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DRAFT STAFF PAPER

Senate Bill 350 Energy Efficiency Targets for Programs Not Funded through Utility Rates

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Efficiency Division

California Energy Commission

California Energy Commission

Edmund G. Brown Jr., Governor

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ABSTRACT

Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015 (De León, Chapter 547, Statutes of 2015), states that on or before November 1, 2017, the California Energy Commission (Energy Commission) "shall 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." Efficiency Division staff show in this report how programs not funded through utility rates could contribute to meeting the goal. Staff identified programs, developed methods, and projected savings through 2029. This report estimates that under mostly business-as-usual approaches the State will be short of its doubling goal by January 1, 2030. To close the gap, staff makes several recommendations, including continuing funding and operating existing programs, expanding some existing programs, pursuing agricultural and industrial energy savings, collecting additional data from non-utility programs, increasing funding for workforce training, outreach and education to increase code compliance, and working with other state agencies on new energy efficiency programs.

Keywords: Senate Bill 350, energy efficiency

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EXECUTIVE SUMMARY

Summary

Senate Bill (SB) 350, the Clean Energy and Pollution Reduction Act of 2015 (De León, Chapter 547, Statutes of 2015), states that on or before November 1, 2017, the California Energy Commission must establish targets that will achieve a doubling of statewide energy efficiency savings by January 1, 2030. To meet the objectives of SB 350, the California Energy Commission staff has estimated energy savings from programs not funded through utility rates in three areas. These include: codes and standards, financing, and behavioral and market transformation programs. Savings from programs funded through utility rates are explored in a companion staff paper.

In this paper, the energy savings from each program not funded through utility rates are grouped to show the expected progress toward the doubling energy savings goal in SB 350. Staff analyses of the results show that the expected electricity savings from these areas together fall short of the goal, while natural gas savings are expected to exceed the goal. When electricity and natural gas projected energy savings are combined, results show that the State would be short of its doubling goal by January 1, 2030 without newly conceived sources of savings. While staff has identified program areas where energy savings can be achieved, more work needs to be done to reach a scale of efficiency market activity that achieves a cumulative doubling of statewide energy efficiency savings, and meets the objectives of SB 350.

Introduction

Senate Bill 350 states that, "On or before November 1, 2017, the Energy Commission, in collaboration with the California Public Utilities Commission and local publicly owned utilities, in a public process that allows input from other stakeholders, shall 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." While the energy efficiency savings called for by SB 350 are ambitious, the legislative intent language of SB 350 declares that the targets of the bill are to be "permanent, enforceable, and quantifiable." The Energy Commission may need additional statutory authority for enforcement. The bill also states that the Energy Commission shall establish annual targets for statewide energy savings . . . to the extent doing so is cost-effective, feasible, and will not adversely impact public health and safety." Finally, the bill also states that "beginning with the 2019 edition of the Integrated Energy Policy Report and every two years thereafter, the commission shall provide recommendations and an update on progress toward achieving a doubling of energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030. . ."

This staff paper prepared by the Energy Commission's Efficiency Division staff addresses energy savings from programs <u>not</u> funded through utility rates. A companion staff paper

prepared by the Energy Commission's Energy Assessments Division staff addresses energy savings from programs that are funded through utility rates. Note that the distinction is not always clear cut; therefore, savings overlap was necessary to consider and certain programs are mentioned in both papers. A draft of the SB 350 2030 Energy Efficiency Savings Goal has been published previously by the Energy Commission staff for stakeholder comment.[1] The two Staff Papers, and the SB 350 2030 energy efficiency savings doubling goal, will be combined into one report prior to a planned September 2017 workshop.

Programs and Areas

The Energy Commission's Efficiency Division staff, with the help of its contractor NORESCO (and subcontractors), has estimated energy savings from programs not funded through utility rates in the following program areas: codes and standards, financing, and behavioral and market transformation programs. Specific programs within the codes and standards category include: *Building Energy Efficiency Standards* (Title 24, Part 6), California Green Building Standards Code (Title 24, Part 11), *Appliance Efficiency Regulations* (Title 20), and *Federal Appliance Standards*. Financing programs include: Property Assessed Clean Energy (PACE); Local Government Challenge; Proposition 39; Energy Conservation Assistance Act; Low Income Weatherization Program; Water Energy Grant; California Department of General Services-operated Energy Savings Program, and possible air quality management district programs. Behavioral and market transformation programs include: the state-wide Benchmarking and Public Disclosure Program; smart meters and controls savings; behavioral, retrocommissioning, and operational savings; energy asset rating; and fuel substitution (also known as electrification). In addition to providing the energy efficiency savings projections by programs, these are broken down by sectors (residential, non-residential). Staff plans to include potential energy savings from the industrial and agricultural sectors in the upcoming draft Commission report.

Staff studied energy efficiency savings beyond those already accounted for in the baseline of the demand forecast and energy savings potential studies for investor-owned utilities and publicly owned utilities, with the exception of codes and standards savings that are partially accounted for in these studies.[2] Staff estimated energy savings that are expected to accrue by December 2029, because the deadline for achieving the objectives of Senate Bill 350 is January 1, 2030. The methods to estimate energy savings by program are discussed in Chapter 3 of the report.

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1 "Framework for Establishing the Senate Bill 350 Energy Efficiency Savings Doubling Targets," California Energy Commission, Docket Number 17-IEPR-06, TN# 215437, January 18, 2017.

2 For codes and standards programs, regulatory authority and implementation responsibility lies with the Energy Commission, Department of Energy and local governments, but a large portion of funding comes from regulated utilities. Future building codes (2019 Additions and Alterations through 2028) will be discussed as part of this staff paper. Building codes for the years 2016-2019 will be estimated in the upcoming draft Commission report.

The energy savings results from each program are grouped to show the expected progress towards the 2030 doubling goal of SB 350, as that goal is currently proposed by staff. Figure 1 shows that the expected energy savings fall short of the goal. However, staff thinks that the potential savings for additional industrial and agricultural energy efficiency will result in savings targets that considerably close the gap in achieving the doubling goal. Figure 2 show the same energy efficiency savings but grouped as program bins, that is, similar programs from Figure 1 are combined into financing, codes and standards, or market transformation and benchmarking.[3] Combining ratepayer energy savings with energy savings from programs not funded through utility rates allows the Energy Commission to estimate how closely the State would be to meeting energy efficiency savings goals each year, through 2029. The energy saving estimates will to be updated every two years, as directed by SB 350.[4]

Recommendations

Staff has identified program areas where energy savings can be achieved, but overall the current energy savings estimates fall slightly short of achieving the SB 350 doubling goal. Additional work needs to be done to achieve the SB 350 objectives. These challenges and detailed recommendations are discussed in Chapter 4.

Staff recommends that the Energy Commission adopt the targets (illustrated in Figures 1 and 2) for energy savings from programs not funded through utility rates. For future work to close the gap staff recommends:

- To extend the life of programs expected to end, such as Proposition 39.
- To expand the funding and therefore savings potential of programs that overlap with the baseline significantly, like the Energy Conservation Assistance Act loans.
- To maintain the funding for all other existing programs shown to produce cost-effective energy savings.
- To pursue energy savings from the agricultural and industrial sectors.
- To collect and analyze consumption and market data for any and all sources of savings, especially those called out in SB 350.
- To increase funding for workforce training to improve energy efficiency measure installation, as a way to scale up programs' effectiveness.
- To increase funding for outreach and education of building energy efficiency standards and appliance efficiency regulations to improve compliance.

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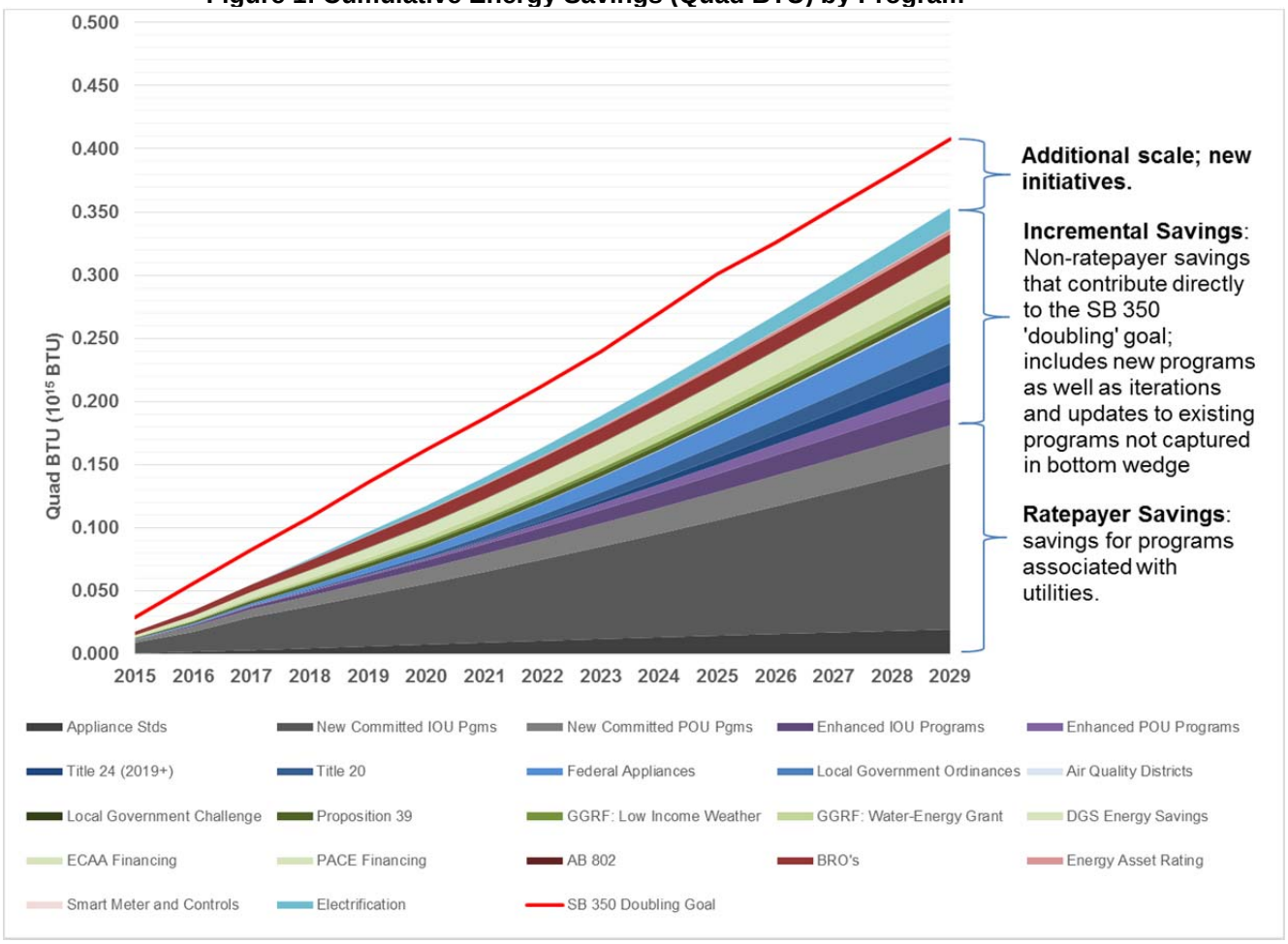
3 Note that the lower collection of wedges, labeled Ratepayer Savings, is explained in detail in the Energy Assessments Divisions paper, with the exception of the Appliance Standards wedge.

4 Public Resources Code § 25310(e), providing, "Beginning with the 2019 edition of the integrated energy policy report and every two years thereafter, the commission shall provide recommendations and an update on progress toward achieving a doubling of energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030."

- To work with other state, regional, and local agencies to create new energy efficiency programs.

Staff's immediate focus for draft Commission report will be to estimate agricultural and industrial energy efficiency savings strategies. Efficiency Division's paper will be combined with Energy Assessments Division's paper on energy savings from ratepayer-funded programs into a draft Commission Report in fall 2017. Energy savings targets will be updated every two years as part of the IEPR process. With these updates, Energy Commission staff expects to report progress towards achieving the doubling goal and to present new programmatic recommendations.

