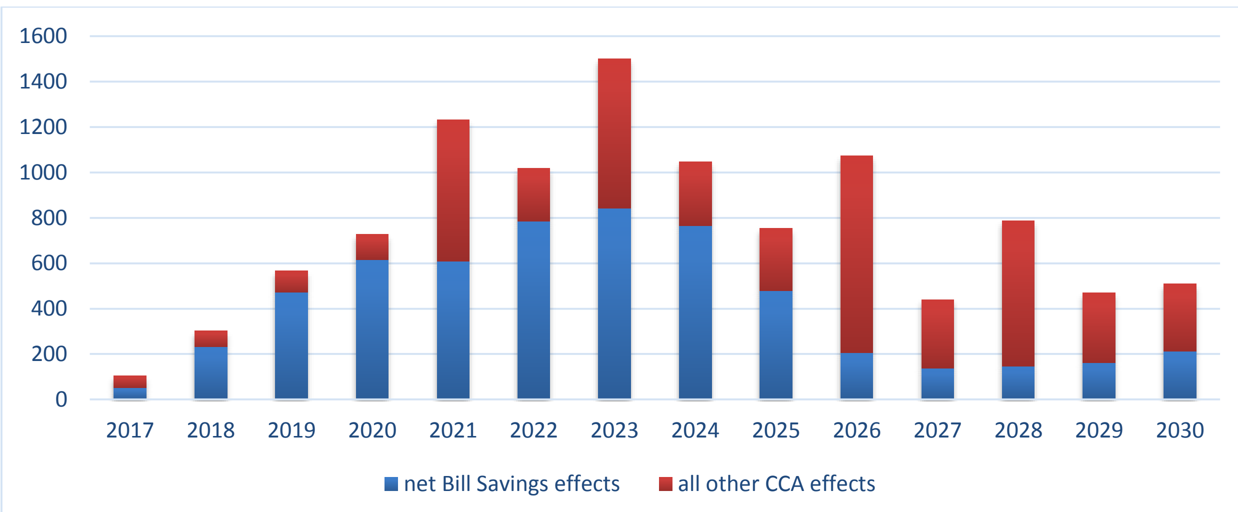
CCA Scenario 3 County Job Impacts



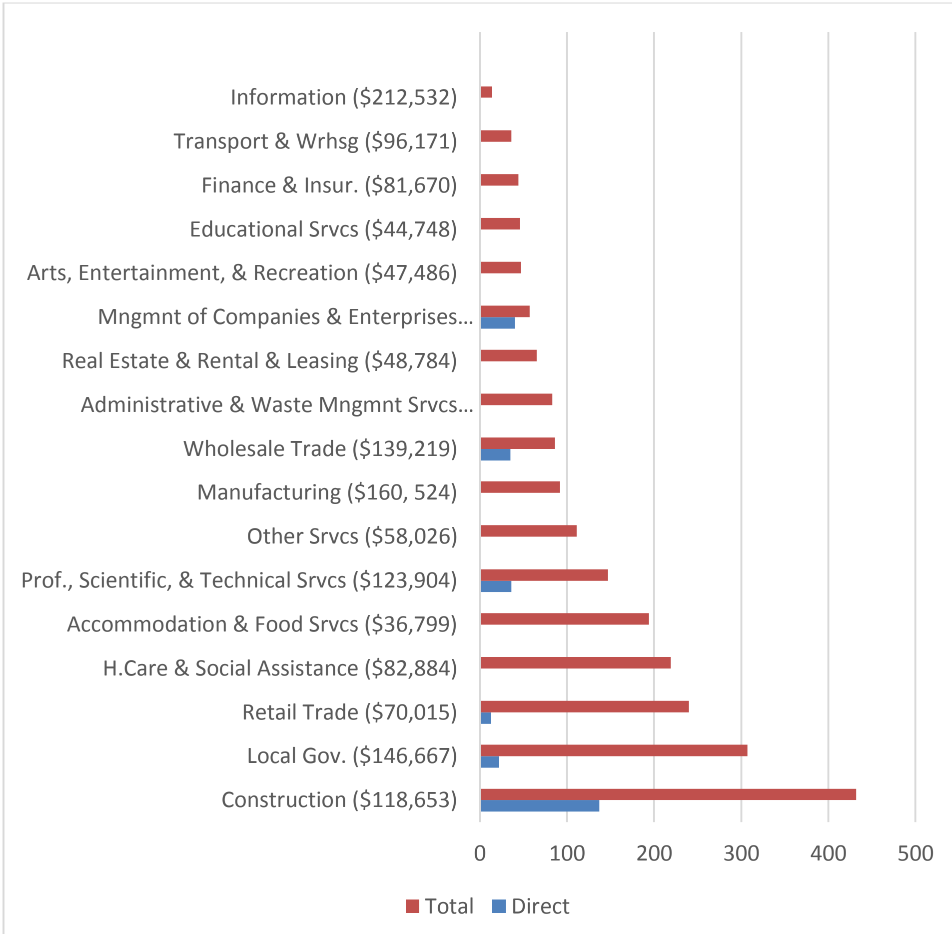
Alameda County CCA Scenario 2 Total Jobs Impacts by Source



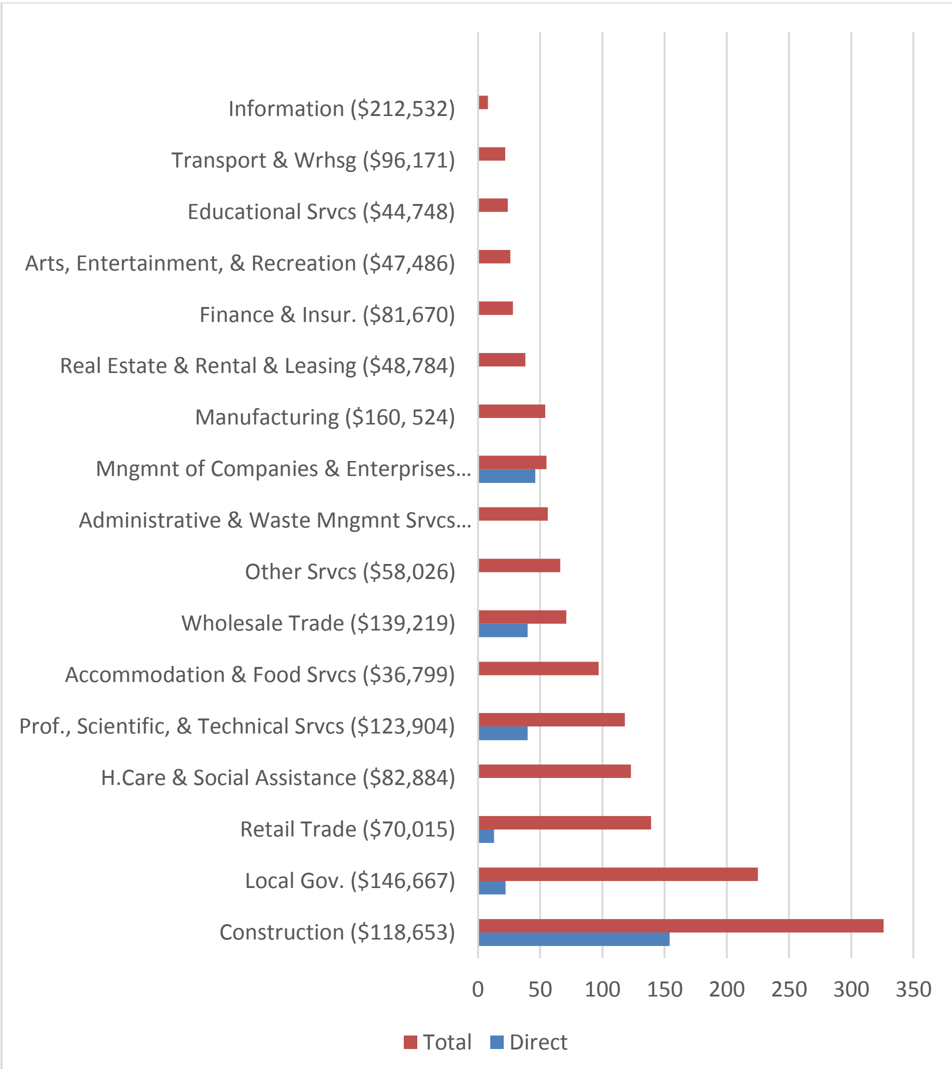
Alameda County CCA Scenario 3 Total Jobs Impacts by Source



Alameda County Jobs Changes by sector (annual earnings per worker), Scenario 2, 2023



Alameda County Jobs Changes by sector (annual earnings per worker), Scenario 3, 2023

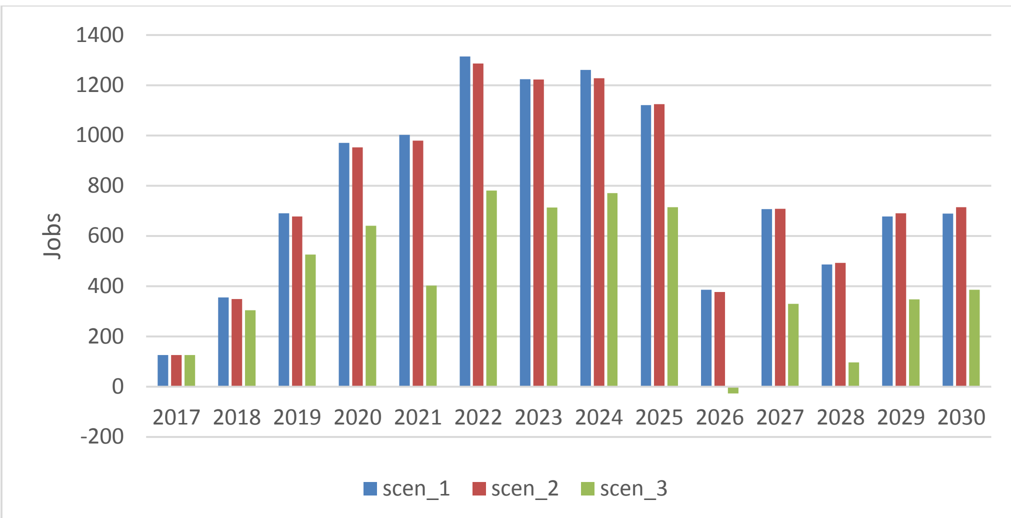


Results for rest of California Economy

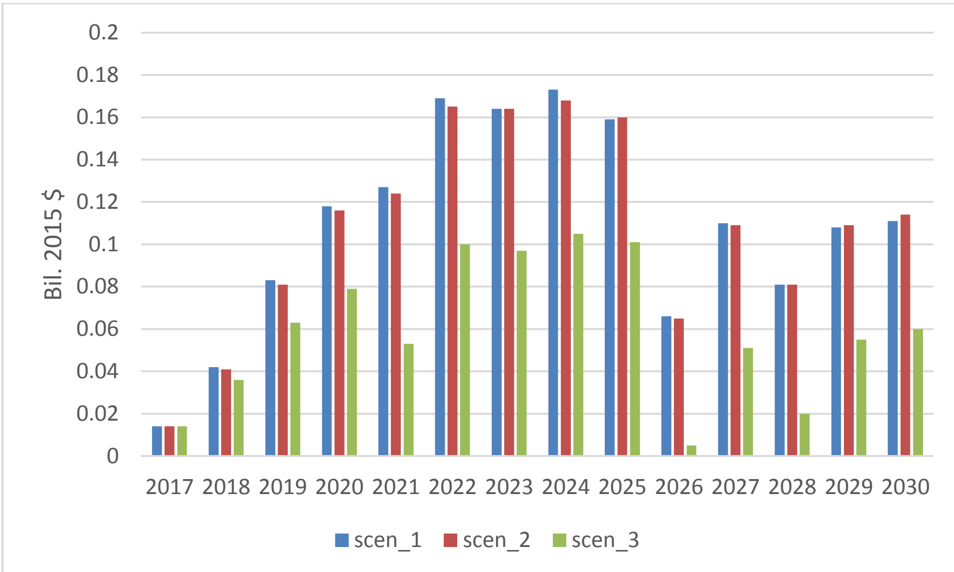
CCA Scenario	**rest of CA Impacts**				
	local capture on changes in RE investments & O&M (bil$) ……	*as % of roCA's Total project cost*	*as % of region's expected Economic Activity*	**Avg. Annual Direct Jobs**	**Avg. Annual *Total* Jobs**
1	-$0.155	53%	-0.0002%	-30	786
2	-$0.143	58%	-0.0002%	-24	780
3	-$0.115	40%	-0.0002%	-33	436