Figure 1: Cumulative Energy Savings (Quad BTU) by Program

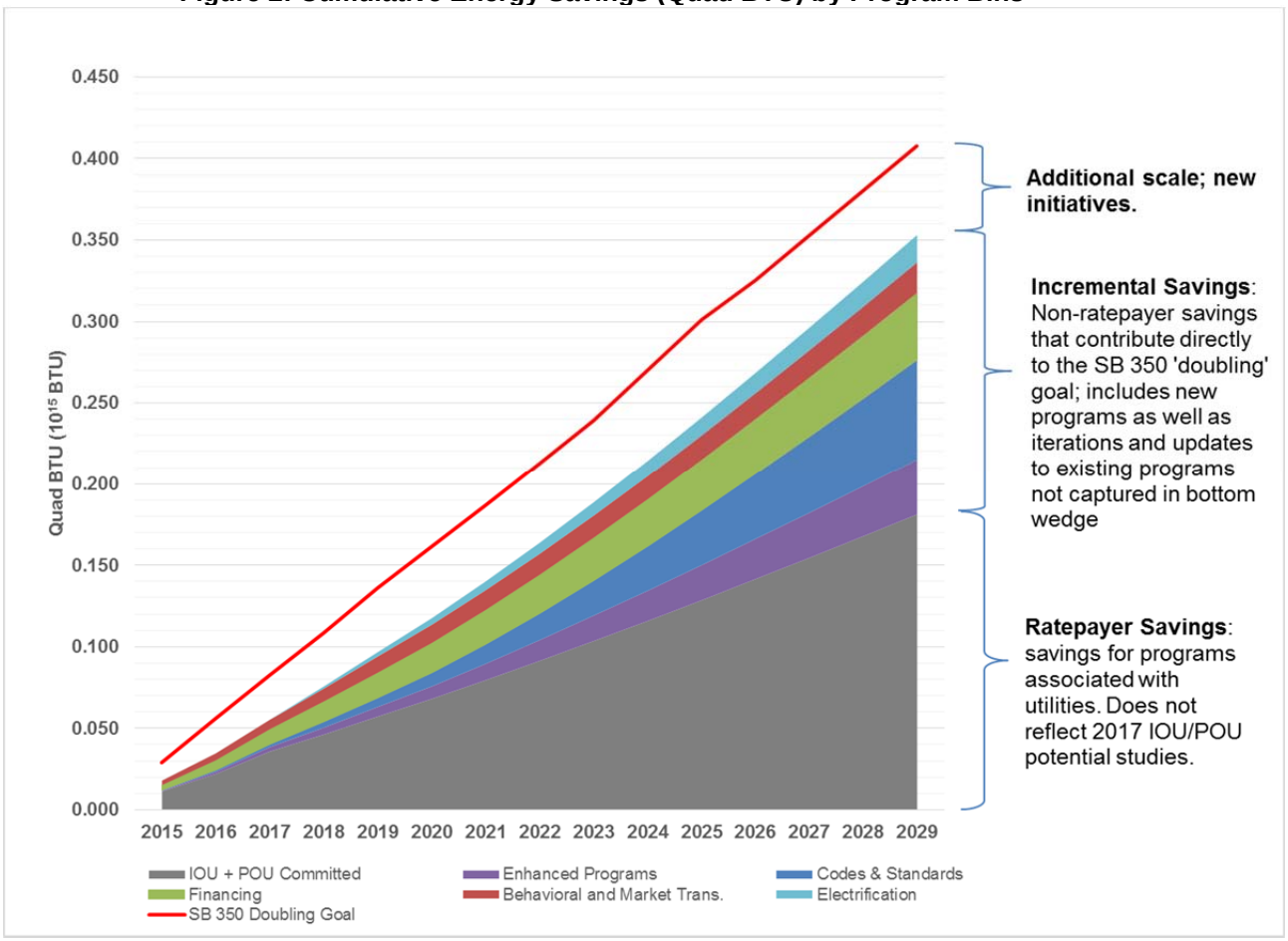


Source: California Energy Commission Staff

Figure 1 Abbreviations

Stds: Standards
BROS: Behavioral, Retrocommissioning, Operational Savings
DGS: Department of General Services
ECAA: Energy Conservation Assistance Act
Pgms: Programs
PACE: Property Assessed Clean Energy
GGRF: Greenhouse Gas Reduction Fund
SB 350: Senate Bill 350
IOU: Investor-owned utility
POU: Publicly owned utility
AB 802: Assembly Bill 802

Figure 2: Cumulative Energy Savings (Quad BTU) by Program Bins



Source: California Energy Commission Staff

Figure 2 Abbreviations
IOU : Investor-owned utility
POU: Publicly-owned utility
SB 350: Senate Bill 350

Acronyms and Abbreviations

AAEE	Additional achievable energy efficiency
AB 802	Assembly Bill 802 (2015)
AMI	Advanced metering infrastructure
APCDs	Air pollution control districts
AQMDs	Air quality management districts
ARRA	American Recovery and Reinvestment Act
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASHRAE bEQ	American Society of Heating, Refrigerating and Air-Conditioning Engineers Building Energy Quotient
BRO	Behavioral, Retrocommissioning, Operational
BSO	Building Standards Office
BTU	British thermal unit
CAISO	California Independent System Operator
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CBECS	Commercial Buildings Energy Consumption Survey
CDFA	California Department of Food and Agriculture
CEQA	California Environmental Quality Act
CEUS	Commercial End-Use Survey
CPUC	California Public Utilities Commission
CSD	Department of Community Services and Development
DGS	Department of General Services
DOE	U.S. Department of Energy
DHW	Domestic hot water
DWR	Department of Water Resources
EAD	Energy Assessments Division

EBEE Action Plan	Existing Buildings Energy Efficiency Action Plan
EBO&M	Existing building operations and maintenance
ECAA	Energy Conservation Assistance Act
ED	Efficiency Division
EE	Energy efficiency
EMS	Energy management System
Energy Commission	California Energy Commission
ESCOs	Energy service companies
GGRF	Greenhouse Gas Reduction Fund
GHG	Greenhouse gas
GWh	Gigawatt-hour
HVAC	Heating, ventilation and air conditioning
IoT	Internet of Things
IOU	Investor-owned utility
IEPR	Integrated Energy Policy Report
kWh	Kilowatt-hour
LEA	Local education agency
LEED	Leadership in Energy and Environmental Design
LGC	Local Government Challenge
LIWP	Low-Income Weatherization Program
Massachu-setts DOER	Massachusetts Department of Energy Resources
MM Therms	Million therms
PA	Program administrator
PAC	Program administrator cost
PACE	Property Assessed Clean Energy
PCT	Participant cost test
POU	Publicly owned utility

Quad BTU	Quadrillion British thermal units
RIM	Ratepayer impact measure
SB 350	Senate Bill 350 (2015)
SPM	Standard Practice Manual
TRC	Total Resource Cost
ZNE	Zero net energy

Chapter 1: Introduction

Senate Bill 350

Senate Bill 350, the Clean Energy and Pollution Reduction Act of 2015 (De León, Chapter 547, Statutes of 2015), sets forth ambitious clean energy goals for California. In addition to setting a 50 percent RPS to be achieved by January 1, 2030, the legislation requires that the California Energy Commission (Energy Commission) establish annual targets that achieve a cumulative doubling of projected statewide energy efficiency savings in electricity and natural gas end uses of retail customers by January 1, 2030.[5] The targets are subject to the constraints of being cost-effective, feasible, and not adversely impact public health and safety.[6]

Scope of This Report

The annual targets consist of projected energy efficiency savings in the State due to programs funded through utility rates and those not funded through utility rates. This report focuses on the latter sources of energy efficiency savings, which may also be referred to as "non-utility savings." Energy efficiency savings are calculated for electricity (in terms of GWh), and natural gas (in terms of MM therms or 1 million therms). These energy calculations are combined using a common unit, the British thermal unit (BTU). Given the magnitude of the energy savings, combined energy savings figures are in quadrillion BTUs (Quad BTUs). The sources of energy savings include state agencies, local governments, and private lenders that can increase energy efficiency at the end uses of retail customers through financing, directly installing energy efficiency measures, and increasing public awareness of energy efficiency best practices. Renewable energy measures like solar photovoltaics are outside the scope of this report, and therefore, are not included in energy savings estimates.

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5 SB 350 amended Public Resources Code section 25310(c)(1) to read as follows: "On or before November 1, 2017, the commission, in collaboration with the Public Utilities Commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, shall 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. The commission shall base the targets on a doubling of the midcase estimate of additional achievable energy efficiency savings, as contained in the California Energy Demand Updated Forecast, 2015-2025, adopted by the commission, extended to 2030 using an average annual growth rate, and the targets adopted by local publicly owned electric utilities pursuant to Section 9505 of the Public Utilities Code, extended to 2030 using an average annual growth rate, to the extent doing so is cost effective, feasible, and will not adversely impact public health and safety."

6 *Ibid.*

Definitions

To project energy savings to January 1, 2030, the Energy Commission staff used the following definitions of cost effective, feasibility, and not having adverse impacts to public health and safety to analyze programs.

Cost Effective

Many of the programs listed section 25310(d) of the Public Resources Code already have specific statutory definitions of "cost effective" or require the Energy Commission, California Public Utilities Commission, or publicly owned utilities to take into consideration certain factors when determining cost-effectiveness. The programs that already have a specific definition of "cost-effective" and/or a method of calculating cost-effectiveness are listed below.

- Appliances Standards. §25402(c)(1) of the Public Resources Code governs cost-effectiveness determinations for appliance standards.[7]
- Building Standards. § 25402(b)(3) of the Public Resources Code governs cost-effectiveness for building standards.[8]
- Proposition 39, the Clean Energy Jobs Act. Section 26206 of the Public Resources Code governs cost-effectiveness calculations for Proposition 39 projects.[9] The Energy Commission's methods for determining cost-effectiveness are found in the Proposition 39 Guidelines.[10]
- Investor-Owned Utility Programs. Public Utilities Code § 701.1(c) governs cost-effectiveness calculations for investor-owned utility programs.[11] The California

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7 Public Resources Code § 25402(c)(1): "The standards adopted or revised pursuant to this subdivision shall not result in any added total costs for consumers over the designed life of the appliances concerned. When determining cost-effectiveness, the commission shall consider the value of the water or energy saved, impact on product efficacy for the consumer, and the life cycle cost to the consumer of complying with the standard. The commission shall consider other relevant factors, as required by Sections 11346.5 and 11357 of the Government Code, including, but not limited to, the impact on housing costs, the total statewide costs and benefits of the standard over its lifetime, economic impact on California businesses, and alternative approaches and their associated costs."

8 Public Resources Code § 25402(b)(3): The standards adopted or revised pursuant to subdivisions (a) and (b) shall be cost-effective when taken in their entirety and when amortized over the economic life of the structure compared with historic practice. When determining cost-effectiveness, the commission shall consider the value of the water or energy saved impact on product efficacy for the consumer, and the life cycle cost of complying with the standard. The commission shall consider other relevant factors, as required by Sections 18930 and 18935 of the Health and Safety Code, including, but not limited to, the impact on housing costs, the total statewide costs and benefits of the standard over its lifetime, economic impact on California businesses, and alternative approaches and their associated costs.

9 Public Resources Code § 26206(c): All projects shall be cost effective; total benefits shall be greater than project costs over time. Project selection may include consideration of non-energy benefits, such as health and safety, in addition to energy benefits.

10 The Proposition 39 Guidelines can be found at: http://www.energy.ca.gov/2016publications/CEC-400-2016-005/CEC-400-2016-005-CMF.pdf.

11 Public Utility Code § 701.1 (c) In calculating the cost-effectiveness of energy resources, including conservation and load management options, the [Public Utilities Commission] shall include, in addition to other ratepayer protection objectives, a value for any costs and benefits to the environment, including air quality. The [Public

Public Utilities Commission has developed a set of cost-effectiveness tests available in the California Standard Practice Manual (SPM), for implementing this statutory provision. The SPM defines a system for measuring costs and benefits using five cost-effectiveness tests, each representing a different perspective: the total resource cost test (TRC), program administrator cost test (PAC), ratepayer impact measure test (RIM), participant cost test (PCT), and total resource cost—societal variant (that is, societal cost test), which could include a greenhouse gas adder and an air quality value, as well as a social discount rate.[12] These tests can be used for different purposes depending on objectives.

- Publicly Owned Utility Programs. Public Utilities Code § 9505 governs cost-effectiveness for POU programs.

In its SB 350 target setting work, for the above and any other energy efficiency programs not listed above, staff recommends that the Energy Commission not supersede any cost effectiveness test adopted and used by the entity with authority over the program. For any other programs and energy efficiency measures, staff recommends that the Energy Commission use the general definition of cost-effectiveness in section 25000.1(c) of the Public Resources Code.[13]

Feasible

A common sense definition of "feasible" is contained in the California Environmental Quality Act: "Feasible means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."[14] For SB 350, feasibility includes how technically feasible the energy efficiency program is; how likely participation is in an energy efficiency program; and how

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Utilities Commission] shall ensure that any values it develops pursuant to this section are consistent with values developed by the State Energy Resources Conservation and Development Commission pursuant to Section 25000.1 of the Public Resources Code. However, if the commission determines that a value developed pursuant to this subdivision is not consistent with a value developed by the State Energy Resources Conservation and Development Commission pursuant to subdivision (c) of Section 25000.1 of the Public Resources Code, the [Public Utilities Commission] may nonetheless use this value if, in the appropriate record of its proceedings, it states its reasons for using the value it has selected.

12 California Public Utilities Commission Rulemaking R.14-10-003, Standard Practice Manual http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=7741

13 In calculating the cost-effectiveness of energy resources, including conservation and load management options, the [Energy Commission] shall include a value for any costs and benefits to the environment, including air quality. The [Energy Commission] shall ensure that any values it develops pursuant to this section are consistent with values developed by the Public Utilities Commission pursuant to Section 701.1 of the Public Utilities Code. However, if the [Energy Commission] determines that a value developed pursuant to this subdivision is not consistent with a value developed by the Public Utilities Commission pursuant to subdivision (c) of Section 701.1 of the Public Utilities Code, the [Energy Commission] may nonetheless use this value if, in the appropriate record of its proceedings, it states its reasons for using the value it has selected.

14 Public Resources Code § 21061.1.

realistic savings projections are given economic, social, technological, and environmental constraints. In assessing the feasibility of energy efficiency savings, SB 350 requires the Energy Commission and the California Public Utilities Commission (CPUC) to "consider the results of energy efficiency potential studies that are not restricted by previous levels of utility energy efficiency savings."[15]

Adversely Impact Public Health and Safety

SB 350 does not define ''not adversely impact public health and safety.''[16] However, if energy efficiency is relied upon by the California Independent System Operator transmission planning (CAISO), CPUC and investor-owned utility (IOU) reliability planning, or publicly owned utility (POU) reliability planning, but does not materialize, the missing energy efficiency could hypothetically cause power outages at the transmission and/or distribution level. Electrical outages can cause health and safety issues, such as traffic light outages leading to traffic accidents, or air conditioning systems shutting down during a heat wave. Outages can affect industrial processes and essential public services, although those likely have back up electrical generation. Therefore, as it relates to SB 350, one meaning of an adverse impact on public health and safety is not maintaining reliable electricity supply.

Beyond grid reliability, adverse impacts to public health and safety also include the effects of greenhouse gases (GHGs) and other air pollutant emissions. Energy efficiency programs should reduce the need for fossil fuel consumption and therefore the resulting emissions of harmful air pollutants. If expected energy efficiency fails to occur, there could be a negative impact on the public health. So another interpretation of not adversely impacting public health and safety is that energy savings must also reduce GHG and air pollutant emissions.

Baseline Demand Forecast and Utility Energy Efficiency Savings Potential Studies

For this chapter, staff is interested in energy efficiency savings beyond the energy savings already accounted for in the baseline of the demand forecast and utility energy efficiency savings projections, either from IOUs or POUs. The demand forecast is published by the Energy Commission and includes three primary cases designed to capture a reasonable range of demand outcomes over the next 10 years. The high energy demand case incorporates relatively high economic/demographic growth and climate change impacts, and relatively low electricity rates and self-generation impacts. The low energy demand case includes lower economic/demographic growth, higher assumed rates, and higher self-generation impacts. The mid-energy demand case uses input assumptions at levels between the high and low cases. The demand is calibrated according to the previous years' actual

15 Public Resources Code § 25310(c)(4).

16 Public Resources Code § 25310(c)(4).

energy consumption so any program that existed at the time of calibration will have the associated savings incorporated into the forecast. This means that any program that also existed before 2015 must produce energy efficiency savings beyond those captured by the baseline of the demand forecast so that they can be counted as incremental savings.

Utilities have been developing estimates of energy efficiency savings potential for many years. In 2011, the CPUC began developing its own energy efficiency potential studies for IOUs. About the same time, POUs began developing energy efficiency potential studies and submitting these to the Energy Commission. In 2017, two new potential studies, one each for IOUs and POUs, were completed that form the basis for determining incremental savings beyond that included in the baseline of the demand forecast. The potential energy savings feed in the development of additional achievable energy efficiency (AAEE). AAEE is credible, incremental energy savings not included in the baseline demand forecast but reasonably expected to occur, including future updates of building codes, appliance regulations, and new or expanded utility programs. Combing the baseline forecast with various AAEE scenarios results in a managed forecast for use in resource and transmission planning, and reliability studies. Both utility potential studies were conceived and launched in 2016 before the implications of SB 350 energy efficiency savings goals and targets were clarified; thus neither study fully satisfies the scope that might be desired to identify possible savings to match the SB 350 doubling goal.

In the most recent Potentials and Goals Study by Navigant for the CPUC, the scope of the potential study included savings from the Building Standards up to the 2019 cycle (new construction only), and the *Appliance Efficiency Regulations* up to 2019 with a few adopted in 2023 and 2024.[17] In discussions with the CPUC's Energy Division staff, any overlap from codes and standards and IOU rebate programs would likely be small and difficult to separate in the short run, until evaluation of programs generates more updated information. To account for potential overlap, a blanket 10 percent reduction was applied to programs that staff determined to be at risk.[18] This 10 percent will be adjusted program-by program as more information regarding energy savings overlap becomes available. Staff also only projected energy savings for years of building standards beyond those included in utility potential and goals studies but will estimate savings for the years between 2016-2019 in the upcoming draft Commission report.

In the recent potential study by Navigant sponsored by the California Municipal Utilities Association (CMUA) on behalf of all POUs, each POU was able to define which categories of energy efficiency savings it wished to include in projections. Some POUs chose to include savings from codes and standards, and some did not. Based on initial discussions with

17 Navigant. 2017. *Energy Efficiency Potential and Goals Study for 2018 and Beyond*; *Codes and Standards Appendix.*

18 This 10 percent overlap is shown in figures as enhanced IOU and POU program wedges. These wedges may be removed if staff determines them to reside in either the ratepayer savings wedge or the non-utility savings wedge.

specific POUs and CMUA, it appears that only savings from the 2016 *Title 24 Building Standards* were included when a POU chose to include code and standard savings in its targets, thus there is no overlap with future codes and standards. Staff may identify energy savings that go beyond those captured in the most recent version of these two studies.

Annual Targets

As stated previously, staff identified programs not funded through utility rates which result in energy efficiency savings additional to the baseline of the demand forecast and those reported in IOU and POU potential studies. Staff then projected estimates of electricity and natural gas energy efficiency savings from identified sources through December 2029.[19] Energy efficiency programs are broken down by sector (residential and non-residential). Energy efficiency savings are broken down by program and grouped as program bins, that is, similar programs are combined into a bin like financing, or codes and standards. The energy efficiency savings from this report will be combined with ratepayer program energy savings to estimate how closely the State is to meeting energy efficiency savings goals each year, through December 2029. This will permit the Energy Commission and stakeholders to have the same background information when it comes to energy efficiency planning.

The Energy Commission is also in the process of developing an energy baseline tool. This tool will enable tracking of consumption trends across the state, and will enable both a grounded appreciation of our overall progress toward the doubling goal, as well as a rigorous assessment of where the savings are being produced. Our growing analytical foundation will allow detailed understanding of such macro-level trends.

Update Cycle

The energy efficiency savings targets and the programs that contribute to those targets will be updated on a two year cycle[20]. Staff will deliver the update as part of the *Integrated Energy Policy Report* (IEPR). The update will include:

> 1) An assessment of the effect of energy efficiency savings on electricity demand statewide, in local service territories, and on an hourly and seasonal basis.[21]
>
> 2) Specific strategies for, and an update on, progress toward maximizing the contribution of energy efficiency savings in disadvantaged communities identified under to Section 39711 of the Health and Safety Code.[22]

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19 Public Resources Code § 25310(c)(1).

20 Public Resources Code § 25310(e).

21 Public Resources Code § 25310(e)(1).

22 Public Resources Code § 25310(e)(2).

Chapter 2:
Scope

Non-Utility Energy Savings

Senate Bill 350 (De León, Chapter 547, Statutes of 2015) requires the Energy 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.[23] The energy efficiency doubling will come from ratepayer programs and programs not funded by ratepayers. Ratepayer-funded programs are those programs that are operated by, and/or funded by, IOUs, POUs, or other *program administrators* (a non-utility organization that administers programs funded by ratepayers such as community choice aggregators and regional energy networks). This chapter identifies energy efficiency savings outside the typical energy efficiency programs funded by ratepayers. An example of this type of program is Proposition 39, in which the Energy Commission provides funds to local education agencies to invest in energy efficiency.

Identifying Energy Savings Targets

The first step is to identify possible programs that would contribute to additional energy savings. These energy savings need to be additional to energy savings identified in IOU and POU potential studies and the baseline from the demand forecast, as described earlier. Once incremental efficiency activities are identified, estimates of energy savings can be projected through December 2029 with the hope of reaching the January 1, 2030 doubling of energy efficiency goal. This chapter identifies the potential non-utility ratepayer savings sources, including savings from programs at the Energy Commission, other state agencies, local governments, and other local entities. The Energy Commission is responsible for a portion of the non-utility ratepayer savings, including: the *Building Energy Efficiency Standards*, the *Appliance Efficiency Regulations*, multiple financing programs, and facilitating market transformation to realize more energy efficiency. Many of the energy efficiency savings strategies of the Energy Commission are outlined in the *Existing Buildings Energy Efficiency Action Plan* (*EBEE Action Plan*), which will be discussed next.[24] [25] Other state agencies that operate energy efficiency programs include: the Department of Community Services and

23 Public Resources Code § 25310(c).

24 California Energy Commission, *Existing Buildings Energy Efficiency Action Plan*, California Energy Commission, Sacramento, California, 2015, Page i, Publication Number: CEC-400-2016-023SD, Available at: http://www.energy.ca.gov/ab758/

25 California Energy Commission, *2016 Existing Buildings Energy Efficiency Action Plan Update*, California Energy Commission, Sacramento, California, 2016, page 3, Publication Number: CEC-400-2015-013-F, Available at: http://www.energy.ca.gov/ab758/

Development (CSD), Department of Water Resources (DWR), Department of General Services (DGS), and the Department of Food and Agriculture (CDFA).

Many of the programs, or financing options offered through the State, come with specific requirements. These requirements necessitate some accountability by the beneficiary. In situations where funds are given to an entity to finance a project, the beneficiary must report on how the funds were used. For example, DWR reports to the California Air Resources Board (CARB) about how funds from the Greenhouse Gas Reduction Fund (GGRF) were awarded to applicants in the Water-Energy Grant program. Understanding and making educated assumptions about the compliance rates across the various programs will be necessary to attain best estimate energy savings expectations, however, for the purposes of this paper staff have assumed a blanket compliance rate of 100 percent in an attempt to portray the full energy savings potential.

Existing Buildings Energy Efficiency Action Plan

The *Existing Buildings Energy Efficiency Action Plan* was adopted by the Energy Commission in September 2015. It provides a 10-year plan to transform California's existing residential, commercial, and public building stock into energy efficient homes and buildings. The goals are to increase energy efficiency markets, create more effective targeting and delivery of energy efficiency upgrade services, improve the decision making of occupants and investors, and advance improvements to the performance of California's buildings. The EBEE Action Plan outlines ways to increase energy savings and GHG reductions, contributing to the collective goal of reducing the impacts of climate change while improving the resilience of the state's environment and economy. The Energy Commission adopted an updated *EBBEE Action Plan* in December 2016.

The *EBEE Action Plan* provides a comprehensive framework centered on five goals, each with an objective and a series of strategies to achieve it. These goals are:

1. Increased government leadership in energy efficiency.
2. Data-driven decision making.
3. Increased building industry innovation and performance.
4. Recognized value of energy efficiency upgrades.
5. Affordable and accessible energy efficiency solutions.[26]

The EBEE Action Plan discusses many energy saving programs and strategies. Some of these programs and strategies contribute to utility programs that are ratepayer funded while others will be additional incremental savings not funded by utility ratepayers. This portion of the paper will focus on the additional incremental savings that are beyond utility programs.

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26 California Energy Commission, *Existing Buildings Energy Efficiency Action Plan*, California Energy Commission, Sacramento, California, 2015, Page i, Publication Number: CEC-400-2016-023SD, Available at: http://www.energy.ca.gov/ab758/

Energy Savings Areas

Future Codes and Standards

Future codes and standards are considered here to contribute to non-utility ratepayer sourced energy savings. Staff looked at future versions of the *Building Energy Efficiency Standards*, California Green Building Standards Code, *Appliance Efficiency Regulations*, and the Federal Appliance Standards for potential energy savings.[27] Staff acknowledges that the projected energy savings include possible future utility advocacy claims but the years of codes and standards considered are not yet funded by utility ratepayers. Future codes and standards can be projected using historical data and expectations that each of the codes and standards becomes more stringent over time resulting in decreased energy savings potential.

Building Standards

The *Building Energy Efficiency Standards* (standards), Title 24, Part 6, contain cost effective energy efficiency requirements for newly constructed buildings, additions to existing buildings, and alterations to existing buildings. The Energy Commission develops updates to these standards as part of the triennial update cycle of the California Building Code, which will include updates in 2019, 2022, 2025, and 2028.

Public Resources Code § 25402(b)(1) directs the Energy Commission to "Prescribe, by regulation, energy and water conservation design standards for new residential and new nonresidential buildings." The code further states, "The commission shall periodically review the standards and adopt any revision that, in its judgment, it deems necessary."[28] Consistent with this direction, each iteration of the standards evaluates proposed new efficiency measures and improvements to existing measures. The 2019 and 2028 Standards will include consideration of new zero-net-energy (ZNE) approaches for residential and nonresidential buildings, respectively, consistent with the Governor's 2020 and 2030 ZNE goals. The 2022 Standards will examine low-rise and high-rise multifamily buildings and the potential for establishing efficiency measures specific to multi-family buildings, distinct from other residential and nonresidential buildings.

Savings for 2019 new construction and older vintages will be included in future updates, as staff need additional time to finalize estimates for those standards. The 2019 (additions and alterations) 2022, 2025, and 2028 Standards are considered in this paper. Staff recognizes that the projected energy savings likely include future codes and standards advocacy savings the utilities will claim and that in future updates to the SB 350 targets,

27 Estimates of the energy savings potential for Title 24 Part 6 between 2016-2019 will be included in the upcoming draft Commission report.

28 Public Resources Code § 25402(b)(1).

codes and standards savings will move from non-ratepayer sourced to ratepayer-sourced as a they become funded.

In addition to the required provisions in Title 24, Part 6, the *California Green Building Standards Code*, Title 24, Part 11, also known as *CALGreen*, provides a set of voluntary specifications that can be used as model ordinances and allow a city and/or county the ability to easily establish more stringent building efficiency standards based on local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must be filed with the California Building Standards Commission to become effective, and cost effectiveness must be demonstrated to the Energy Commission before they can be enforced. These local ordinances complement the statewide standards and ensure California consumers fully realize the benefits of advancements in energy efficiency.