The local renewable investment (O&M) changes are negative as a result of expected cancellation of future PG&E renewable project and the amount of CCA funded renewable projects that would be sited in this region. The reason the *rest of California* region can create positive *total* job impacts despite small negative average annual *direct* job impacts is due economic flows between the county and this large region. In any scenario the Alameda County business segments in particular are benefitted by lower electric rates which was shown to expand their business (and jobs). When a business grows it requires more supplies and services and some of those come as *'imports from elsewhere in the state.'* Working age households that commute into Alameda County from outside also gain earned income to spend in the *rest of California* region. Since scenario 3 has the lowest rate savings it is also associated with the smallest *total* job impact in the *rest of California* region.

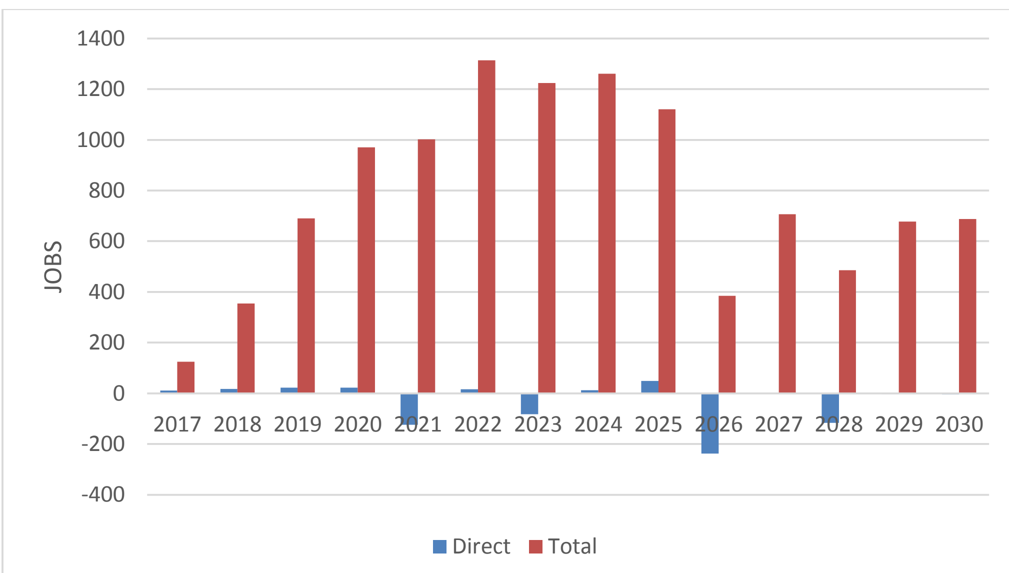
Rest of California Total Job Impacts by Scenario



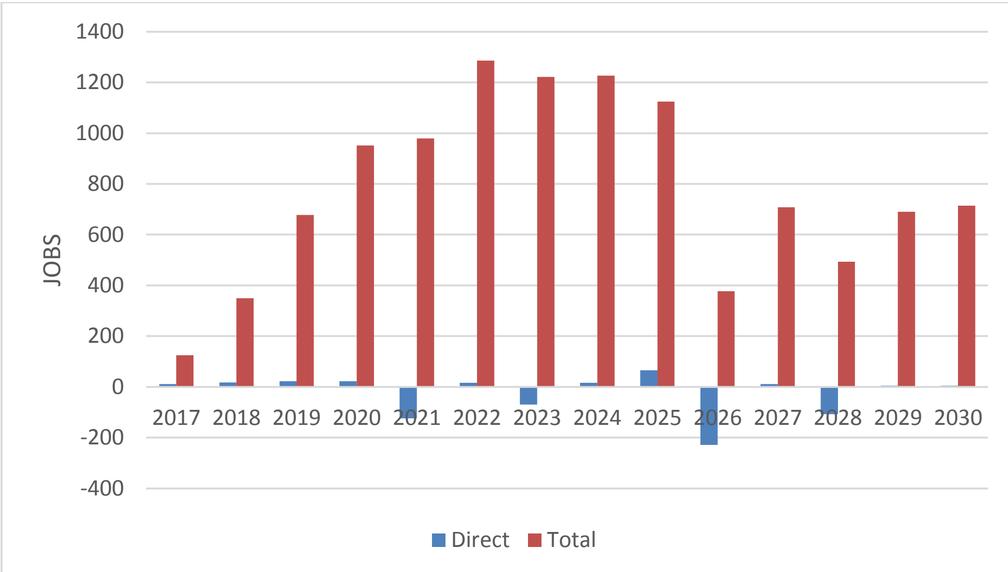
Rest of California Total GRP Impacts by Scenario



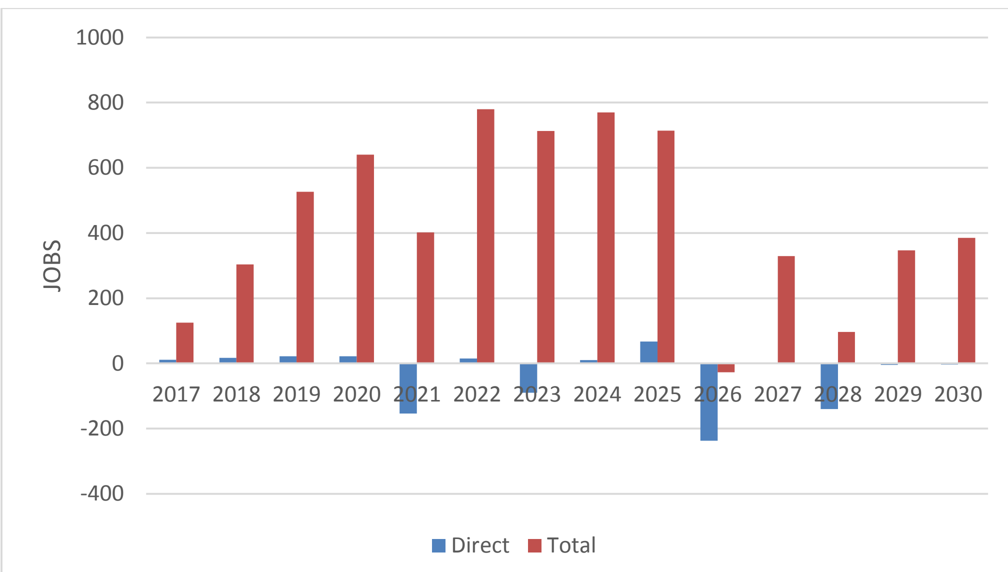
CCA Scenario 1 Rest of California Job Impacts



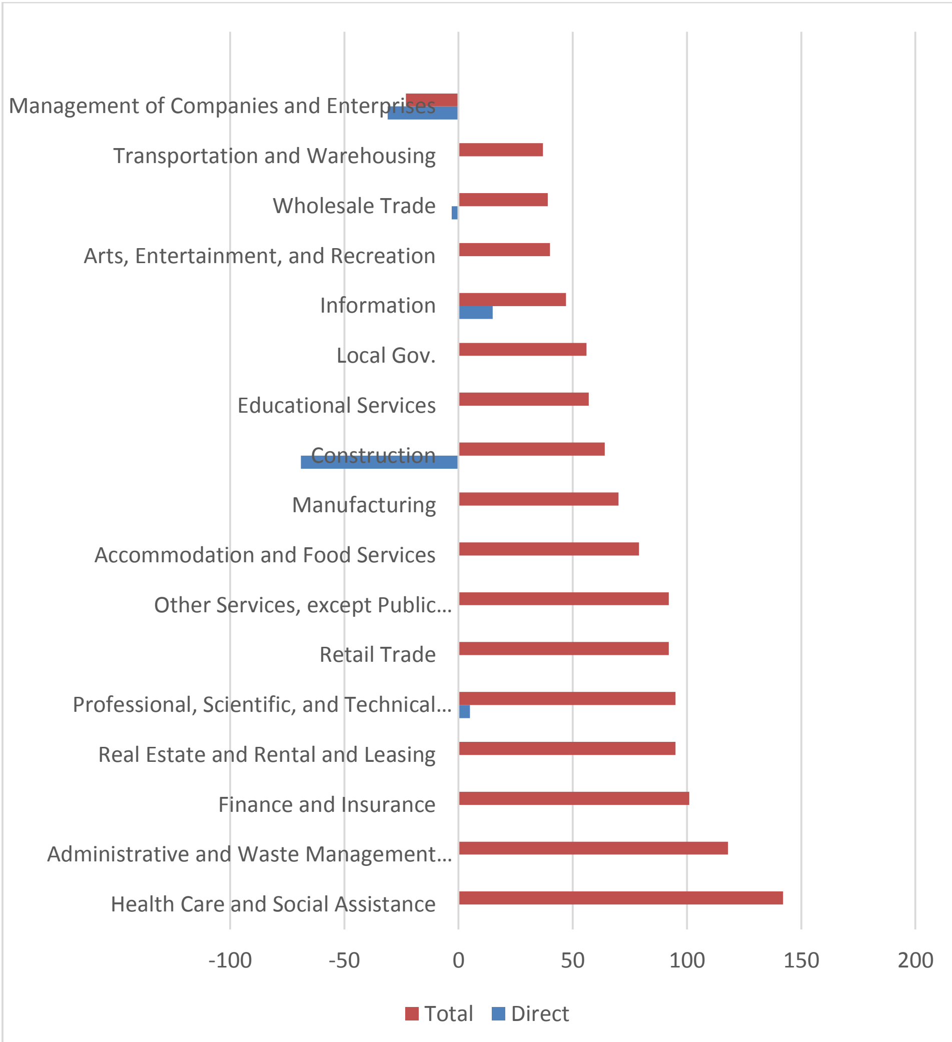
CCA Scenario 2 Rest of California Job Impacts