The investor owned utilities have been claiming energy savings credit for codes and standards advocacy since the 2006-2008 funding cycle. Utility advocacy is a ratepayer-funded activity in which the utilities develop technical research to support the adoption of building and appliance standards both at the state and federal level. Other ratepayer-funded activities include implementation support for adopted standards, although the utilities do not claim savings for these activities. The utilities may also claim energy efficiency savings for *CALGreen* standards they help local jurisdictions adopt, as long as the standards are adopted and enforced by jurisdictions. In the 2010-2012 funding cycle, the CPUC staff attempted to quantify such savings for credit. Due to lack of data and other methodological difficulties, the utilities did not claim savings credit for this activity in subsequent cycles. In fact, the 2018 Potentials and Goals Study that Navigant is conducting for the CPUC does not include *CALGreen* for any energy savings. This means that all energy savings from *CALGreen* will be considered additional incremental savings to ratepayer-funded efforts of utility advocacy.

Appliance Regulations

The *Appliance Efficiency Regulations* (Appliance Regulations), in Title 20 of the California Code of Regulations, sections 1601-1609, include minimum efficiency standards, test procedures, labeling, and disclosure requirements for both federally regulated appliances and non-federally regulated appliances. As of January 2017, the Appliance Regulations contain 23 categories of appliances. Each appliance standard has an effective date; products manufactured on or after that date must certify to the Energy Commission that they comply with the applicable standards.

The Appliance Regulations are frequently updated to add new efficiency standards and test procedures. Current standards development is operating under an order instituting rulemaking from 2012.[29] A list of federal standards, separate from state appliance

29 California Energy Commission, Order Instituting Rulemaking Proceeding, California Energy Commission, Sacramento, California, 2012, Available at:

regulations, which the U.S. Department of Energy (DOE) is supposed to undertake over the next five years, is located on DOE's website.[30] This list does not include new appliances that the DOE could consider for standards, and is based on mandatory deadlines in the federal appliance statute. The federal rules have a preemptive effect on state standards, meaning that California can't set standards for products for which there is a federal standard, with minor exceptions to this rule. California typically participates in these federal rulemakings to help ensure that the DOE establishes stringent standards that save Californians money on their utility bills.

Staff included savings estimates for appliance regulations from the 2015 AAEE and for new measures from 2017 through 2029, as well as, any measures that can be updated to provide additional incremental savings.

Financing

A major contributor to the energy savings not funded through utility rates are taxpayer or privately funded financing programs. Staff looked at several financing programs offered by state agencies and private entities that capture energy efficiency savings in the residential and non-residential sectors. These programs are projected into the future in a business-as-usual fashion to understand potential energy savings. The energy savings from these programs are mostly additional to utility programs. In cases where overlap is expected, staff has made assumptions about the percent of savings to attribute to utility programs, which will be updated as more data becomes available.

Property Assessed Clean Energy

Property Assessed Clean Energy (PACE) is a financing program permitted in California starting in 2007 with the passage of Assembly Bill 811 (Levine, Chapter 159, Statutes of 2008). This financing program, hereafter referred to as PACE, is offered by private lenders, and does not rely on public funding. A PACE loan allows a property owner to fund energy efficiency, water efficiency, or renewable energy projects with limited up front capital. This financing is available to owners of both residential and non-residential buildings. The fundamental mechanism of PACE relies on the existing framework of building property taxes whereby the entire loan, including principal and interest, can be repaid through a special tax assessment made on the property where energy projects are implemented. Loan payments can be amortized for a period of up to 20 years, with an option to extend the

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http://www.energy.ca.gov/appliances/2012rulemaking/notices/prerulemaking/2012-03-14_Appliance_Efficiency_OIR.pdf.

30 U.S. Department of Energy, Draft 5-Year Appliance Standards Rulemaking Schedule, U.S. Department of Energy, Washington D.C., 2017, Available at: https://energy.gov/sites/prod/files/2017/01/f34/5-year_current_and_future_rulemakings_asrac_01.18.2017.pdf

payback period as necessary. According to several PACE providers, the following features represent the key benefits of the program:

- Long-term, fixed-rate financing
- No down payment required
- Financing terms independent of credit history
- Non-recourse, no financial covenants
- Easy credit approval
- Fully transferable and assignable upon sale
- Repaid through property taxes
- Treated as an operating expense and available for pass-through to tenant
- Available in active PACE participating districts in California

Due to the basis of property tax assessment, PACE financing is available only in participating districts where the private lenders have established legal agreements with cities and counties to channel the loan repayment through property taxes. This may be one of the limitations in the statewide adoption rate of PACE, although the number of PACE providers is on the rise. There are 12 PACE providers in California available to residential and non-residential property owners.[31] The number of projects funded by PACE is higher for residential than for non-residential, primarily due to the simplicity in ownership for residential buildings. The complexity of non-residential buildings may arise from the variance in owners, investors, lease holders, lease terms, and other factors that inhibit the adoption of PACE financing for improvement projects. As the program stands in California, there are limited estimated savings or verification of energy savings from projects financed by a PACE loan.[32]

Any energy savings from this program will be incremental to what is captured by utility programs since the funding source is private. Although, a recipient may use utility rebates to lower the cost of their upgrade, therefore, a 10 percent savings overlap is estimated. There is also some portion of PACE savings likely included in the baseline of the demand forecast, meaning that not all savings can be considered additional.

Local Government Challenge

The Local Government Challenge (LGC) is grant program designed to help the state meet the goals set by SB 350 and Assembly Bill 802 (Williams, Chapter 590, Statutes 2015). The LGC

31 "PACE in California," PACE Nation, accessed June 3, 2017, http://pacenation.us/pace-in-california

32 Fadrhonc, Emily Martin, *et al.* Lawrence Berkeley National Laboratory. Residential PACE in California: Feasibility of Studying Impacts on Mortgage Performance and Energy Savings. January 2016

uses funds remaining from the federal American Recovery and Reinvestment Act of 2009 (ARRA) to encourage local jurisdictions to implement aggressive energy efficiency, disclosure, compliance, and permitting programs. The grants were open to cities, counties, joint power authorities, metropolitan planning organizations, councils of governments, and other local government consortia. The grant program was split into two parts: the Small Government Leadership Challenge and the Energy Innovation Challenge. The solicitation for proposals went out in January 2017 with the funds approved in June 2017.

The energy innovation grants winners are (by entity and title of project or program):

1) Marin Clean Energy: Building Efficiency Optimization Project
2) City of San Diego: Smart City Open Urban Platform (SCOUP)
3) City of San Leandro: Innovative Energy Efficiency and Renewable Energy Deployment Project
4) Stop Waste Energy Council: Accelerating Multifamily Building Upgrades

The small government leadership challenge grants were awarded to:

1) City of Del Mar: Civic Center Energy Efficiency Enhancements
2) Gateway Cities Council of Governments: Climate Action Planning (CAP) Framework
3) San Bernardino Council of Governments: Sub-Regional Greenhouse Gas Reduction Plan Update
4) County of San Luis Obispo: EnergyWise Plan's Energy Section Update, including Zero Net Energy Neighborhood Feasibility, Design, and Implementation Study
5) City of Santa Cruz: Deep Energy Efficiency at Municipal Facilities through Advanced Building Controls
6) Ventura County Regional Alliance: Central Coast Energy Plan
7) Marin General Services Authority: Marin Climate and Energy Partnership/Resilient Neighborhoods Grassroots Climate Action
8) City of Galt: City of Galt Climate Action Plan, Corridor Plan, and Master Plan
9) City of Santa Barbara: City of Santa Barbara, ZNE Roadmap and Implementation Plan

The types of eligible projects differ in the separate grant categories. Small Government Leadership Challenge applicants proposed to develop planning documents, like a climate action plan, which will help the local governments meet the goals of the *EBEE Action Plan*, SB 350, and AB 802. Energy Innovation Challenge applicants proposed innovative energy efficiency projects that help meet the goals of the *EBEE Action Plan*, SB 350, and AB 802. The exact ways in which energy will be saved by each recipient will be updated as information becomes available. Beyond energy savings, these grants are expected to result in shared knowledge that leads to more high-quality funded projects by local governments.

Energy efficiency savings that result from the LGC are likely to be incremental to any energy savings captured by utility programs and the baseline demand forecast. Overlap with ratepayer programs may occur if the local jurisdiction implementing the program uses utility incentive programs to lower the project costs, in which cases, energy savings will

need to be allocated accordingly. Local jurisdictions should inform the Energy Commission of such circumstances should they occur, so that attribution can be taken into account.

Proposition 39: Clean Energy Jobs Act

The Clean Energy Jobs Act (Proposition 39) was passed with voter approval in 2012. The resulting statute amended the corporate income tax code and allocated projected revenue from the additional taxes on corporations to the state's General Fund and the Clean Energy Job Creation Fund for five years annually from 2013-14 through the 2017-18 fiscal years. A total of $2.07 billion was appropriated for the five year period. Proposition 39 funds can be used for energy efficiency retrofits and clean energy installations. Furthermore, funds can be used to hire energy managers and provide relevant energy related staff training. Energy efficiency and demand response projects are first priorities, followed by renewable energy generation, distributed generation, combined heat and power applications, and clean and efficient fossil-fired generation, in the order stated. The Energy Commission is primarily responsible for administering the Proposition 39 K-12 Program while the California Community Colleges Chancellor's Office administers the Community College Proposition 39 Program component.

The K-12 program provides grants to schools within a local education agency (LEA). The LEA submits an energy expenditure plan to the Energy Commission for review and approval. The California Department of Education then distributes the funding to the approved LEA. Funding can be combined with Energy Conservation Assistance Act loans and utility incentives; however these funds and associated savings are tracked separately. Any energy savings from this program are incremental to energy savings projected by utility programs. However, the baseline forecast likely captures a small percent of savings from this program since it was in effect at the time the baseline was calibrated. Projects may also use utility rebates to lower cost, which might result in overlap. Therefore, in order for the K-12 program to produce incremental savings, more projects must be done per year or greater energy savings achieved per project than caught in the baseline or claimed through utility rebates.

The Community College Program pools money received from the Clean Energy Jobs Fund with IOU partners and outside consultants. This partnership reviews, approves, administers, and verifies clean energy projects and energy savings.[33] Due to the collaborative nature of this program, a method will be required to assign savings appropriately to non-utility savings and to utility program saving, for example in proportion to the amount of funding provided.

33 California Community Colleges Chancellor's Office, *Citizens Oversight Board- Proposition 39 Clean Energy Jobs Act Summary Report,* 2017.

Energy Conservation Assistance Act

The Energy Conservation Assistance (ECAA) loan program delivers revolving loans to schools, cities, counties, and special districts to finance projects with proven energy and/or demand cost savings. The ECAA financing program is designed to ease the adoption of energy projects, through a simple process that does not involve credit approval, collateral or fees. There are two types of loans offered through this program: a 0 percent interest loan and a 1 percent interest loan. The 0 percent interest loan is available to:

- K-12 school districts
- County offices of education
- State special schools
- Community colleges

This loan was developed separately as ECAA-Ed using ARRA funds.[34] The 1 percent loan is available to:

- Cities
- Counties
- Special districts
- Public colleges or universities
- Public or nonprofit care facilities
- Public or nonprofit hospitals

Residential, commercial, and/or private non-profit institutions are not eligible for any funds. Applicants must prove that their project has energy and/or demand cost savings. Any applicants already receiving funding for the project through another loan or program are ineligible.[35]

Energy efficiency savings that result from the ECAA loan are at risk of overlap with utility ratepayer programs and the baseline demand forecast. The recipient of the loan may use utility incentives to reduce the cost of projects. Also, since ECAA provided loans that resulted in energy savings and, therefore, demand reduction during the year of calibration for the baseline demand forecast, some amount of energy savings are incorporated into it. For energy efficiency savings resulting from ECAA loans to be incremental, they must add to savings beyond those absorbed in the baseline forecast or produced because of utility incentives.

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34 *Proposition 39: California Clean Energy Jobs Act, K-12 Program and Energy Conservation Assistance Act 2015-2016 Progress Report*, California Energy Commission, 2016.

35 "Energy Efficiency Financing," California Energy Commission, accessed June 3, 2017, http://www.energy.ca.gov/efficiency/financing/

Greenhouse Gas Reduction Fund

The Greenhouse Gas Reduction Fund (GGRF) was set up by three bills: Assembly Bill 1532 (Pérez, Chapter 807, Statutes of 2012), Senate Bill 535 (De León, Chapter 830, Statutes of 2012), and Senate Bill 1018 (Budget and Fiscal Review Committee, Chapter 39, Statutes of 2012). These statutes directed the proceeds of the California Cap-and-Trade Program into the GGRF. The goal of the GGRF is to reduce emissions of GHGs, benefit disadvantaged communities, and advance the goals laid out in Assembly Bill 32, the California Global Warming Solutions Act of 2006 (Núñez, Chapter 488, Statutes of 2006). All the programs of participating agencies are collectively referred to as California Climate Investments. For this report, staff is interested in GGRF-funded programs that capture end-use energy savings as a result of reducing GHG.

The California Air Resources Board (CARB) acts as the lead administrator of the funds. Agencies that receive funds must then periodically report on estimated benefits of their program, including energy savings. A portion of the GGRF budget is used to fund programs that save energy through installation of more energy efficient appliances and weatherization of low-income homeowners' properties.

The energy efficiency programs funded by the GGRF all produce incremental savings that contribute to the goals in SB 350. Since these programs began realizing energy savings at the end of 2015, none were included in the baseline demand forecast calibration. Also, these programs do not combine funds from IOU/POU ratepayer programs so there is no risk of overlap. Staff analyzed two GGRF programs for potential savings.

Low-Income Weatherization Program

The GGRF funds the Low-Income Weatherization Program (LIWP), operated by the Department of Community Services and Development (CSD). The program is also funded by the federal weatherization program.[36] The LIWP is broken into three subprograms, each targeting a different subset of low-income households in disadvantaged communities: (1) Single Family/Small Multi-Family EE and Solar Water Heating, (2) Single-Family Solar Photovoltaics, and (3) Large Multi-Family EE and Renewables. Energy efficiency is a key component of two of the subprograms. The Single Family/Small Multi-Family EE and Solar Water Heating provide single-family and small multi-family low-income homes with weatherization and energy efficiency measures. The Large Multi-Family EE and Renewables subprogram provides multi-family, low-income properties with technical assistance and incentives for weatherization and energy efficiency measures. Any subprograms that offer renewable generation measures will have those removed so that only energy efficiency measures are considered in energy savings estimates. CSD has selected a service provider to administer the program throughout California. Savings for the large multi-family EE and

36 Energy savings from other programs that receive funds from this federal program will be considered in future updates.

renewables subprogram have not been estimated at this time due to a lack of available data.[37]

Water-Energy Grant

The Department of Water Resources also receives funding from the GGRF. This funding is used to run the Water-Energy Grant Program and given to applicants from the residential and non-residential sectors. Grants are used to finance upgrades that improve water efficiency, reduce GHG emissions, and reduce water and energy use. Energy savings are captured primarily by installing measures to reduce hot water use, which then decreases the energy needed to heat water.[38]

Energy Savings Program

The Department of General Services (DGS) operates the Energy Savings Program. An initial $25 million payment from the Energy Commission provided the seed money to begin the EE Retrofit Revolving loan program. This program and others under the umbrella of the Energy Savings program provide loans to state agencies to finance energy efficiency retrofits. The participating state facilities use the savings realized through the retrofits to pay back their loans to DGS. DGS has an approved list of energy service companies (ESCOs) that are hired to implement the energy efficiency retrofit, which reduces the startup time needed to begin the project. There are several energy efficiency projects in progress from the previous funding cycle (2014-2015), with 1 project out of 16 completed to date.[39] A new funding cycle has been approved for 2017-18 which includes a streamlined process for program implementation[40]

This program produces energy efficiency savings at some risk of double counting. Since the program began realizing savings in late 2015, none should have affected the demand forecast calibration. However, it is possible that some utility rebates may be used by the ESCOs to lower the cost of the project. Therefore, some part of the energy savings could be captured by ratepayer programs. DGS and the ESCOs need to communicate overlap if it should occur, so that in future updates of energy savings, proper attribution can be updated.

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37 *California Climate Investments Using Cap-and-Trade Auction Proceeds, Annual Report 2017*, pp 70-77, California Air Resources Board, 2017.

38 *California Climate Investments Using Cap-and-Trade Auction Proceeds*, Annual Report 2017. pp. 82,

39 "Energy Savings Program Project List," MS Excel, Department of General Services, 2017

40 Valerie Keisler (DGS Energy Efficiency Program Manager) in discussion with Energy Commission staff, April 2017.

Air Quality Management District Savings

Air quality management districts (AQMDs) and air pollution control districts (APCDs) are responsible for permitting stationary sources of air pollution.[41] In addition they inspect businesses to confirm compliance with local, state, and federal rules; investigate citizen complaints; educate the public and local businesses about the rules and regulations; and conduct research projects to find new technologies that support their efforts.[42]

All the districts are members of the non-profit association called the California Air Pollution Control Officers Association (CAPCOA). This association coordinates the promotion of clean air and provides a forum for districts to share knowledge, experience, and information.[43] CAPCOA also funds studies and approves project plans that can be used for the GHG credit exchange. A CAPCOA-funded study highlighted the multiple ways districts can reduce GHG emissions. This study included measures to reduce energy consumption at the building level. It specifically refers to exceeding Title 24 standards, installing programmable thermostat timers, upgrading lighting, and installing energy efficient appliances.[44] CAPCOA also recently approved project implementation plans that reduce GHGs through energy efficiency. These include weatherization of homes and replacements of boilers and chillers.[45]

None of the AQMDs or APCDs offer energy efficiency programs. In 2014, San Luis Obispo Air Pollution Control District planned to offer a program to retrofit homes, similar to the weatherization project approved by CAPCOA, but did not implement the program.[46] These types of programs would be an excellent way to capture incremental savings and GHG reduction, both of which get the State closer to the goals laid out in SB 350.

Any energy savings reliably captured by AQMDs or APCDs will be above any energy savings incorporated into the baseline demand forecast. Ratepayer funded programs might capture overlapping savings if incentives are used to reduce the cost of a project. Therefore the

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41 "California Stationary Sources Permitting-Background," California Air Resources Board, accessed May 25, 2017, https://www.arb.ca.gov/permits/stationary-sources-overview.htm

42 "About Us," *California Air Pollution Control Officers Association*, accessed May 26, 2017, http://www.capcoa.org/about/

43 "California Air Pollution Control Officers Association-CAPCOA," California Air Resources Board, accessed May 25, 2017, https://www.arb.ca.gov/capcoa/capcoa.html

44 "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," California Air Pollution Control Officers Association, August 2010.

45 "CAPCOA Greenhouse Gas Reduction Exchange," California Air Pollution Control Officers Association, accessed May 26, 2017, http://www.ghgrx.org/

46 "Residential Retrofit Planning Study," County of San Luis Obispo Department of Planning and Building, Revised April 2011

AQMD or APCD implementing the energy efficiency measures must report if any utility incentives are combined with their funding so energy savings can be attributed correctly.

Behavioral and Market Transformation Programs

This section describes energy efficiency savings that come as a result of behavioral changes as opposed to implementation of a physical measure like new HVAC or lighting units. These behavioral changes are initiated by informing the customer or building owner of their energy usage through benchmarking, energy asset ratings, and computer applications using their smart meter data, among others.

Energy savings can also be realized though market transformation efforts which are measures that are on the cusp of widespread adoption but need additional public education or funding to be adopted. Examples of market transformation include the automation of appliances through the Internet of Things[47] (IoT) or replacing natural gas appliances with electrical ones.

Benchmarking

Mandatory state-wide benchmarking first appeared in California in 2007 with the passage of Assembly Bill 1103 (Saldana, Chapter 533, Statutes of 2007). AB 1103 required the owner or operator of a nonresidential building to disclose benchmarking information for the building to a prospective buyer, lessee, or lender. AB 802 (Williams, Chapter 590, Statutes of 2015) repealed this requirement and directed the Energy Commission to create a mandatory benchmarking and public disclosure program for certain commercial and multifamily residential buildings, and required utilities to make building-level energy-use information available to building owners, owners' agents, and operators on request.

Proposed Regulations

The Energy Commission has proposed regulations that would implement the benchmarking and public disclosure provisions of AB 802. Specifically, the regulations would require the owners of most commercial and residential buildings larger than 50,000 square feet to report building-level energy performance information to the Energy Commission annually, with commercial buildings beginning in 2018, and multifamily residential buildings beginning in 2019. The Energy Commission would publish this information on a public website. The increased availability of energy performance information would help:

- Potential buyers and lessees to better understand buildings they are considering purchasing or leasing.
- Policy makers and planners to make better-informed decisions.
- Energy service companies to target their services.

The ultimate outcome is expected to be an increased demand for energy-efficient buildings, resulting in decreased building energy use. Under the proposed regulations, local

47 the communication between electronic devices and a smart energy meter using the internet

jurisdictions with benchmarking and public disclosure ordinances would be allowed to apply to the Energy Commission for a determination that, if granted, would exempt building owners who report to a local jurisdiction from also reporting to the Energy Commission.

Assessment and Opportunities for Improvement

Once the program has been implemented, the Energy Commission will analyze the results and consider program enhancements including:

- Expanding the population of buildings included in the program, for example by decreasing the minimum building size (currently 50,000 square feet).
- Requiring action beyond benchmarking and reporting, for example by requiring building owners to complete an energy audit. (The local ordinances in the cities of San Francisco, Berkeley, and Los Angeles all require energy audits in addition to benchmarking.)
- Proposing targeted program efforts based on improved knowledge of the building stock.

Support for Local Programs

At this time, the cities of San Francisco, Berkeley, and Los Angeles have local ordinances requiring benchmarking, reporting, and audits. Energy savings from these early adopters are not estimated in this report, but will be considered in future updates. The increased access to building-level energy use information provided by AB 802 will make it easier for more jurisdictions to create local ordinances. As local ordinances with requirements exceeding the state-wide requirements (for example, by including smaller buildings or by requiring audits or retro-commissioning) become more common, the role of the Energy Commission could shift from primarily that of the implementer of the state-wide program to that of an advisor to local governments on matters including:

- Designing and implementing a benchmarking and disclosure program.
- Aligning data transfer protocols with state and national standards.
- Encouraging building owners to go beyond what is required for compliance (benchmarking or completing an audit) to performing cost-effective improvements to buildings and equipment.

Smart Meters and Controls

The focus of this section is on the automation of appliances and other loads in a building by communicating with a smart meter. This communication saves energy by turning off loads when they are not needed and reduces peak demand by running appliances at off hours. For a program like this to occur, it would require utilities to provide price signals through rates or other approaches. This type of demand response and load shifting builds on the Energy Commission's *2016 Existing Buildings Energy Efficiency Action Plan* Strategy 2.1, "Data for Improved Decisions," although the strategy also covers additional smart meter possibilities which are included in the behavioral, retrocommissioning, and operational program area.

This program makes use of the energy utilities efforts to install advanced metering infrastructure (AMI) to enable two-way communications with their customers. Instead of monthly energy usage data, smart meters can send energy consumption data in daily or 15-minute intervals to both the utility and the customer. Via energy management system (EMS) computer, website, or mobile app interfaces, customers can use the data to monitor their usage patterns throughout the day and gain insight into their energy bills.[48] When paired with utility time-of-use rate plans that charge more during peak hours, customers are offered incentives and given the tools to reduce their energy consumption or shift it to off-peak hours.

Energy Asset Rating

The Energy Commission's *2016 Existing Buildings Energy Efficiency Action Plan* Strategy 1.4, "Adopt Uniform Asset Ratings to Compare Building Properties," calls for standardized energy asset ratings for both residential and non-residential buildings. An asset rating is a standardized method of quantifying the efficiency of a building itself, based on its physical characteristics independent of occupancy. The factors affecting underlying efficiency include the envelope, heating, cooling, ventilation, and hot water systems of the building, along with the installed lighting and major appliances, as well as any offsetting electrical power produced by on-site renewable systems.

By including an asset rating as part of real estate listings or information for a building owner, one can objectively compare buildings, which will influence real estate markets. This would in turn drive investment in energy efficiency upgrades at the market scale. To establish an energy asset rating for the non-residential sector, staff needs to review the energy asset ratings that exist, such as those that have been developed and/or adopted by U.S. DOE, Residential Energy Services Network (RESNET), Energy Commission, Home Energy Rating System-Whole House (HERS), ASHRAE (Building Energy Quotient), and other states.[49]

Energy savings that can be directly attributed to an energy asset rating are behavioral or operational changes a building owner makes, like changing hours of building operation, or direct investment in energy upgrades by the building owner, whereas any measures implemented using third-party financing are proportionately attributable to that specific program. Energy asset ratings results in savings that do not overlap with the baseline of the demand forecast. However, it is possible savings might overlap with savings claimed by utilities since they also anticipate offering rebates or incentives for energy savings coming from behavioral changes.

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48 "What is the Smart Grid?" U.S. Department of Energy, accessed June 12, 2017, https://www.smartgrid.gov/the_smart_grid/smart_home.html

49 California Energy Commission, *Existing Buildings Energy Efficiency Action Plan*, California Energy Commission, Sacramento, California, 2015, Page 50, Publication Number: CEC-400-2016-023SD, Available at: http://www.energy.ca.gov/ab758/

Fuel Substitution

Public Resources Code § 25310(a)(2) defines "energy efficiency savings" as "reduced electricity or natural gas usage produced either by the installation of an energy efficiency measure or the adoption of an energy efficiency practice that maintains at least the same level of end-use services or by conservation actions that reduce energy use by reducing the quantity of baseline energy services demanded." In other words, the efficiency measures must reduce the consumption of either electricity or natural gas, while ultimately reducing greenhouse gas emissions and overall energy demand. Therefore, measures such as transportation electrification, which increase electricity use to decrease the use of petroleum fuels for transportation, do not satisfy the requirements of SB 350 and are not in the scope of this report.

The requirements of SB 350 allow measures such as appliance electrification, which is, substituting a natural gas appliance with an electric appliance. Advances in heat pump technology[50] have made substituting natural gas with electricity for heating systems more viable and offer increased efficiency compared to traditional resistance heating devices such as electric clothes dryers. The vast majority of buildings in California use natural gas for water and space heating. Substituting natural gas with heat pumps for space and water heating[51] could reduce both energy consumption and greenhouse gas emissions. The companion paper prepared by the Energy Assessments Division in this proceeding addresses several questions about how fuel substitution programs might be designed to provide energy savings for SB 350 goals.