CCA Scenario 3 Rest of California Job Impacts



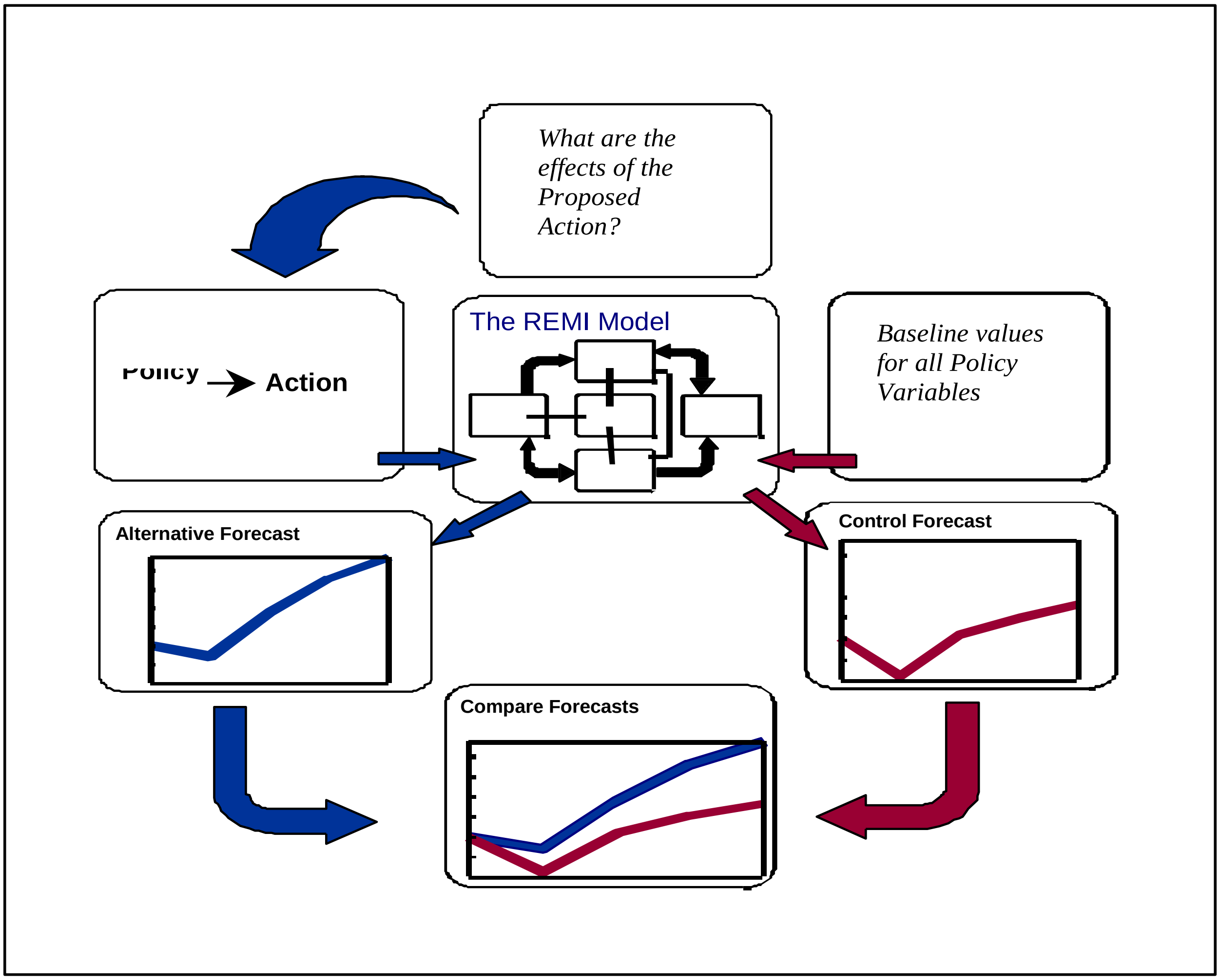
Rest of California Jobs Changes by sector, Scenario 1, 2023



About the REMI Policy Insight Model

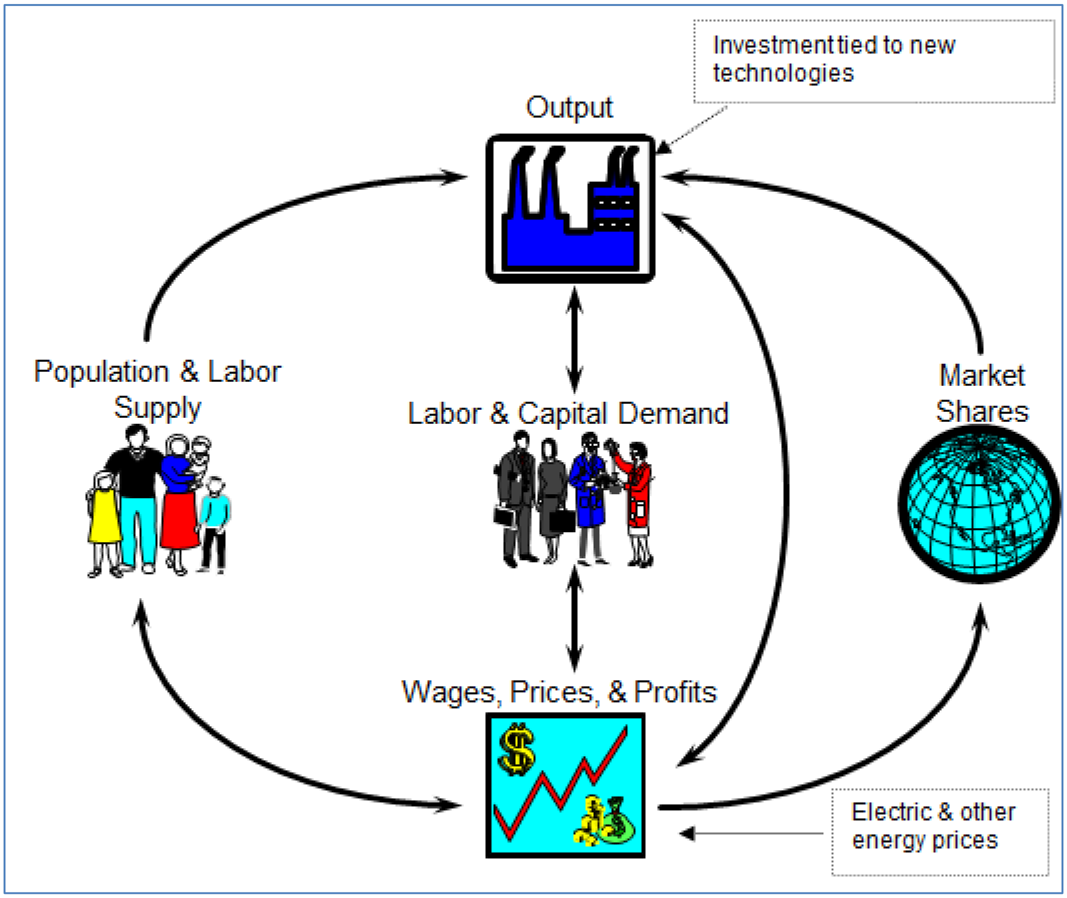
A software analysis forecasting model developed by Regional Economic Models, Inc. (REMI) of Amherst Massachusetts in the mid 1980's. It has a broad national customer base among public agencies, academic institutions, and the private-sector. It is also used in Canada (NRCan), and among other international clients. The model configuration used for this study consisted of 18 aggregate private-sector industries, plus a farm sector, a combined state/local government sector and two federal government sectors.

Economic Impacts Identified with the REMI Model



In the above figure, the central box "The REMI model" is the engine for predicting the economic and demographic dimensions of a *region-of-impact* (here Alameda County) under *no-action* (or Control forecast) and with a proposed CCA (alternative forecast). The engine is a combination structural econometric model, part input-output transactions, all with general equilibrium features – meaning *an economy can encounter a disruption (positive or negative), and over time (typically 1-3 years depending on the scale of the region and the size of the shock) re-adjust back* *to an equilibrium*. The diagram below depicts the organization of the REMI regional model in terms of the major blocks functioning in an economy and the arrows denote the feedback accounted for. Keep in mind this portrayal is at a very high-level, sparing the industry-specific details. Scenario specific changes are inserted through policy variable *levers* into the appropriate block of the model. There is another important dimension of economic response for the key region-of-impact that effectively layers on top of the below diagram – interactions with another regional economy. That additional region - *rest of California* -was explicitly modeled at the same time. The REMI model captures the flows of monetized goods and services, and commuter labor between regions when one (or both) is *shocked* by introduction of a CCA.

Core Logic of the REMI Model



Appendix G. Energy Efficiency

Contents

Energy Efficiency Research Objectives

The research undertaken by the MRW team to inform the potential for energy efficiency within the Alameda County CCA feasibility study, and associated REMI model, include the following objectives:

1. Provide a brief overview of key legislative, regulatory, and local market initiatives influencing the potential for energy efficiency.
2. Provide an assessment of the technical, economic, and market potential for energy efficiency based on tools used by the CPUC to assess potential within PG&Es service territory.
3. Provide general guidance on where CCA energy efficiency initiatives might achieve energy efficiency that are incremental to current PG&E goals.
4. Assess the current funding environment and potential costs for CCA administered energy efficiency initiatives.
5. Define the economic inputs for energy efficiency for the REMI model.

Legislative, Regulatory, and Local Market Environment for Energy Efficiency

The potential for any administrators of energy efficiency programs to deliver savings is influenced by underlying regulatory factors along with the ability of a community to deliver energy efficiency products and services. The following discussion provides a brief summary of the regulatory and service delivery environment in which energy efficiency programs administered by an Alameda County CCA would likely begin operating.

Legislative Environment

Recent legislation that is now defining the regulatory landscape under which CCA administered energy efficiency programs would operate include;

SB 350. Signed by the Governor on October 7, 2015, Senate Bill (SB) 350, the Clean Energy and Pollution Reduction Act of 2015 requires the State Energy Resources Conservation and Development Commission to establish annual targets for statewide energy efficiency savings and demand reduction that will achieve a cumulative doubling of statewide energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030. SB 350 allows CCA energy efficiency programs to count towards statewide energy efficiency targets, and will likely have a significant impact on funding levels available for energy efficiency, and on administrative and goal setting requirements for energy efficiency program administrators, including CCA's.

AB 802. Effective September 1, 2016, the CPUC will authorize electrical and gas corporations to provide incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings. This legislation may provide for new measure acceptance and cost effectiveness criteria that could expand opportunities for energy efficiency, including new High Opportunity Program Designs (HOPPS) currently under design.

Regulatory Environment

Rulemaking 09-11-014.[46] This ruling sought to clarify how CCAs will be able to participate in administering energy efficiency programs on behalf of the customers and/or geographic areas they serve. The ruling outlines how the commission would assess the benefits of the party's proposed program to ensure that the program meets the following objectives:

- Is consistent with current administrative rules as established pursuant to Section 381 of the public utility code.
- Advances the public interest in maximizing cost-effective electricity savings and related benefits.
- Accommodates the need for broader statewide or regional programs.

The ruling further defined the methods and guidelines for budgeting energy efficiency programs administered by a CCA, and also clarified the capacity of CCA to administer energy programs, that may also serve non-CCA customers located within the CCA's operating region.