Behavioral, Retrocommissioning, Operational Savings

Behavior, installation, and building and equipment operations drive energy consumption. These drivers are why AB 802[52] and SB 350[53] have required the CPUC and the Energy Commission to work together to include these energy savings in their respective programs. The idea is to give energy customers greater accessibility to their energy data for a greater understanding of their energy usage, that analysis can precisely determine where inefficiencies and thus the potential savings exist. Energy customers can then pursue with ease and confidence energy efficiency improvements such as purchasing more efficient technologies, or by changing behavior that affects building energy usage, including shifting appliance and equipment use to off-peak hours and turning off energy-consuming equipment when not needed. Behavior has been shown to provide quantifiable effects on

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50 "Heat Pump Systems," *U.S. Department of Energy*, accessed June 12, 2017, https://energy.gov/energysaver/heat-pump-systems

51 "Heat Pump Water Heaters," U.S. Department of Energy, accessed June 12, 2017 https://energy.gov/energysaver/heat-pump-water-heaters

52 Public Utilities Code 381.2(b).

53 Public Resources Code § 25310(c)(4).

energy consumption. Numerous opportunities exist to achieve savings at a lower price point than other, more costly measures, such as replacing expensive equipment.[54]

Retrocommissioning is the process of checking that equipment and systems are installed correctly, like the control system for a central heating and cooling plant. It helps discover ways to capture energy savings in existing buildings. Effective building operations have significant effect on energy use for multifamily and commercial buildings, as illustrated with the Leadership in Energy and Environmental Design (LEED) and Existing Building Operations and Maintenance (EBO&M) program.[55]

Energy savings from behavioral, retrocommissioning, and operational programs potentially overlap with expected utility ratepayer programs but not with the baseline of the demand forecast since the savings from these programs have not been realized prior to the year of calibration.

Industrial Sector

In 2016, California became the sixth largest economy in the world. Manufacturing and other industrial production play a major part in maintaining California's economic success, contributing nearly 10 percent of the state's gross domestic product. California leads the nation in such market segments, as electronics and computer manufacturing.[56] The industrial sector has a diverse customer type, size, and operation. Industries in this sector include oil refineries, oil and gas extraction industries, printing plants, plastic injection molding facilities, component fabrication plants, lumber and paper mills, cement plants and quarries, metal processing plants, chemical industries, assembly plants, water and wastewater treatment plants, and food processing, among others. During the past two decades, the composition of industry in California has been changing with a decrease in "heavy" manufacturing and energy-consuming industries, and the rise of "light" manufacturing and less energy intensive industries.[57] In spite of the decrease in heavy industry, the industrial sector still consumes significant amount of energy in the State. Statewide, the industrial sector uses about 15 percent of electricity and 28 percent of natural gas.[58] This sector has significant untapped potential for energy savings.

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54 California Energy Commission, *Existing Buildings Energy Efficiency Action Plan*, California Energy Commission, Sacramento, California, 2015, Page 67, Publication Number: CEC-400-2016-023SD, Available at: http://www.energy.ca.gov/ab758/

55 *Ibid.*

56 Energy Efficiency Business Plan 2018-2025. January 2017. Pacific Gas and Electric Company.

57 de la Rue du Can, Stephane, Ali Hasanbeigi, and Jayant Sathaye. Lawrence Berkeley National. 2011 ACEEE Summer Study on Energy Efficiency in Industry. http://aceee.org/files/proceedings/2011/data/papers/0085-000057.pdf

58 Energy Consumption Data Management System. 2017. California Energy Commission. staff Communication.

Programmatically, a central challenge in tapping those savings is that each industry has unique situations and proprietary information. Because this sector consumes a significant amount of the state's energy resources, staff will collaborate with industry groups to assess energy savings potential, and develop initiatives to promote effective process improvements. An initial estimate will be made in the upcoming draft commission report. Industry can and shall contribute to achieving SB 350's doubling goal.

Agricultural Sector

California is home to the nation's largest and most diversified agricultural and food processing sector. California's agricultural abundance includes more than 400 commodities, which are grown on its 77,500 farms and ranches, collectively were valued at about $47 billion in 2015.[59] The state's largest irrigated crops by acreage are nuts (almonds, pistachios, and walnuts), grapes, tomatoes, broccoli, and lettuce. Although food processing occurs throughout the State, these industries are concentrated in the Central Valley. The valley is home to more than 3,000 factory sites[60] including: the world's largest facility for processing milk, milk powder and butter (California Dairies, Inc.); cheese (Hilmar Cheese Company); wine (E & J Gallo); and poultry (Foster Farms). There are common loads that are likely to lend themselves to efficiency improvements, such as refrigeration. Statewide, agricultural sector (including water pumping) uses slightly less than 7 percent of electricity, and about 1 percent of natural gas.[61] The Energy Commission staff will estimate agricultural energy savings in the upcoming draft commission report and collaborate with agricultural groups to assess the energy savings potential going forward to help close the gap in achieving the SB 350 doubling goal.

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59 California Department of Food and Agriculture, https://www.cdfa.ca.gov/statistics/

60 http://www.energy.ca.gov/publications/displayOneReport.php?pubNum=CEC-500-2011-035, *PIER Industrial, Agricultural, and Water Energy Efficiency Program RD&D Targets: Consolidated Roadmap* - PIER Consultant Report, 2009.

61 Energy Consumption Data Management System. 2017. California Energy Commission. staff Communication.

Chapter 3:
Methods, Analysis, and Results

This section details the methods used to determine energy savings for each program, the analysis of the program, and the resulting projected energy savings. The methods discussed here are still in the process of finalization, a detailed methodology with data sources, assumptions, and limitations for each program will be released upon the completion of the work.

The analysis was based on collaboration with Energy Commission staff, CPUC, POUs, and Navigant to understand areas and percentages of savings overlap, and to determine if programs met the terms of being cost-effective, feasible, and not adversely impacting public health and safety. In cases where overlap occurs with utility programs, a 10 percent reduction was applied to energy savings and attributed to enhanced IOU or POU programs. The percent overlap will be adjusted on a program by program basis as more data becomes available. Each program was deemed to be cost-effective, feasible, and to not adversely impact public health and safety. Every program has its own cost-effective metric that is currently met. Additionally, the types of measures installed through these programs are considered feasible and since they improve grid reliability and reduce GHG emissions, do not have an adverse impact on public health and safety.

The results of the analyses are generally limited by a lack of energy savings data or program information. Updates to energy savings estimates will be included in the draft Commission report to the extent possible.

Codes and Standards Methods, Analysis, and Results

Building Energy Efficiency Standards

California has been establishing *Building Energy Efficiency Standards* (standards) since 1978. The standards become more stringent over time by increasing energy efficiency requirements, approximately every three years. Prior to analysis of potential energy savings, the buildings affected, and if possible, the standards applied to a building, needed to be identified.

The standards apply to buildings from the residential and non-residential sectors for occupancy group A, B, E, F, H, M, R, S, and U; occupancy Group L and I (hospitals, industrial buildings, and non-covered processes, including refrigerated warehouse loads and data center uninterruptible power supply power) are exempt from the current standards.[62]

62 Title 24, § 100.0(a)(1)

Methods

Data from the Energy Commission staff, CPUC, publicly owned utilities, and potential studies were collected to inform the analysis. These data include the types of standards, the amount of energy savings expected to be in IOU/POU energy efficiency potential studies, and what new standards are estimated to go into effect in 2019, 2022, 2025, and 2028. While little data was available regarding new standards in 2019 (this paper includes analysis for only additions and alterations), 2022, 2025, and 2028, energy savings were estimated and projected using an initial top-down approach using high level estimates of potential standards enhancements. Energy savings estimates for 2016-2019 (2019 new construction) are still in development. It was also assumed that future standards would improve efficiency from previous standards, 10 percent for 2019 (building additions and alterations only), 5 percent for 2022 and 2025, and 10 percent for 2028 with the expectation that the standards will expand scope to include, but not limited to, hospital loads.

After additional data were collected, a bottom-up approach using a standard-based energy modeling was completed. Standard inputs include measure per unit electricity, gas, and demand savings, building type(s) affected, statewide floor space of affected buildings, naturally occurring market adoption, naturally occurring standards adoption, attribution factors and construction forecasts by climate zone. For building alterations, as opposed to new building construction, savings projections were based on existing condition estimates by building type and climate zone. Savings estimates considered which building type(s) were affected, what triggered to-code updates and how frequent the to-code updates were expected to occur. For alterations, the altered component needs to be brought up to-code to meet energy efficiency of the current standards. Savings projections for new construction either estimated the impact of specific measures or groups of measures, or applied typical savings from measured data program impacts.

Analysis

The analysis also considered measures included in the standards such as the envelope, lighting, and space conditioning systems, among others. Once buildings and measures were identified, staff collected necessary data and analyzed the measures to create the potential energy efficiency savings projections.

The steps taken to project energy savings through 2029 consider current cost-effectiveness tests used by the Energy Commission. The Energy Commission currently uses a time dependent valuation of energy savings, which are the expected time varying energy costs used by the building to provide space conditioning, water heating, and for specified lighting of buildings.[63]

63 California Energy Commission, *2016 Building Energy Efficiency Standards*, California Energy Commission, Sacramento, California, 2016, Page 79, Publication Number: CEC-400-2015-037-CMF, Available at: http://www.energy.ca.gov/title24/2016standards/.

Results

Table 1: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Building Energy Efficiency Standards

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	0	0	0	36	153	277	439	684	935	1223	1590	1961	2384
NG (MM therms)	0	0	0	0	0	1.0	3.9	7.0	11.3	17.4	23.8	31.3	40.6	50.2	61.4

Source: California Energy Commission staff.

California Green Building Standards Code

California has been and continues to be a leader in energy efficiency, as a state, but also seeks to enable local jurisdictions to innovate even further. *CALGreen* gives California cities and counties the opportunity to continue pushing the boundaries of energy savings at the triennial update of the standards. Cities and Counties can adopt California Building Standards Commission-approved *CALGreen* standards to require that selected or all new construction and/or additions, alterations, and repairs projects improve energy efficiency beyond the standards baseline. For residential buildings cities and counties can adopt Tier 1 to be 15 percent above the standards baseline, or Tier 2 which is 30 percent above the standards baseline. For nonresidential buildings cities and counties can adopt Tier 1 to be 5 percent above the standards baseline with either lighting or mechanical, or 10 percent with lighting and mechanical. Adopting Tier 2 would be 10 percent above the standards baseline with either lighting or mechanical, or 15 percent above the standards baseline with lighting and mechanical. Analysis of *CALGreen* includes both residential and nonresidential sectors whether they are private or public buildings.

Methods

Data from the Energy Commission staff, CPUC, POUs, and energy efficiency potential studies were collected for creating the methods used. This includes the types of relevant measures and the amount of energy savings expected to be in the baseline of the demand forecast, IOU/POU energy efficiency potential studies, and the new versions of *CALGreen* that are estimated to go into effect in 2019, 2022, 2025, and 2028. Where data are available regarding new *CALGreen* in 2019, 2022, 2025, and 2028, energy savings were estimated and projected with an initial top-down approach using square footage by climate zones for future versions of *CALGreen*. Where data were not available, buildings were simulated at the Standards baselines to estimate energy savings potential for future versions of *CALGreen*. To estimate potential electricity and gas savings for *CALGreen*, it was necessary to first estimate the efficiency improvements expected for each future cycle of the standards for 2019, 2022, 2025 and 2028. Staff then gathered data on the number of cities and counties that are likely to adopt ordinances requiring energy efficiency improvements over the Standards baselines. Projections for cities and counties that are likely to adopt *CALGreen* were based on previous adoption trends and data provided by Navigant in the IOUs and POUs potential studies.

After additional data were collected, a bottom-up approach using a measure-based energy modeling approach was completed. Staff assumes that cities and counties that previously adopted *CALGreen* will adopt *CALGreen* in the future. Historical permit data was used to estimate future new construction and major renovations. For building simulations, the model incorporates a package of measures that may not be implemented in all projects, but represent the level of savings expected to be achieved. Local ordinances more often require whole building performance rather than prescriptive measures, meaning that projects can use any mix of measures to meet the energy savings requirements.

Analysis

After concluding what buildings and measures are included in *CALGreen*, staff collected necessary data and analyzed it to create the potential energy efficiency savings projections.

Results

Table 2: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for CALGreen

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0.5	1.0	1.5	2.4	3.3	4.2	5.3	6.4	7.5	8.8	10.0	11.4	13.0	14.4	15.8
NG (MM therms)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.8	1.2	1.6	2.1	2.7	3.4

Source: California Energy Commission staff.

Appliance Efficiency Regulations

The *Appliance Efficiency Regulations* (appliance regulations) include minimum efficiency standards, test procedure, and disclosure requirements for both federally regulated appliances and non-federally regulated appliances offered for sale, or being installed in California. There is no code cycle such as for the *Building Energy Efficiency Standards*, but appliances and equipment energy efficiency standards are added and regulations are made more stringent routinely. The appliance regulations include performance requirements for electric, and natural gas appliances, and cover water usage. Staff's analysis of the appliance regulations takes into account appliances and equipment in buildings in the residential and nonresidential sectors, whether they are private or public. The analysis considered relevant measures included in the appliance regulations, such as, HVAC, lighting, envelope, personal electronics, and other devices not hard-wired into the building. Once buildings and measures were identified, necessary data was collected and analyzed to create the potential energy efficiency savings projections.

Methods

Data from the Energy Commission staff, CPUC, POUs, and energy efficiency potential studies were collected to inform the analysis. The analysis focused on the new appliance regulations may go into effect from 2018 through 2029. Staff also looked at possible regulations and existing regulations that could be updated due to the speed of technological advancements. Staff's initial analysis for appliance regulations, from 2018 through 2029, used top-down estimates of the savings potential for the statewide market and a potential schedule for developing new and updated regulations. Where no data was available regarding new appliance regulations from 2018 through 2029, a set of assumptions was developed for the energy savings potential based on previous versions of work by Navigant.

After additional data were collected, a bottom-up approach using a measure-based energy modeling approach was completed. A list was developed of potential efficiency measures that are viable for development and inclusion into the appliance regulations through 2029. This list will include any known measures identified by Navigant, but not included in the 2018 Potential and Goals study; any known long-term future measures that are in guiding documents from the Energy Commission or other sources; and additional measure opportunities identified such as updates to existing appliance standards and newly developed standards (such as, industrial fans and blowers, sprinkler spray bodies, tub spout diverters, irrigation controller, and standby mode and power factor). Staff developed detailed projections of the savings potential and market penetration.

Analysis

Staff looked at new measures for future versions of the appliance regulations that are not captured in the baseline forecast or IOU and POU energy efficiency potential studies. Staff also looked at possible updates to existing regulated measures for potential energy savings. Any measures after 2024 will not have any overlap with utility program savings.

Results

Table 3: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Appliance Efficiency Regulations

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	19	236	443	674	1002	1377	1820	2267	2767	3247	3707	4147	4567
NG (MM therms)	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	1.6	2.8	5.8	8.7	11.5	14.2	16.8

Source: California Energy Commission staff.

Federal Appliance Standards

U.S. Department of Energy (DOE) has been developing and updating federal appliance standards that set the minimum requirements for appliances and equipment throughout the nation. The federal appliance standards are implemented at the manufacturing stage and affect any market sector where the products are installed or used. These sectors include residential and nonresidential, whether the buildings are private or public. This analysis considered the measures included in the federal appliance standards (for example, battery chargers, clothes washers, and dryers, and so forth).

Methods

Data from Energy Commission staff, CPUC, POUs, and energy efficiency potential studies were collected to inform the analysis. This analysis focused on the new federal appliance standards may go into effect from 2019 through 2029. Staff also looked at possible new measures and appliances that could be updated to increase energy savings. Staff recognizes that there is uncertainty regarding new standards and updates in the coming few years given any shifts at the DOE which may impact California's strategy and efforts. For new federal standards from 2019 through 2029, energy savings were estimated with an initial top-down approach using previous versions of Navigant's federal appliance standards analysis.

After additional data were collected, a bottom-up approach using measure-based energy models was completed. This approach focused on high-energy-consumption appliances, which have the greatest potential for energy savings and are known or prevalent in the market. These appliances include HVAC systems, domestic hot water (DHW) systems, commercial clothes washers, and lighting. Coordination with the California appliance regulations analysis was necessary to account for overlap in measure lists, especially for emerging technologies and appliances not currently regulated by DOE. Given federal preemption, DOE's federal appliance standards pre-empt state regulations. An estimated level of efficiency for each measure was established based on available information, achieving maximum technical performance for measures through 2029 where it was deemed feasible. Measure characteristics were gathered or estimated based on best available data. These characteristics include appliance type/technology by end use, market sector affected, potential efficiency improvement based on previous rulemakings where a lower efficiency level was adopted, savings potential in kWh and therms, compliance rate for standards, sales or installation estimates, expected effective date, and normal market adoption.

Analysis

After determining what measures are included in the federal appliance standards, staff collected necessary data and analyzed them to create the potential energy efficiency savings projections.

Results

Table 4: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Federal Appliance Standards

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	71	192	316	565	816	1192	1571	2015	2531	3052	3578	4107	4641	5182	5729
NG (MM therms)	2.2	3.5	5.4	8.6	11.7	16.0	20.4	27.0	33.7	41.9	51.1	60.2	69.4	78.5	87.8

Source: California Energy Commission staff.

Standard Savings Included in the *2016 IEPR Update* Managed Demand Forecast

The analyses described in the previous sections for Energy Commission and federal standards do not include savings for the impacts of standards adopted in 2015 and futures up to 2019 that are embedded in the Energy Commission's managed demand forecast last adopted in the *2016 IEPR Update* proceeding.

Methods

Staff reviewed the baseline demand forecast and the corresponding AAEE projections (subtracting AAEE from the baseline makes the managed demand forecast) from the *2016 IEPR Update* proceeding to determine the size of these impacts. The *2016 IEPR Update* cycle did not include new AAEE analyses; rather, the AAEE analyses developed in the *2015 IEPR* proceeding were simply scaled down by the first year of savings (added into the 2016 baseline forecast) and extrapolated out one additional year into the future.[64] Table 12 of the *2015 California Energy Demand Update* report summarizes the vintages of Title 24, Title 20, and federal appliance efficiency standards that were assessed in that proceeding.[65]

As the five AAEE cases are defined to include some of the same vintages of prospective Title 24 building standards that have been reassessed and described earlier in this report, staff selected the Mid Baseline-Mid Low AAEE case to obtain savings projections for just 2016 updates to Title 24 Building Standards, Title 20 Appliance Standards, and federal appliance standards enacted, but not yet effective. Further, since the CPUC is now implementing revised programs to address AB 802 requirements to use existing baseline in most instances, staff believes that some portion of the Title 24 Building Standards savings reported in the *2016 IEPR Update* duplicates behavior, retrocommissioning, operational efficiency (BROs) savings projections included in the staff companion paper describing utility target setting. Thus of the selected AAEE case, only appliance standards have clearly incremental savings that do not duplicate other assessments in the two utility potential studies[66] or the assessments of future standards described above in this paper.

Table 5 reports the electricity and natural gas savings for recently adopted Title 20 and federal appliance standards affecting appliances purchased in 2015 and future years. In staff's judgment these are incremental savings to those reported earlier in this paper.

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64 California Energy Commission, *California Energy Demand Updated Forecast, 2017-2027*. Publication Number: CEC-200-2016- 016-CMF, p. 47. See http://docketpublic.energy.ca.gov/PublicDocuments/16-IEPR-05/TN215745_20170202T125433_FINAL_California_Energy_Demand_Updated_Forecast_20172027.pdf

65 California Energy Commission, *California Energy Demand 2016-2026, Revised Electricity Forecast*. Publication Number: CEC-200-2016-001-V1., p. 58. See http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN207439_20160115T152221_California_Energy_Demand_20162026_Revised_Electricity_Forecast.pdf

66 California Energy Commission, *Senate Bill 350 Energy Efficiency Target Setting for Utility Programs*, Chapter 2, forthcoming.

Results

Table 5: Electricity (GWh) and Natural Gas (MM Therms) Savings Projected from 2015 Onwards for Recently Adopted State and Federal Appliance Standards

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	92	242	502	851	1200	1541	1864	2185	2505	2769	3029	3287	3506	3752	3990
NG (MM Therms)	3.9	11.4	15.5	18.8	22.1	25.5	29.1	32.6	36.2	40.4	44.7	49.0	53.3	57.6	61.8

Source: California Energy Commission staff.

Residential Methods, Analysis, and Results

Low-Income Weatherization Program

Department of Community Services and Development's Low Income Weatherization Program serves low-income homes. Specifically, it seeks to help households in disadvantaged communities as identified by CalEnviroScreen 2.0, which determines if someone qualifies as disadvantaged or low-income in the State. The program will expand in the near future from only single family homes to include small and large multi-family buildings. Each recipient receives a home energy assessment to generate a list of recommended measures to improve the energy efficiency of the home. Of the program measures, staff considered lighting, ceiling fans, appliances, insulation, and microwaves for the SB 350 target setting. Solar thermal will be included in updates to savings estimates, whereas solar photovoltaics are excluded from energy savings estimates.

Methods

The Department of Community Services and Development provided data regarding expected energy reductions, cost of the project, project life, and GGRF funding allocated. Using this information, staff project potential energy savings through 2029 by:

- First, using a top-down approach, in which staff projects the energy savings from the only year of data in a cumulative fashion up through 2029.
- Next, staff applied corrections to refine the initial estimates. Project data show that approximately 36 percent of energy savings come from solar PV projects, which is not considered in the scope of SB 350 and 15 percent from solar thermal, which will be updated in the draft commission report. Further refinement is possible if additional data at the measure level is available.

These savings projections are based on assumptions of funding availability and different scenarios that are consistent with other programs similar to LIWP. Where energy modeling is applied, measure inputs are defined to align with known measure performance, energy assumptions, and projections for future measure improvements.

Analysis

The Department of Community Services and Development does not explicitly define a cost-effectiveness test in their applicant guidelines. However, this program focuses on bringing energy efficiency improvements to communities that could otherwise not afford them so a traditional cost-effectiveness test would not apply.

Results

Table 6: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for the Low Income Weatherization Program

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	31.8	63.6	95.4	125.9	156.3	186.7	216.5	246.2	274.7	302.9	329.8	356.6	383.3	410.0	436.7
NG (MM therms)	1.8	3.6	5.4	7.1	8.8	10.5	12.2	13.9	15.5	17.1	18.6	20.1	21.6	23.1	24.6

Source: California Energy Commission staff.

Water-Energy Grant

The Department of Water Resources Water-Energy Grant aims to improve the water and energy efficiency of residential and commercial buildings. Measures that satisfy the requirements of SB 350 in this program are clothes washers, dryers, and dishwashers.

Methods

Staff received two years of estimated project savings from the Department of Water Resources.[67] With these data, staff generated top-down estimates of the savings potential for the program. An estimate of the projected energy savings for this program was made by taking the average of electricity and gas savings from 2014 and 2016. The annual average savings from 2014 and 2016 then can be applied as the annual savings projections for 2015-2029 due to a lack of more granular data. The annual growth of savings and funding level remain the same as the average of 2014 and 2016 values.

These savings are refined by applying decay factors to the implemented measures. This means that certain measures will see a drop in the savings they can realize after they exceed their effective useful life. The specific drop in energy savings due to decay varies by measure from over 50 percent in lighting equipment to less than 5 percent with HVAC control equipment.

Analysis

The application process through DWR has stringent requirements to prove that a project is economically and technically feasible, while providing evidence for other benefits including public health. The program application consists of requirements that proposed measures be technically feasible.

Results

Table 7: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for the Water-Energy Grant

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	18	93	168	242	313	385	456	525	595	661	727	790	853	915
NG (MM therms)	4.3	8.7	13.0	17.4	21.7	26.0	30.4	34.7	39.1	43.4	47.7	52.1	56.4	60.7	65.1

Source: California Energy Commission staff.

67 "Water Energy Grant 2014 and 2016 Awardee Data", MS Excel, 2017, Department of Water Resources.

Local Government Challenge

Using funds from the American Recovery and Reinvestment Act (2009), the Energy Commission offered grants to local jurisdiction to implement new energy efficiency projects, update climate action plans, and address other energy/climate issues. Depending on the awardee of the grant, various building sectors will be affected.

The specific measures that will be implemented by each grant recipient vary. Those that fall into typical end-use categories (for example, residential or non-residential HVAC, or lighting) can be evaluated similarly to those other programs use but if some measures are outside a typical end-use category then they will require separate evaluation.

Methods

Staff used information from the Energy Commission award notice, the proposal guidelines, interviews with awardees, and submitted applications to establish a methodology to project energy efficiency savings. Other published information on converting GHG emissions reductions into energy savings units (GWh, MM therm) was needed to analyze climate action plans. First, the staff categorized the Energy Innovation Grant projects and Local Government Challenge programs into projects (1) with specific energy efficiency measures or targets, and (2) with general GHG reduction goals. Electricity and natural gas savings estimates were taken from the projects with that information. Projects with only GHG reductions were converted to electricity and natural gas to estimate the potential savings. The City of Pleasanton Plan, although not an applicant or recipient, was used as the basis for GHG conversions, sector-level energy usage, and per capita reductions.[68] An attribution factor of 25 percent was given to climate action plan projects, meaning that only 25 percent of estimated energy savings were attributed to the project. The remaining savings are expected to be realized by some other means like a utility incentive.

To refine initial energy savings results, staff uses more individual LGC awardees information. The baseline energy consumption from each project area was found from the application, local government agencies, or by city census estimates and comparisons of similar jurisdictions with available data. Next, staff evaluated each remaining project by mitigating factor to determine the fraction of potential energy savings that can be directly attributed to the project. This step removed the savings associated with PV, ratepayer overlap, and non-building EE, like street lights upgrades. Projects for Del Mar and Marin Clean Energy were removed from future analysis because they deal only with PV generation and supply side distributed energy resource management, which are beyond the scope of SB 350. Projects that estimated energy savings for specific buildings were used as the actual energy savings. Finally, savings calculations were divided into annual incremental savings. For broader projects that affect a large number of buildings, it was assumed that the projects would ramp up in scope and savings steadily from 10 percent of targeted savings

68 City of Pleasanton. 2011. *City of Pleasanton Climate Action Plan*, December 2011. Available online at: http://www.cityofpleasantonca.gov/civicax/filebank/blobdload.aspx?BlobID=24757

in 2021 to 100 percent in 2030. Additional updates may consider the feedback effect of the LGC, that is, if other local governments learn from current recipients and implement their own energy efficiency projects because of that knowledge.