Decision 15-10-028. As part of CPUC Decision 15-10-028 (a component of the rulemaking 13-11-005), the operation of energy efficiency programs will transition to a 'rolling portfolio' model. Historically, California has allocated ratepayer funding for energy programs through decisions made on a one, two, or three-year cycle by the California Public Utilities Commission (CPUC). This cyclical funding resulted in significant administrative burdens in the planning, assessment, and uncertainty regarding ongoing programmatic operations that potentially limited customer participation. The rolling portfolio concept, defined in the fall of 2015, initiates the conversion to a "rolling portfolio" cycle. Through this cycle, energy efficiency (EE) program administrators, including CCA's, are responsible for the creation of 5-year "business plans" in an effort to decrease administrative burden, increase transparency, and provide a more stable business platform from which to engage customers.

Local Market Environment

Alameda County has an existing and robust market of firms engaged in energy efficiency, including the capacity to provide innovative products and services to all market sectors including energy efficiency, renewable generation, energy storage, and demand response capabilities. As such, it is very likely that adequate administrative and technical support availability will be required to rapidly launch programs that would have a high likelihood of success. The following provides a brief, inexhaustive overview of this capacity.

StopWaste. StopWaste began operations in 1976 as a public agency responsible for reducing the waste stream in Alameda County. StopWatse is governed jointly by three Boards, including the Energy Council that was formed in Spring 2013 as a Joint Powers Agency to seek funding on behalf of its member agencies to develop and implement programs and policies that reduce

[46] Administrative Law Judge's Ruling Regarding Procedures For Local Government Regional Energy Network Submissions For 2013-2014 And For Community Choice Aggregators To Administer Energy Efficiency Programs

energy demand, increase energy efficiency, advance the use of clean, efficient and renewable resources, and help create climate resilient communities. StopeWaste and the Energy Council will be key stakeholders in any distributed energy resource activities associated with an Alameda County CCA.

Bay Area Regional Energy Networks (BayREN). BayREN offers 2 programs that provide benefits to Alameda County residential facilities in Alameda County, including single and multifamily dwellings. BayREN also offers commercial PACE programs in addition to a proposed innovative financing pilot program, referred to Pay-As-You-Save (PAYS). PAYS intends to retrofit 2,000 multifamily housing units in Hayward with an array of resource efficiency measures that will assist multifamily property owners monitor and reduce both water and energy use. All BayREN programs offered in Alameda County are administered by StopWaste.

PG&E. The 2015 PG&E portfolio includes 66 programs available throughout Alameda County that provide financial incentives and technical support for energy efficiency activities. These programs, listed in Appendix A, cover all market sectors and energy end uses and are representative of programs that will likely continue to operate in the coming years. PG&E spends roughly $300M to $400M annually across its service territory on programs and marketing efforts designed to promote energy efficiency.

Local Energy Efficiency and Sustainability Firms. The County has substantial local resources including public institutions and numerous public and private companies, some of which have been in continuous operation since the early 1980s.

In summary, the preceding discussion on the legislative, regulatory and market environment for energy efficiency indicates;

1. The legislative environment created by SB350, AB802, AB758, AB32 are expanding the opportunities for funding and program innovations for distributed energy resources, such as energy efficiency, along with the capacity of CCA's to implement programs.
2. Structural changes now underway through the rolling portfolio initiative (RP Decision) may reduce the overall administrative burden on program administrators and provide a more stable business platform in the form of consistent funding over longer term program cycles. Regulatory proceedings are continuing to address procedural issues that will clarify the rules of CCA program operation and budgeting issues.
3. Alameda County has significant local delivery capacity, including firms with a long history of successfully operating energy efficiency and resource management programs, including the technical and administrative capabilities needed to successfully deliver on regulatory requirements. This implies that innovative programs that incorporate emerging concepts such as High Opportunity Projects and Programs (HOPPS) or integrated demand side management (IDSM) techniques can be developed and implemented with acceptable risk.
4. Risks exists in the form duplicate efforts between established utility programs and CCA administered programs, and also the potential for customer confusion from other market entrants. In the longer term, the role of energy efficiency and related opportunities is

evolving as advances in renewable energy and storage technology change the economics associated with avoided costs, greenhouse gases priorities, and operational dynamics associated with grid management. This indicates some uncertainty in program design and delivery priorities.

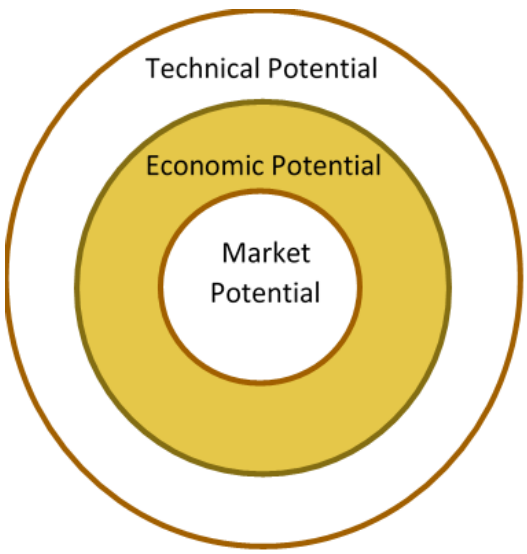
Energy Efficiency Potential

The following section provides an estimate of the overall level of energy efficiency potential in Alameda County as derived from a publically available potential model, and also provides several examples of incremental potential not represented in this model that may be developed by CCA administered programs.

Types of Energy Efficiency Forecasts and Alameda County Market Potential

Forecasts of energy efficiency potential are generally based on three levels of screening, as illustrated in **Error! Reference source not found.** and discussed below.

Figure 3. Diagram of Types of Energy Efficiency Potential



1. **Technical Potential Analysis.** Technical potential is defined as the amount of energy savings that would be possible if all technically applicable and feasible opportunities to improve energy efficiency were taken, including retrofit measures, replace-on-burnout measures, and new construction measures. Technical potential varies over time depending on market adoption and saturation of existing technologies, and the development of new technologies that are more efficient than the current market baseline. It is also a very notional metric intended to provide a benchmark that compares the current market with a hypothetical market where the most current energy efficiency technologies have been installed, and all machines and systems may be upgraded to a high level of efficiency.

2. **Economic Potential Analysis.** Using the results of the technical potential analysis, the economic potential is calculated as the total energy efficiency potential available when limited to only cost-effective measures. All components of economic potential are a subset of technical potential. Economic potential is less than technical potential because it considers the influence of financial payback on customer selection, along with regulatory requirements that exclude certain energy efficiency activates based on cost effectiveness criteria. Economic potential is also a notional metric which adjusts technical potential to account for various regulatory and market economic constraints.
3. **Market Potential Analysis.** The final output of most potential studies is a market potential analysis which is defined as the energy efficiency savings that could be expected to occur in response to specific levels of program funding and customer participation based on assumptions regarding market influences and barriers. All components of market potential are a subset of economic potential. Some studies also refer to this as the "Maximum Achievable Potential." Defining market potential requires an estimate of how much market activity occurs each year where there is an opportunity to install efficient equipment. The opportunity is often related to natural stock turnover (i.e., old equipment burns out and needs to be replaced) or the favorable economic conditions such that residents and businesses invest in energy efficiency, or the influence of codes and standards. Market potential generally does not exceed 1% of total electricity consumption in any given year, but is influenced by the level of spending and the development of new and innovative market interventions.

The assessment of energy efficiency potential in Alameda County completed for this feasibility study used outputs from the 2013[47] and 2015[48] Energy Efficiency Potential and Goals studies developed by the CPUC. These CPUC studies define the technical and economic potential for energy efficiency in PG&E's service territory, and also determine the market potential used to set energy efficiency production goals and budgets for PG&E's energy efficiency programs. Because of its size, varied economy, diverse demographics, and range of climates it is likely that both energy use characteristics and the potential for energy efficiency in Alameda County is consistent with the potential for energy efficiency in PG&E's overall service territory, with some exceptions such as a reduced presence of agricultural and oil extraction loads found elsewhere in the state. For example, a review of Alameda County electric usage data provided to the MRW team for this analysis indicates that the residential sector accounted for 29% of sales to the County by PG&E in 2013 and 2104, with non-residential sales accounting for the remaining 71%. Similarly, the CEC electric demand forecast for the overall PG&E service territory[49] indicates that the residential sector accounted for 31% of total system-wide sales for those same years, with nonresidential sales accounting for 69% of sales, consistent with the distribution of sales in Alameda County. Based on these consistencies in markets and energy usage, this analysis concludes that energy efficiency potential for electricity in PG&E's overall service

[47] 2013 California Energy Efficiency Potential and Goals Study, Final Report. Prepared for the California Public Utilities Commission by Navigant Consulting, Inc. February 14, 2014

[48] Energy Efficiency Potential and Goals Study for 2015 and Beyond, Stage 1 Final Report. Prepared for the California Public Utilities Commission by Navigant Consulting, Inc. Reference No.: 174655, September 25, 2015

[49] Form 1.1 – STATEWIDE California Energy Demand 2015 Revised - Mid Demand Case, Electricity Consumption by Sector (GWh)

territory can be allocated to Alameda County in proportion to overall electricity sales, which average approximately 7.5% of total annual PG&E electricity sales.

Figure 4 shows technical and economic electric potential as a percent of sales as presented in the 2015 CPUC potential study. Technical and economic potential start at approximately 21% and 18%, respectively in 2016 and drop to approximately 16% and 15% by 2024. Using this forecast along with PG&E electric sales data to Alameda County, **Error! Reference source not found.** provides a range of estimates of technical and economic potential during this same timeframe. This provides a notional indication of the amount of energy efficiency potential that exists in Alameda County that PG&E and any CCA administered programs would be serving.

Figure 4. Potential for Electric Savings as a Percent of Annual Sales

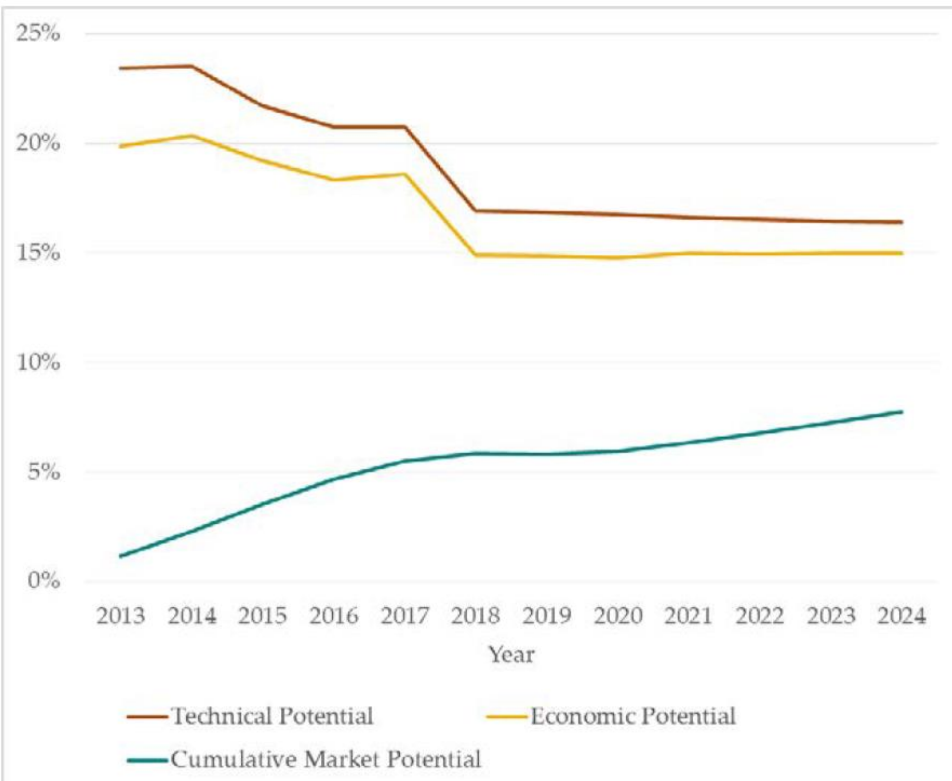


Table 3. Alameda County Average Technical and Economic Energy Efficiency Potential

Metric	Technical Potential		Economic Potential	
Range (% of sales)	21%	16%	18%	15%
Potential (GWh)	1,623	1,237	1,391	1,159

Table 3**Error! Reference source not found.** provides a summary forecast of the market potential for energy efficiency in Alameda County based on this same approach. It is important to note that the difference between technical, economic potential and market potential is that market potential represents the annual rate at which efficient equipment is installed, or the percent of the population that adopts energy efficiency practices. As such, market potential is a smaller value when compared to technical or economic potential because the natural cycle at which equipment burns out and must be replaced tends to regulate the rate at which new, high efficiency equipment can be installed, given reasonable program, market incentives, and assumptions about customer adoption rates. Market potential also recognizes that only a fraction of customers actually install high efficiency systems when it is time to replace equipment. The row labelled " PG&E Goals" represents Alameda County's share of the PG&E 2015 EE program portfolio savings target.[50] The row labelled "High Savings Scenario" represents Alameda County's share of the more aggressive energy efficiency scenarios for PG&E as defined by the 2013 CPUC potential study high savings scenario.[51] The row labelled "Incremental Potential" is the difference between PG&E's 2015 portfolio goals, and the high savings scenario and represents the total market potential that could be served by CCA administered programs.

Table 4. Alameda County Incremental Energy Efficiency Market Potential (GWh)

Year	2017	2018	2019	2020	2021	2022	2023	2024
Alameda Component of PG&E Goals	25.9	35.8	24.6	29.4	41.1	48.2	50.0	25.9
Alameda of High Savings Scenario	44.2	59.8	56.6	65.6	71.7	84.2	88.4	44.2
Incremental Potential	18.3	24.0	32.0	36.3	30.6	36.0	38.4	18.3

[50] Net GWh, as defined by the CEC Mid Additional Achievable Energy Efficiency (AAEE) forecast

[51] Referred to as the High AAEE Potential Scenario

The forecast presented in **Error! Reference source not found.** represents an estimate of energy efficiency potential that is "net" of free-riders and represents the following types of energy efficiency measures and market sectors:

- Emerging Technologies
- E Program Measures
- Residential
- Commercial
- Industrial-Manufacturing

This forecast does not include energy efficiency potential associated with building codes, appliance standards, or estimates for the agricultural or mining market sectors.

Examples of Potential Programs and Measures

While there are countless opportunities and approaches to achieve energy efficiency, following presents several examples of technologies and programs that will yield savings above what is being targeted through the current portfolio of PG&E programs operating in Alameda County. This includes initiatives that might compliment and leverage existing technologies or programs, or highlight emerging opportunities that are in design or in early deployment.

High Efficacy LED Lighting. Commercial and residential lighting currently make up 25% of California's total statewide electricity consumption.[52] LED lighting will provide increasing opportunities for energy savings in the coming years as prices continue to fall and LED efficiency (i.e., efficacy or lumens per watt of power, lm/w[53]) improves. Figure 5 shows that between 2020 and 2030, LEDs lighting will achieve efficiencies of 200 lm/w and prices will reach parity with current CFL and incandescent prices within the next 10 years.

Table 5 shows that 200 lm/w represent a 74% reduction in current average residential lighting efficiency, and approximately a 50% reduction in average non-residential lighting efficiency. As the LED adoption rates at present are low, and because the technology and costs are both evolving rapidly and favorably, the potential exists for CCA energy efficiency programs to drive this transition by focusing on high efficacy LED applications. The potential between the current market efficacy for lighting shown in

Table 5 and a full market penetration of 200 lm/w LED lighting represents a reduction in state wide (and Alameda County) consumption of electricity of approximately 14%. While programs do exist that promote LED lighting, a program focused on the highest efficacy products, some of which currently exceed 140 lm/w[54], would provide savings that are incremental to many products

[52] California Commercial Saturation Survey. Itron Inc., August 2014 Table 5-82

[53] U.S. Energy Information Administration, Annual Energy Outlook 2014 Early Release

[54] http://www.cree.com/LED-Components-and-Modules/Products/XLamp/Discrete-Directional/XLamp-XPE-HEW

currently being installed. Capturing the highest savings possible from LED lighting and targeting 200 ln/w technologies is very important because LED lamps operate for between 20 and 30 years, and once lower efficacy lamps are installed it will be difficult to capture rapidly improving efficiencies.

Figure 5. Trends in LED Lighting Efficacy and Cost per Bulb

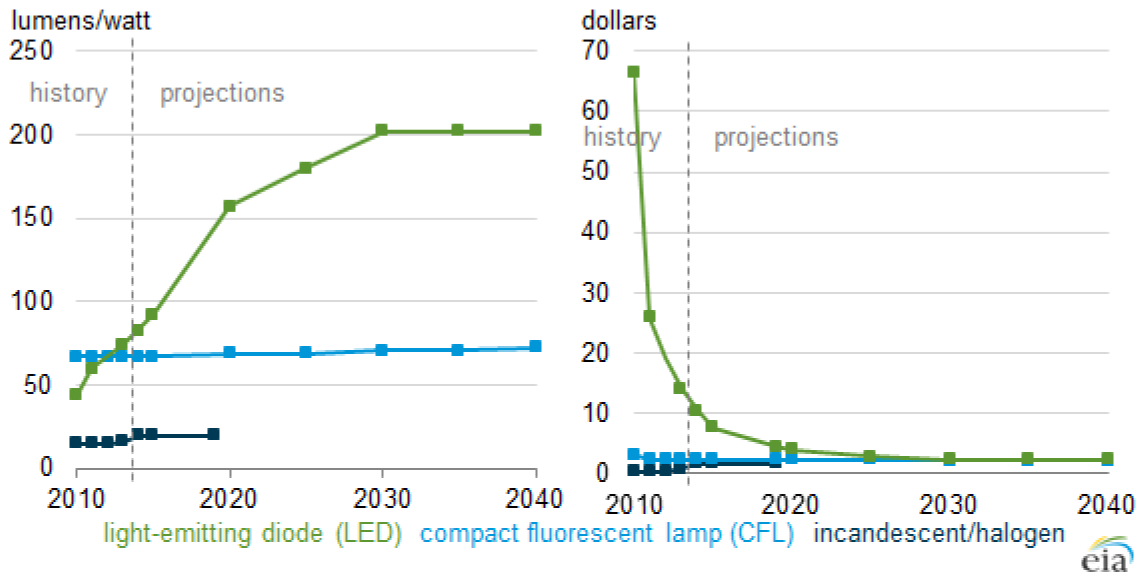


Table 5. Average Lighting Efficacy by Sector, and Potential Reductions from LED Lighting

Market Sector	Residential	Commercial	Industrial
Current est. average market lighting efficacy, lm/w	53	93	99
% reduction in energy for same light level at 200 lm/w	74%	54%	50%

Energy Controls and Information Systems. As with LED lighting, there are programs that currently deliver both energy controls and information systems, but they are not fully represented in the 2013 and 2015 potential model efforts and represent opportunities for new initiatives to contribute towards higher savings. In general, opportunities for controls and information systems is largest in the following two areas.

- **Lighting Controls.** In addition to converting to LED lighting, recent studies have shown significant potential for lighting controls. The 2015 commercial saturation study[55] included

[55] California Commercial Saturation Survey. Itron Inc., August 2014 Table 5-82

an analysis of lighting controls indicating that 67% of light commercial buildings are controlled manually while 33% are operated with various other types of lighting controls. Lighting controls in commercial buildings can save an average of 20% of lighting energy.

- **Building Information & Energy Management Systems.** Various studies indicate that the penetration of Energy Information Systems (EIS) and Energy Management Systems (EMS) are low compared to potential applications, and new ways to combine and extract value from these systems are also emerging. Additionally, the past five years has seen the growth of many new companies and applications involving energy information. Favorable trends in information systems, controls technologies, and associated costs suggest that market penetration of these technologies could be much higher. A technical analysis supporting AB802[56] forecasts the potential to leverage the combined use of these EIS and EMS technologies (referred to in that study as 'Building Information & Energy Management Systems', or BIEMS) As noted in that study, benefits at the core of the BIEMS concept include:
    - ***Energy visualization.*** Energy visualization represents the most minimalistic version of BIEMS. It uses basic utility, sub-meter, and other collected data to provide a basic visualization of energy consumption, sometimes in real time depending on data availability and frequency.
    - ***Energy analytics.*** Energy analytics go beyond energy dashboards and utilizes energy-related data to analyze building-level energy consumption characteristics. These analytics engines can perform a wide variety of functions such as uncovering opportunities to improve efficiency while supporting benchmarking efforts.
    - ***Operations and Facility Management.*** Operations and facility management services help automate and track maintenance and repair action items, including the automation of a building's maintenance schedule while reconciling operational changes in equipment/control set points. Some platforms also assist in managing capital expenditures related to equipment and asset management or helping customers evaluate any available energy supply options, including analysis of demand response opportunities.
    - ***Continuous Commissioning and Self-Healing Buildings.*** Continuous commissioning is a specialized application that several BIEMS vendors currently offer. This is closely related to operations management and typically requires the application of fault detection and diagnostics-based algorithms that track individual controls and equipment performance on an ongoing basis against ideal parameters to detect anomalies in system performance while reporting on any variance in performance.

  Building level energy savings estimates for comprehensive controls range from 10% for small building to 5% for large buildings and current saturations are estimated to be 37% across all commercial building types, indicating that significant potential exist for programs that combine both EIS and EMS systems. Programs that offer BIEMS type solutions

[56] AB802 Technical Analysis. Potential Savings Analysis. Prepared for the California Public Utilities Commission by Navigant Consulting, Inc. March 16, 2016. Reference No.: 174655.

represent potential that is underrepresented in both the current offerings of PG&E programs and underrepresented in the past CPUC potential studies.

Increased Use of Market Ready Funding and Financing Products. A CCA may be an effective platform from which to increase awareness and use of a broad array of market ready funding and financing mechanisms, some of which are designed specifically to achieve sustainability goals. Expanding the use of these mechanisms has several benefits, including an existing market capacity to lend, along with the potential for very cost effective delivery of energy efficiency without the need for rebates or other financial incentives. In general, funding and financing may be defined in two categories including 1) infrastructure and public facilities projects and 2) customer market financing. The following provides a brief description of each, and a list of over 50 currently available financing and funding tools can be found in Appendix B:

- Infrastructure and Redevelopment Public Funding and Financing. These are the mechanisms that will be selected by city planners and financiers to accomplish large redevelopment and water projects and generally include grant funding, land based financing tools such as tax increment financing, and usage fees.
- Residential and non-residential funding and financing. These are the tools that will be used to implement sustainability projects in the residential and non-residential facilities that are included within priority areas, and community wide in both existing building and new construction applications through these mechanisms. These include commercial loan products such as home equity lines and utility on bill products, targeted federal agency products such as VA or HUD loans, state agency products such as SAFEBIDCO and COIN, and tax increment financing products such as PACE financing.

More aggressive use of these market ready funding and financing programs to implement sustainability projects may offer the opportunity for a CCA program that leverages private capital in lieu of rebates to achieve various County sustainability goals.

High Opportunity Programs and Projects (HOPPs). In October 30, 2015, an amended scoping memorandum expanded the ‘Rolling Portfolios’ proceeding scope to include the implementation of AB 802. It established a process specifically for addressing “High Opportunity Programs or Projects” (HOPPs). HOPPs expanded to target increased energy efficiency of existing buildings, including “stranded potential” via AB 802’s new approaches to valuing and measuring savings. HOPPs are intended to focus on interventions (and associated intervention strategies and savings measurement regimes that program administrators could not previously undertake). The following outlines some of the HOPPs currently being proposed or deployed as pilot programs at the time of this analysis.

- **The Residential Pay-for-Performance (P4P) HOPP (PG&E).** This pilot seeks to develop a scalable model for residential retrofits that leverages rapidly emerging market actors and products while minimizing administrative and implementation costs. The program will seek out parties referred to as “Aggregators” who will either directly or through a network of contractors perform energy efficiency interventions in customers’ homes with the goal of maximizing measureable savings. Aggregators may consist of existing energy efficiency market participants, such as Property Accessed Clean Energy (PACE) loan providers, smart thermostat vendors, vertically integrated contractors, program implementers, and/or new entrants to the California market. These Aggregators will compete for funding through Power Savings Agreements (PSA).

- **The Business Equipment Early Retirement HOPP (SDG&E).** This pilot is open to all business customers in the C/I/A segments with aging HVAC equipment. Some old inefficient equipment has been kept in service past its expected useful life. Customers often choose to repair, rather than replace, their aging equipment because the current rebates offered for such measures are insufficient to defray a meaningful portion of new equipment costs. Such existing equipment may be far below current code. The untapped savings represented by replacing an old inefficient unit with a new efficient one may be considered the stranded savings potential.
- **The Tiered Incentive Custom Calculated HOPP (SDG&E).** This pilot targets mid-sized to large-sized (above 200kW) non-residential customers with retrofit opportunities for large To-Code and Above Code energy savings. Tiered Incentives will target customers who have large To-Code and Above Code projects that have previously been rejected, or those with known equipment that has not been replaced due a lack of incentives. Historically, utilities have not been able to provide incentives for projects that yield only To-Code savings which has created stranded savings in these projects.

HOPP programs offer new opportunities for CCA's to participate in existing energy efficiency programs while also allowing program administrators added flexibility in program design and savings attribution. For example, the SDG&E multifamily HOPP may offer a template for Alameda county to serve it's middle and low income customers, while the PG&E Residential Pay-for-Performance HOPP may offer opportunities for the County to share in revenue earned by aggregators of PACE program savings operating within the County, thereby providing an incentive for the County to help drive and expand these programs.

In summary, the preceding discussion on energy efficiency potential indicates that;

- A review of energy sales and market characteristics indicate that estimates of energy efficiency potential for the overall PG&E service territory can be allocated to Alameda County in proportion to the County's share of PG&E total electricity sales, which is about 7.5%.
- An analysis of the potential study developed by the CPUC to assess the market potential from energy efficiency in PG&E service territory indicates that there is the potential for energy efficiency in Alameda County beyond what is being delivered by the current suite of energy efficiency programs operating in the county.
- A review of current and emerging energy efficiency technologies and innovative new programs designs indicate that it is possible to install higher levels of energy efficiency than has historically been achieved at cost-benefit thresholds that are acceptable under current CPUC guidelines.

Current Funding Opportunities and Energy Efficiency Costs

CCA's have the opportunity use both electric and gas public purpose program funds to provide distributed energy resource programs to customers in a variety of ways. To access funds for electricity energy efficiency programs based on the most current CPUC guidance, including.[57]

Submit a plan, approved by its governing board, to the Commission for the administration of cost-effective energy efficiency and conservation programs for the aggregator's electric service customers that includes funding requirements, a program description, a cost-effectiveness analysis, and the duration of the program. To be approved, the submitted plan must satisfy the following criteria:

- Is consistent with the goals of Public Utilities Code Section 399.4.[58]
- Advances the public interest in maximizing cost-effective electricity savings and related benefits.
- Accommodates the need for broader statewide or regional programs.
- Includes audit and reporting requirements consistent with the audit and reporting requirements established by the commission pursuant to this section.
- Includes evaluation, measurement, and verification protocols established by the community choice aggregator.
- Includes performance metrics regarding the community choice aggregator's achievement of the selected objectives.

Upon submission of a successful plan, A CCA may elect to become the administrator of funds collected from the aggregator's electric service customers and collected through a nonbypassable charge authorized by the Commission may be accessed, except those funds collected for broader statewide and regional programs authorized by the commission. For CCAs electing to become

[57] As defined in Rulemaking 09-11-014

[58] Public Utilities Code Section 399.4 requires;

a. The CPUC shall continue to administer cost-effective energy efficiency programs authorized pursuant to existing statutory authority.

b. The term energy efficiency includes, but is not limited to, cost-effective activities to achieve peak load reduction that improve end-use efficiency, lower customers' bills, and reduce system needs.

c. Any rebates or incentives offered by a public utility for an energy efficiency improvement or installation of energy efficient components, equipment, or appliances in buildings shall be provided only if the recipient of the rebate or incentive certifies that the improvement or installation has complied with any applicable permitting requirements and, if a contractor performed the installation or improvement, that the contractor holds the appropriate license for the work performed.

d. The commission, in evaluating energy efficiency investments under its existing statutory authority, shall also ensure that local and regional interests, multifamily dwellings, and energy service industry capabilities are incorporated into program portfolio design and that local governments, community-based organizations, and energy efficiency service providers are encouraged to participate in program implementation where appropriate.

program administrators, the formula used to estimate the budget available for program activities is defined as;

> *CCA maximum funding = Total electricity energy efficiency nonbypassable charge collections from the CCA's customers – (total electricity energy efficiency nonbypassable charge collections from the CCA's customers * % of the applicable IOU portfolio budget that was dedicated to statewide and regional programs in the most recently authorized program cycle).*

For fiscal year 2015 the CPUC reports[59] that the total cost of customer programs for electricity indicatives in the PG&E service territory to be approximately $1.2B, as shown in Table 6, including various subprograms. Of these customer program funds, the total electricity energy efficiency nonbypassable charges referenced in Rulemaking 09-11-014 are approximately $351M (29%) are allocated for energy efficiency (EE) programs. Based on PG&E sales to Alameda County and as discussed previously, it can be assumed that approximately 7.5% of these funds, or $26.6M annually, are provided by sales of electricity to residents of Alameda County.[60]

Table 6. Allocation of Electric and Gas Utility Cost, April 2016

	Program Costs ($000)	
Customer Program	**PG&E**	**Alameda (estimated)**
Energy Efficiency	$351,311	$26,629
Demand Response	$63,978	$4,850
California Solar Initiative	$94,000	$7,125
Self-Generation Incentive Program	$29,616	$2,245
CARE Subsidy	$565,541	$42,868
CARE Administrative Expenses	$12,794	$970
Low Income Energy Efficiency	$95,089	$7,208
Total	$1,212,329	$91,895

The maximum funding equation provided in R.09-11-014 does not define the amount of the applicable IOU portfolio budget that is dedicated to statewide and regional programs, however it is estimated to be approximately 85% of available budget, based on a review of decisions addressing the approved 2015 Marin Clean Energy program portfolio. This leaves 15% of funds available for CCA administered energy efficiency programs. **Error! Reference source not**

[59] Electric and Gas Utility Cost Report. Public Utilities Code Section 913 Report to the Governor and Legislature, April 2016.

[60] Based on an analysis of PG&E electricity sales within Alameda County for 2013 and 2014 and CEC data on Alameda County and PG&E electricity usage.

found. shows that this is approximately $3.9M for programs administered by a CCA to all Alameda County residents, including PG&E customers, or $3.5M if these programs serve only CCA customers, assuming a 15% opt-out rate.

Table 7. Annual Funding Models for Non-bypassable Electric Charges

Annual Funding Models for Non-bypassable Electric Charges	Estimated Value
Program Administrator - CCA and PG&E customers	$3,941,000
Program Administrator - CCA customer only	$3,350,000

Other funds would also likely be available to help administer energy efficiency programs. An inexhaustive list of other potential funding sources are listed below. This analysis did not estimate the potential value of these funds.

- Funds from Non-bypassable Gas Charges – CPUC Decision D.14-10-046 allows CCA's to administer programs that include funds collected from natural gas customer. This analysis did not estimate the value of these funds.
- Income from CCA Operations. Income generated through CCA operations may be used to fund customer programs.
- Funding secured by StopWaste's Energy Council on behalf of any potential relationship between its member agencies and a CCA.
- Increased funding through the expansion of the CCA territory. Under current regulations it is allowed for a CCA to define its service territory more broadly than a city or county. As such, the rules that define the funding for Alameda County residents would apply to new participants in a CCA and so provide incremental program funding. For example, in 2015 Marin Clean Energy began serving customer in Contra Costa County and has increased its available program funding as a result of this enrollment.

CCA's may also choose to not administer programs. CAs' that choose to be non-administrators have the following authority as defined in R.09-11-014;

> *If a community choice aggregator is not the administrator of energy efficiency and conservation programs for which its customers are eligible, the commission shall require the administrator of cost-effective energy efficiency and conservation programs to direct a proportional share of its approved energy efficiency program activities for which the community choice aggregator's customers are eligible, to the community choice aggregator's territory without regard to customer class.*

and

The commission shall also direct the administrator to work with the community choice aggregator, to provide advance information where appropriate about the likely impacts of energy efficiency programs and to accommodate any unique community program needs by placing more, or less, emphasis on particular approved programs to the extent that these special shifts in emphasis in no way diminish the effectiveness of broader statewide or regional programs.

Assuming that a 'proportional share of its approved energy efficiency program activities for which the community choice aggregator's customers are eligible' refers to funds collected, this is estimated to average approximately $26M annually for 2013 and 2014.

Current Costs of Energy Efficiency

The savings potential for energy efficiency programs operated by an Alameda County CCA were estimated based on the amount of funding available and the unit price of energy efficiency ($/kWh). The MRW team reviewed program savings goals and program budget data for the 2015 PG&E portfolio to identify unit costs and found a broad range of costs depending on the nature of the program and whether or not the program saved only electricity, or also had natural gas savings.

Figure 6 provides a cost of supply curves which shows how much energy efficiency is available in the PG&E's 2015 portfolio, and at what price per first year gross kWh. The cost curve changes as new technologies become available, such as high efficiency LED lighting, or as new delivery models emerge, such as PACE financing. The cost curve also changes as program administrators find more efficient ways to deliver services and new methods to engage customers come to market, such as big data applications that use smart meter data to help identify customers and facilities with high opportunity for savings. Additionally, **Error! Reference source not found.** provides a summary of select program that are representative of the range of markets and program costs most likely to be represented in energy efficiency programs administered by an Alameda CCA.

Figure 6. Normalized First Year KWh Savings Equivalent Costs for the 2015 PG&E Portfolio

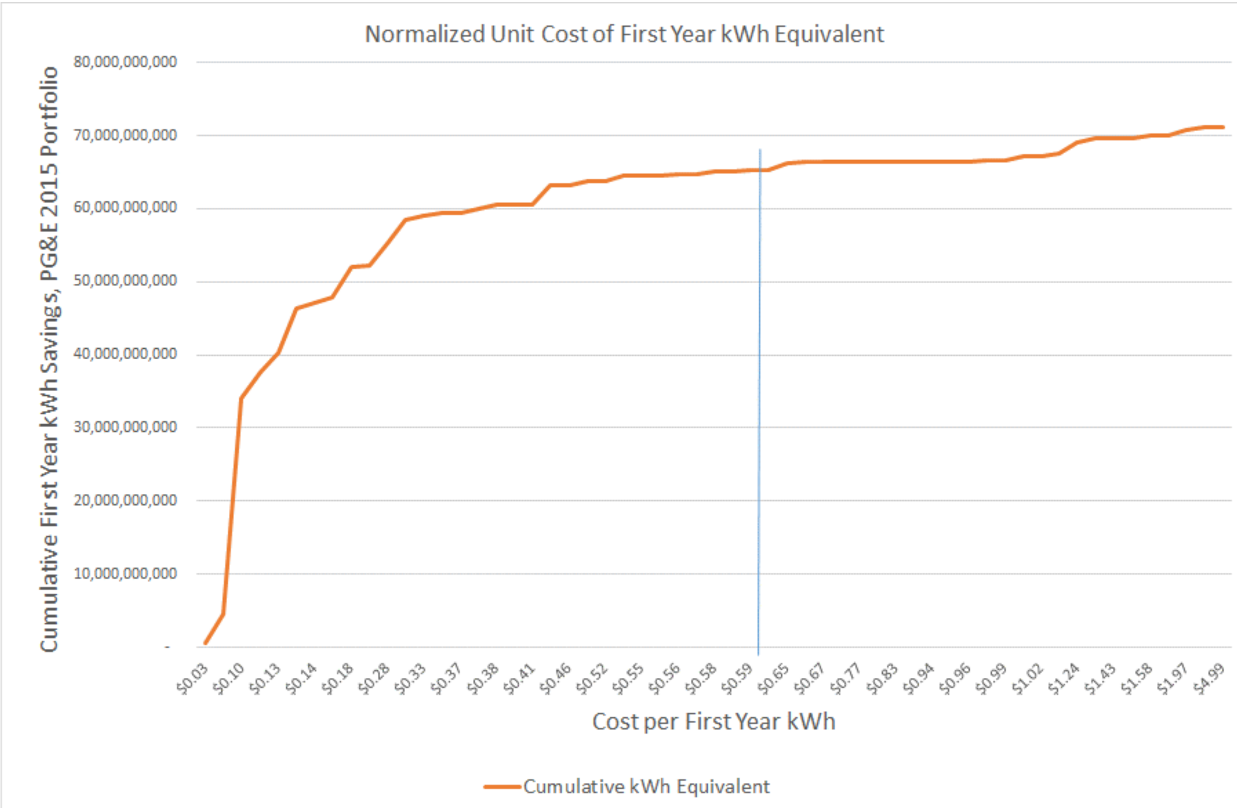


Table 8. Select Unit Costs for Energy Efficiency ($/ net kWh)

Program Admin	Sub-Program Name	Percent Program Savings that are Electric	Cost Per First Year Net kWh Equivalent
PG&E	Commercial Energy Advisor	18%	$0.18
MCE	MEA 02 - Small Commercial	79%	$0.37
PG&E	Lighting Programs Total	100%	$0.38
MCE	MEA01 2013-14 MF - Multifamily	36%	$0.59
PG&E	East Bay	93%	$0.59
Third Party	RightLights	100%	$0.75
PG&E	Energy Savers	100%	$0.81
Third Party	Energy Fitness Program	100%	$0.84

Based on this analysis, a cost of $0.61 per net first year kWh was used to represent the current unit cost of energy efficiency. As discussed in the following section, this unit cost was subsequently multiplied by the available funding to determine how much EE will be achieved in Alameda County, based on the previous assumptions that both the technical and economic market potential exists.

Remi Model Inputs

Based on the proceeding discussions regarding the availability of energy efficiency in Alameda County, and the potential for funding and associated costs, the MRW team developed the inputs for the REMI model that reflects several overarching assumptions;

- Technical, economic and market potential for energy efficiency is available in the County, including markets and technologies that are likely underrepresented in existing program offerings and offer the opportunity for new market interventions to achieve savings that are incremental to the goals currently established by the CPUC for PG&E.
- Regulators have defined the funding mechanisms for CCA's to administer energy efficiency programs, and this analysis used a conservative approach to forecast funding for energy efficiency over the MRW analysis timeframe. additional funding may be developed from multiple other source that can be used to develop additional energy savings.

Table 9 provides a summary of the factors used in the energy efficiency analysis used to develop inputs for the REMI Model, and Table 10 provides additional definitions intended to provide further transparency and clarity into the efficiency analysis.

Table 9. Factors Used in the Energy Efficiency Analysis

Analysis Factors	Value
First year available EE portfolio budget	$3,350,453
Non-Union Labor Cost	$67.26
Union Labor Cost	$79.37
Average Labor Cost	$73.32
Ratio of union hourly cot to non-union hourly costs	1.18
Incentives as % of total program costs	51.43%
% of portfolio budget where program labor is union	20.22%
Labor as a % of total measure cost	27.98%
Incentives as % of total measure cost	21.43%
Annual Energy Growth Rates (%)[61]	0.98%
PGE kW/kWh ratio	0.0158%
Average cost per EE program staff	$100,000
Labor as a percent of program spending	70.00%
Ave PG&E program cost per first year annual gross kWh	$0.42
Portfolio NTG	0.7
Average PGC $/kWh	$0.61
% of Program Budget - Incentives which are Direct Install Labor	65.65%
Incentive % total program budget - Residential	33.05%
Incentive % total program budget - Commercial	43.44%
Incentive % total program budget - Industrial	15.51%
Incentive % total program budget - Municipal	8.01%

[61] California Energy Demand 2015 Revised - Mid Demand

Table 10. Definitions Used in the Efficiency Analysis

Budget Growth Factor	Assumed change in annual budget available for Alameda CCA EE program based forecast growth in electric energy consumption from the 2015 IEPR mid-case
Baseline Budget	Assumed annual budget available for Alameda CCA EE program based on current PG&E portfolio costs and current CPUC guidelines for allocation of public goods charges available for CCA programs
Annual incremental GWh savings	Average annual potential GWh savings based on weighted average cost per GWh for relevant programs in the 2015 PG&E EE program portfolio
Annual incremental MW savings	Average annual potential MW savings based on weighted average kW/kWh ratio for relevant programs in the 2015 PG&E EE program portfolio
Non-union Labor (Man-hours)	Annual non-union labor hours to install energy efficiency projects represented in the annual incremental GWh savings estimate
Union Labor (Man-hours)	Annual union labor hours to install energy efficiency projects represented in the annual incremental GWh savings estimate
Total Labor (Man-hours)	Total union and non-union labor hours
Value of Labor ($)	Total dollar value of labor based on union and non-union rates
Value of Products Installed ($)	Total dollar value of products installed. This will be: • Incremental equipment cost for replace on burnout projects where the customer must do the project and where efficient equipment has incremental costs above code compliant equipment • Full cost for retrofit projects where customer elects to do the project and installs above code equipment
Customer Out of Pocket ($)	Total dollar value of customer out-of-pocket costs for products installed. This will be: • No out of pocket costs for direct install projects • Cost of addition funds required above any utility/CCA equipment rebate incentives
Annual Invest Needed	Budget (Admin + M&O - Incentives) + Material + Labor, or customer out of packet plus program spending
Installation Labor	Trade Labor (Union + Non Union) + Direct Installation Labor
Development Timeline	• 3 years to establish core CCA operation • 1 year for filing and development of EE programs, launch in 2021

Energy and Demand Savings Potential

The MRW teams defined the level of energy efficiency input into the REMI model would be based on incremental savings that would result from CCA administered energy efficiency programs, in excess of the levels of energy efficiency savings targeted by current PG&E initiatives. The amount of CCA program potential was calculated based on funding available and the cost of energy efficiency using the following inputs;

- Available annual budget for energy efficacy programs is based on the maximum funding equation provided in R.09-11-014, and assuming programs are administered only to CCA customers. As discussed in **Error! Reference source not found.**, this represents approximately $3.5M annually.
- The cost of energy efficiency programs most likely to be offered under and a CCA would be $0.61 per net first year kWh.
- The savings from energy efficiency during the forecast horizon would grow at a rate consistent with expected annual energy demand as defined in the 2015 CEC IEPR demand forecast.[62]
- Demand savings would be consistent with the ratio of demand to energy savings achieved by the programs most likely to be offered by a CCA as presented in **Error! Reference source not found.**.

Based on this methodology, **Error! Reference source not found.** provides a summary of REMI model energy and demand savings inputs.

Table 11. REMI Model Energy and Demand Savings Inputs

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Annual incremental energy savings (GWh)	5.7	5.8	5.9	5.9	6.0	6.0	6.1	6.1	6.2	6.3
Annual incremental demand savings (MW)	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0

Economic Activity Related to Energy Efficiency

Based on the energy efficiency analysis factors and definitions provides in Table 9 and Table 10 respectively, Table 12 provides a summary of the economic inputs from the REMI model that results from CCA administration of energy efficiency programs as defined above.

[62] Form 1.1 - PGE Planning Area California Energy Demand 2015 Revised - Mid Demand Case. Electricity Consumption by Sector (GWh)

Table 12. REMI Model Economic Inputs

Economic Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Annual Invest Needed	$13.3	$13.7	$14.0	$14.4	$14.8	$15.2	$15.6	$16.0	$16.4	$16.9
Installation Labor	$3.7	$3.8	$3.9	$4.0	$4.1	$4.2	$4.3	$4.5	$4.6	$4.7
Customer Out of Pocket	$9.6	$9.8	$10.1	$10.3	$10.6	$10.9	$11.2	$11.5	$11.8	$12.1
Value of Products Installed	$9.0	$9.2	$9.5	$9.7	$10.0	$10.2	$10.5	$10.8	$11.1	$11.4

Appendix 1. PG&E Programs Active in Alameda County

Table shows 2015 programs, including total PG&E service territory or statewide budgets, and capacity and energy goals, including BayREN program activities. The 'X' in the column title 'Active in Alameda County' indicates the program is either activity providing financial incentives or technical support for activities within Alameda County. With the exception of the opportunities noted earlier, these programs cover most energy efficiency measures across all market sectors, including;

- Codes & standards programs intended to enhance compliance and promote new, more aggressive codes in select jurisdictions;
- Commercial sector programs that include deemed and custom incentives as well as technical support;
- Third party programs administered by PG&E but implemented through various contractors that are target specific technology applications or specific market segments, such as refineries, health care providers, or schools;
- Residential energy efficiency programs providing rebates for the multifamily market, HVAC and whole house solution for the single family market and support for residential new construction
- Government partnership programs that include support for local governments through the East Bay Energy Watch program, as well as various institutional programs focused on universities and community colleges.
- Industrial and agricultural programs providing provide financial incentives and technical support various statewide and 3rd party, segment specific industries.
- Emerging technologies programs that support the integration of emerging technologies.

Program / Sub-Program	Active in Alameda County	Sum of Total Incentive	Sum of Total Budget	Sum of Goals therm	Sum of Goals kWh	Sum of Goals kW
Codes & Standards Programs Total		**$0**	**$16,496,433**	**1,105,275**	**282,613,013**	**44,188**
Appliance Standards Advocacy		$0	$2,396,375	0	0	0
Compliance Improvement	x	$0	$2,094,222	0	0	0
Reach Codes	x	$0	$628,267	0	0	0

2015 C&S		$0	$8,248,217	1,105,275	282,613,013	44,188
Building Codes Advocacy	x	$0	$2,396,375	0	0	0
Planning and Coordination		$0	$732,978	0	0	0
Commercial Programs Total		**$41,866,061**	**$76,775,328**	**4,817,546**	**171,723,947**	**30,271**
Savings by Design	x	$5,844,020	$11,369,534	116,869	24,426,648	6,803
Commercial Calculated Incentives	x	$9,279,579	$24,269,550	2,415,252	69,427,959	7,053
Commercial Deemed Incentives	x	$9,916,156	$17,385,210	858,364	63,124,601	11,187
Commercial Energy Advisor	x	$3,774,215	$5,475,917	1,217,783	7,960,408	3,104
Commercial HVAC	x	$13,052,092	$17,855,076	209,278	6,784,331	2,124
Commercial Continuous Energy Improvement	x	$0	$420,042	0	0	0
Third Party		**$37,126,216**	**$89,088,656**	**3,644,336**	**158,670,368**	**26,223**
Refinery Energy Efficiency Program	x	$1,350,924	$2,784,375	1,100,151	3,100,902	451
California New Homes Multifamily	x	$2,295,459	$4,218,571	120,000	1,720,000	1,316
Enhance Time Delay Relay	x	$556,009	$1,065,230	-23	918,766	1,485
Direct Install for Manufactured and Mobile Homes	x	$3,300,448	$4,541,979	-32,220	6,539,901	3,900
Monitoring-Based Persistence Commissioning	x	$609,275	$2,188,015	180,391	3,182,583	208
LodgingSavers	x	$2,125,000	$4,769,442	-13	7,189,320	1,598

School Energy Efficiency	x	$1,259,822	$3,445,459	198,645	3,345,368	325
Energy Fitness Program	x	$1,100,000	$2,706,116	-14,461	4,583,332	833
Energy Savers	x	$550,000	$1,323,747	-5,352	2,334,528	389
RightLights	x	$2,350,000	$5,075,125	-26,552	9,723,911	1,441
Furniture Store Energy Efficiency	x	$934,283	$1,544,734	-23,844	4,011,500	846
LED Accelerator	x	$1,473,572	$2,722,282	-8,085	4,664,841	954
Casino Green	x	$500,000	$1,374,085	8,055	1,762,414	347
Healthcare Energy Efficiency Program	x	$323,517	$770,461	65,152	1,323,900	189
K-12 Private Schools and Colleges Audit Retro	x	$1,256,288	$2,068,748	-23,486	2,896,447	255
Innovative Designs for Energy Efficiency Approaches (IDEEA)	x	$2,631,321	$7,924,297	185,261	5,932,977	521
Air Care Plus	x	$1,006,857	$3,471,776	371	9,024,156	902
Boiler Energy Efficiency Program	x	$641,630	$1,945,225	729,383	34,331	16
EnergySmart Grocer	x	$1,964,682	$6,637,581	15,746	17,685,129	1,847
Industrial Recommissioning Program	x	$310,000	$1,339,090	0	2,982,339	247
California Wastewater Process Optimization	x	$250,000	$953,641	0	1,774,954	204
Energy Efficiency Services for Oil Production	x	$1,980,782	$4,447,949	0	15,650,820	1,389

Heavy Industry Energy Efficiency Program	x	$4,710,923	$12,041,118	950,064	27,582,099	3,727
Industrial Compressed Air Program	x	$551,654	$1,661,321	0	5,109,111	516
Dairy Industry Resource Advantage Pgm	x	$502,246	$1,522,197	-4,826	2,261,157	484
Process Wastewater Treatment EM Pgm for Ag Food Processing	x	$364,855	$1,015,922	0	2,166,210	224
Dairy Energy Efficiency Program	x	$116,344	$427,467	-9	649,719	55
Industrial Refrigeration Performance Plus	x	$917,842	$1,562,711	0	3,850,895	347
Light Exchange Program	x	$283,295	$863,570	-25	860,177	210
Wine Industry Efficiency Solutions	x	$475,400	$1,675,216	29,992	3,362,430	554
Comprehensive Food Process Audit & Resource Efficiency Pgm	x	$433,789	$1,001,206	200,020	2,446,152	443
Residential Energy Efficiency Programs Total		**$33,850,892**	**$60,142,415**	**2,706,366**	**128,508,610**	**12,925**
Residential Energy Advisor	x	$11,026,625	$13,316,458	1,800,000	90,000,012	0
Plug Load and Appliances	x	$7,233,850	$17,791,846	223,735	32,476,767	8,129
Multifamily Energy Efficiency Rebates Program	x	$362,547	$1,685,302	90,715	981,794	94
Whole Home Upgrade Program	x	$7,537,049	$13,672,077	429,482	3,159,402	2,523
Residential New Construction	x	$2,554,476	$4,422,870	114,696	639,133	1,306
Residential HVAC	x	$5,136,345	$9,253,861	47,737	1,251,503	874

Government Partnership Programs Total		**$30,735,492**	**$70,026,290**	**1,481,091**	**107,205,951**	**12,766**
California Community Colleges	x	$1,536,198	$2,249,794	163,439	3,679,913	505
University of California/California State University	x	$6,996,526	$12,363,959	744,372	16,759,951	2,302
State of California	x	$1,777,057	$2,294,475	189,064	4,256,884	585
Department of Corrections and Rehabilitation	x	$1,597,166	$3,099,187	169,925	3,825,960	525
Local Government Energy Action Resources (LGEAR)	x	$1,926,566	$5,446,566	26,009	7,406,533	856
East Bay	x	$5,187,765	$9,685,962	56,197	21,652,559	2,487
Agricultural Programs Total		**$8,330,403**	**$17,449,635**	**1,690,030**	**70,047,080**	**20,515**
Agricultural Calculated Incentives	x	$4,231,087	$9,351,902	1,501,966	24,661,230	5,242
Agricultural Deemed Incentives	x	$1,965,211	$3,583,046	152,460	21,486,589	11,904
Agricultural Energy Advisor	x	$2,134,105	$4,049,572	35,604	23,899,261	3,369
Agricultural Continuous Energy Improvement	x	$0	$465,115	0	0	0
Lighting Programs Total		**$7,799,802**	**$12,856,179**	**-850,920**	**40,081,866**	**5,344**
Primary Lighting	x	$6,978,299	$10,710,998	-850,920	40,081,866	5,344
Lighting Innovation	x	$821,503	$1,496,016	0	0	0
Lighting Market Transformation	x	$0	$649,166	0	0	0

Industrial Programs Total		**$15,468,886**	**$24,995,292**	**8,842,652**	**33,399,496**	**4,785**
Industrial Calculated Incentives	x	$13,302,782	$20,361,087	8,591,960	27,987,597	3,515
Industrial Deemed Incentives	x	$538,604	$1,091,268	201,525	5,053,897	1,057
Industrial Energy Advisor	x	$1,627,500	$3,031,540	49,167	358,002	213
Industrial Continuous Energy Improvement	x	$0	$511,398	0	0	0
BayRen		**$6,815,663**	**$11,930,137**	**315,403**	**2,360,400**	**825**
Single Family Residential	x	$2,980,710	$4,840,886	81,794	205,724	521
Multifamily Residential	x	$3,750,000	$6,476,600	175,391	1,769,656	175
Commercial PACE	x	$84,953	$251,505	3,096	144,540	108
Pay As You Save (Green Hayward PAYS)	x	$0	$361,146	55,122	240,480	21
Emerging Technologies Programs Total		**$0**	**$5,959,297**	**0**	**0**	**0**
Technology Development Support	x	$0	$417,151	0	0	0
Technology Assessments	x	$0	$2,860,463	0	0	0
Technology Introduction Support	x	$0	$2,681,684	0	0	0
Grand Total		**$182,447,885**	**$386,918,729**	**23,959,687**	**1,000,870,238**	**158,063**

Appendix 2. Market Ready Funding and Financing Mechanisms

Market ready funding and financing mechanisms that may be used to drive energy efficiency projects in Alameda County may be defined in two categories of funding and financing mechanisms including 1) infrastructure and public facilities projects and 2) residential and non-residential market sector financing. A partial list of these mechanisms to be considered;

1. Infrastructure and Redevelopment Public Funding and Financing. These are the mechanisms that will be selected by city planners and financiers to accomplish large redevelopment and water projects and include;
   - State grant funding including
     - Greenhouse Gas Reduction Fund programs
     - Environmental Enhancement and Mitigation (EEM) Program
     - CalConserve Water Use Efficiency Revolving Fund Loan Program
   - Land-based financing tools
     - Energy Development Districts (EDD)
     - Benefit Assessment Districts
     - Enhanced Infrastructure Funding Districts (EIFD)
     - Community Facilities Districts (CFDs)
     - Tax Increment Financing,
     - California Community Capital Collaborative
   - Other Fresno propositions and usage fees
     - Proposition M Sustainable Transportation funds
2. Residential and non-residential facilities funding and financing. These are the tools that will be used to implement sustainability projects in the residential and non-residential facilities that are included within priority areas, and community wide in both existing building and new constructions through these mechanisms;
   - Non-utility private and public funding and financing
     - Small Business Investment Companies (SBIC/SBA)
     - Tax-Exempt Industrial Development Bonds
     - California Organized Investment Networks (COIN)
     - Fresno Community Development Financial Institutions (CDFI)
     - Community Investment Note
     - State Assistance Fund for Enterprise / Business and Industrial Development Corporation (SAFE-BIDCO)
     - Socially Responsible Investors (SRI)
     - Residential and Commercial PACE
     - ChargePoint® Net+ Purchase EV Charge Station Financing
     - Corporate Investment in Shared Value
     - Social Impact Bonds
     - Community Currency and Time Banks
     - Solar $mart Home Equity Line of Credit
     - Home Equity Loan
     - Home Equity Line of Credit

- SBA Loan Programs including;
  - SBA Green 504 Loans
  - 7(a) Loans
  - 504 Loans
  - Rural Business Investment Program (RBIP)
- Housing and Urban Development (HUD) instruments including;
  - Choice Neighborhoods Planning and Implementation Grants program
  - Federal Housing Administration (FHA) 203(k) Mortgage program
  - Section 207/223(f) mortgage insurance
  - Section 202 Direct Loan Program for Housing for the Elderly or Handicapped
  - Section 3 program
- Veteran Administration (VA) instruments including;
  - VA Home Purchase Loans
  - VA Interest Rate Reduction Refinance Loans (IRRRL)
  - Specially Adapted Housing (SAH) Grants
  - Special Housing Adaptation (SHA) Grants
  - Chapter 6 Home Loan Guaranty

- Utility and CAEATFA/CHEEF funding and financings opportunities including;
  - IOU statewide and 3rd party rebate programs
  - Low income ESA
  - On-bill financing (pilot)
  - EUC and Flex Path
  - Small Business Lease Program (pilot)