Analysis

To complete the analysis, staff needed to assume a certain amount of energy savings from GHG reductions and that each project can be duplicated or scaled with time. The level of detail available at this time prevents a thorough analysis of the potential energy savings from each recipient's projects.

Results

Table 8: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for the Local Government Challenge

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	-	-	-	-	-	-	3.9	7.9	11.8	15.6	19.4	23.2	26.8	30.5	34.1
NG (MM therms)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.1	1.3

Source: California Energy Commission staff.

Property Assessed Clean Energy

Property Assessed Clean Energy (PACE) financing is offered primarily to residential building owners, while the non-residential market continues to develop.[69] Therefore, energy savings projected for this program will be lumped into the residential sector due to lack of available data to separate non-residential sector savings. A non-residential estimate will be considered in future updates.

The measures funded by a PACE loan vary from provider to provider. In many jurisdictions, energy audits are recommended though not required for residential applications, whereas ASHRAE-level energy audits are often required for non-residential buildings. Since the basis of PACE related to property valuation, qualifying savings measures must be permanently affixed to a property and can reduce on-site electric, gas or water consumption. There is not a comprehensive list of measures available that applies to all districts but some common measures include building envelope, attic insulation, HVAC equipment and controls, lighting equipment and controls, and cool roofs. Staff needs access to more PACE information to properly account for all possible measures. Renewable generation measures are not included because they are outside the scope of the SB 350 requirements. The list of relevant measures may also include water conservation measures that reduce pumping load, which in turn, achieves energy savings.

Methods

Staff used the limited information available about the measures and buildings affected by energy upgrades through PACE to do a top-down estimation of energy savings. The California State Treasurer PACE Loss Reserve Program is the only source of estimated energy savings in the State.[70] Under the program, PACE providers are required to report on the size and status of their portfolios semi-annually for all participating residential projects. Although this data source represents only a subset of all residential projects within the PACE framework and does not include non-residnetial, the data available present a reference point for annual enrollment, funding and energy savings for the residential sector. Savings projections are assumed to continue at a constant level based on the annual energy savings data reported by the PACE Loss Reserve Program for residential projects. This method took a conservative approach in leveraging existing data that represents a subset of the residential market and a subset of the PACE programs. These initial results are updated through detailed calculations using the climate zone, measure life, project cost, loan amount, and loan terms.

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69 Fadrhonc, Emily Martin, *et al.* Lawrence Berkeley National Laboratory. *Residential PACE in California: Feasibility of Studying Impacts on Mortgage Performance and Energy Savings.* January 2016.

70 California State Treasurer John Chiang. PACE Loss Reserve Program. State of California. 2016. http://treasurer.ca.gov/caeatfa/pace/activity.asp.

Analysis

PACE may overlap with ratepayer-funded energy savings if the property owner uses a utility incentive to help reduce the cost of the upgrade. This information would be available only at the individual project level.

Cost-effectiveness requirements are partly enforced through the maximum payback rule of 20-years that is standard for all PACE districts, with exception for longer payback evaluated on a case-by-case basis. There do not seem to be specific cost-effectiveness metrics adopted by the PACE program as a whole, although, for the program to continue to exist, building owners must repay loans rather than default.

Results

Table 9: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for PACE

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	440	880	1320	1760	2200	2640	3080	3520	3960	4400	4841	5281	5721	6161	6601
NG (MM therms)	0.7	1.3	2.0	2.7	3.4	4.0	4.7	5.4	6.1	6.7	7.4	8.1	8.8	9.4	10.1

Source: California Energy Commission staff.

Energy Asset Rating

Energy asset ratings characterize the major energy uses of the building through surveying and energy modeling. The program also provides some level of information on recommended efficiency measures to improve building performance. Staff expects the savings directly attributed to this program will come as a result of behavioral or operational changes a building owner or operator makes, as well as, direct purchases of energy efficient equipment without the use of utility incentive. This would have an effect on both residential and non-residential sectors.

Methods

Staff used information on other existing asset rating programs like ENERGY STAR* Portfolio Manager, ASHRAE Building eQ[71], and Massachusetts DOER[72]. Pilot projects such as the Building Energy Asset Rating System were also used to inform the process. Historical energy performance information was gathered through CEUS and CBECS databases and estimates of site energy use intensity were taken from the Urban Footprint project.

Finding energy savings requires building stock, floor area, and energy use intensity data. These data and ENERGY STAR Portfolio Manager results provide a basis for the percentage energy savings to expect. Assumptions are made that the savings will decay each year but also that new building owners participate. Staff also assumes that 90 percent of energy savings will be realized through other non-utility ratepayer or ratepayer programs, leaving only a 10 percent directly attributable to the rating program. To improve upon initial estimates, staff used energy models of building types and vintages to perform measure-level analysis. This estimated the potential savings from a particular building type and vintage. Applying then assumptions of participation and saturation gave an estimate of how many building owners might be expected to contribute energy savings in a given year.

Analysis

Energy asset ratings are expected to have no overlap with the baseline demand forecast and minimal behavioral or operational savings overlap with ratepayer programs.

The primary barriers to realizing energy savings from this are:

1) Determining the likelihood and timeline that this program will be resumed.
2) Establishing a procedure to link asset rating scores with voluntary efficiency upgrades, unrelated to other EE programs.
3) Determining if asset ratings will affect property valuation.

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71 “Building Energy Quotient,” American Society of Heating, Refrigerating, and Air-Conditioning Engineers, accessed June 29, 2017, http://www.buildingenergyquotient.org/

72 “Building Rating and Labeling-Commercial Buildings,” Energy and Environmental Affairs, Massachusetts Department of Energy Resources, accessed June 29, 2017, http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/building-labeling/building-rating-and-labeling-commercial-buildings.html

4) Determining how receptive the building sectors are to applying building asset ratings to their building stock.

Results

Table 10: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Energy Asset Rating

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Elec (GWh)	0	0	14	47	92	148	211	282	359	440	526	616	715	817	923	1,033
NG (MM therms)	0	0	0.1	0.3	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.0	3.5	4.0	4.5	5.0

Source: California Energy Commission staff.

Smart Meters and Controls

Although they have been widely installed across California, smart meters have not been the focus of specific energy efficiency programs, and much of their potential remains unrealized.[73] The smart meter may be able to communicate through the Internet with devices in the building that are connected as part of the Internet of Things (IoT). For example, the air conditioner can be sent a signal to operate minimally at times of peak demand or when the electricity rates are above a threshold. This communication would result in both load shifting and energy savings. Smart meters are being installed and operated in many different sectors.

Methods

Data on building stock, floor area, and energy use intensities of both residential and non-residential buildings were used in developing the methods. First, staff used generalized energy efficiency savings concepts to project savings. Several conservative assumptions are applied to find initial results, including the following:

- Energy savings from smart meters controlling appliances will not begin to be realized until 2020.
- Approximate savings will increase to approximately 0.5 percent for electricity and 0.25 percent for natural gas by year five and then flatten out after that. A logarithmic fit is applied to determine savings by year.
- Starting in 2020, an additional 2 percent of buildings will begin to realize savings via smart meter and controls each year.

Results are refined from additional data and feedback from stakeholders.

Analysis

Programs that aim to use smart meters in conjunction with other smart technology are difficult to determine cost-effective because it may have little to no upgrade costs, or there could be considerable consumer costs that will require payback. The technology already exists for automation to occur and smart meters are widely installed, so the program is feasible. Assuming all the behavioral measures are included in the BROS program, the reliability of non-consumer interactive measures will likely have high reliability into the future.

Participation in an automated smart meter program is dependent on the rate structure utilities use, whether time-of-use rates are implemented or not, and what options are available for demand response programs.

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73 Mooney, Chris, "Why 50 Million Smart Meters Still Haven't Fixed America's Energy Habits," *The Washington Post*, 2015. Accessed June 12, 2017, https://www.washingtonpost.com/news/energy-environment/wp/2015/01/29/americans-are-this-close-to-finally-understanding-their-electricity-bills/?utm_term=.18f33f7d09e2

Results

Table 11: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for the Smart Meters and Controls

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	0	0	0	7	15	25	36	48	60	73	86	100	115
NG (MM therms)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.6

Source: California Energy Commission staff.

Fuel Substitution

There are only a few fuel substitution programs, but this could apply to a wide range of residential and non-residential buildings. Fuel substitution can include measures for space heating, water heating, and clothes dryers, and possibly additional non-residential measures. The companion paper prepared by the Energy Assessment Division in this proceeding addresses several questions about how fuel substitution programs might be designed to provide energy savings for SB 350 goals.

Methods

Staff used information from white papers, energy models and pilot studies for the analysis. Because there are few existing programs built around fuel substitution, there is limited historical data available from which to project future potential savings. Initial savings are estimated using previous studies by NORESCO and TRC. Results are then improved with a bottom-up energy modeling approach that realistically estimates potential natural gas savings associated with electrification.

Analysis

There is the potential that energy efficiency savings will overlap with other programs being considered in this report. Depending on what assumptions are made regarding the extent to which fuel substitution is expected to be incorporated into future codes and standards, there is the potential for overlap between fuel substitution and code and standards, particularly for years closer to 2030. Also, based on available data, it is known that municipalities such as Palo Alto are considering or implementing policies driving electrification.[74] To the extent that savings potential for *CalGreen* could capture the anticipated effect of such policies, there could be overlap with fuel substitution.

Results

Table 12: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Fuel Substitution

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	0	-139	-280	-423	-569	-717	-867	-1018	-1169	-1321	-1474	-1629	-1787
NG (MM therms)	0	0	0	17.8	35.9	54.1	72.8	91.8	110.9	130.2	149.6	169.0	188.6	208.5	228.7

Source: California Energy Commission staff.

74 City of Palo Alto. TRC Energy Services. "*Palo Alto Electrification Final Report*." November 16, 2016

Behavioral, Retrocommissioning, Operational Savings

Under AB802 and SB350, CPUC worked jointly with the Energy Commission to include programs that achieve energy efficiency through behavioral, retrocommissioning, and operational savings with at least two-year or three-year expected useful life. These savings programs target improvements that either result in accomplishing the same work (e.g. space cooling) more efficiently or reducing energy use without relying on installation of new energy efficient technologies. These types of measures can be applied to any building, residential or non-residential. The measures initially targeted include audits, green leases, community based social marketing, tenant-operator engagement, etc.

Methods

Data from the Energy Commission, CPUC, POUs, and energy efficiency potential studies were collected together to inform the analysis. Since there is little data available regarding behavioral, retrocommissioning, and operational savings programs, energy savings were estimated and projected using programs currently or previously being implemented outside of California for potential savings impacts. The savings estimates used an initial top-down approach that relied heavily on evaluations of these programs and their applicability to the California market based on previous analysis by Navigant. After more research was done to collect additional data, a refined top-down approach was used and included any measures not incorporated into the initial estimates.

Analysis

Potential barriers to the analysis included data availability and determining program implementation and uptake because several of the potential measures are not currently available through any channel in California.

Results

Table 13: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Behavioral, Retrocommissioning, and Operational Programs

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	622.3	881.6	1141	1438	1743	1828	1914	2000	2058	2118	2181	2248	2320	2396	2478
NG (MM therms)	6.9	12.5	18.3	24.8	31.6	38.5	42.0	43.0	45.0	46.4	47.9	49.6	51.4	53.3	55.5

Source: California Energy Commission staff.

Non-Residential Methods, Analysis, and Results

Benchmarking

AB 802 provides data access to owners of buildings with no residential utility accounts and buildings with five or more utility accounts. Moreover, buildings with more than 50,000 square feet of gross floor area and no residential utility accounts, as well as buildings with more than 50,000 square feet of gross floor area and 17 or more residential utility accounts will be included in the benchmarking and public disclosure program.

Methods

It is not straightforward to estimate the savings attributable to the benchmarking program, as the proposed regulations do not require building owners to take any action to reduce energy use; the regulations would only require building owners to report energy performance information to the Energy Commission. However, the increased visibility of building energy performance the program provides may drive building owners and tenants to make capital investments to reduce energy use, and to make behavioral and operational changes, resulting in improved building energy performance.

Staff used investor-owned utility electricity sales as a portion of state-wide electricity sales[75] to estimate the portion of state-wide energy consumption in commercial and residential buildings[76] that is in investor-owned utility territories, then divided energy savings from investor-owned utility efficiency programs[77] by consumption to estimate percent savings from current participation in efficiency programs.

Staff conjectured that participation in the benchmarking program might cause a doubling of the savings from current participation in investor-owned utility energy efficiency programs in those buildings subject to the state-wide benchmarking and public disclosure program that are not already subject to a local mandatory benchmarking and public disclosure ordinance (which have more stringent requirements than the proposed state-wide program).[78] Staff therefore multiplied the estimated savings rate by the estimated consumption in buildings subject to the program but not to local programs to calculate consumption expected to be avoided due to the state-wide program.

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75 California Electric Utility Service Areas, http://www.energy.ca.gov/maps/serviceareas/electric_service_areas.html, July 18, 2017

76 https://www.eia.gov/state/?sid=CA#tabs-2, July 18, 2017

77 http://eestats.cpuc.ca.gov/Views/EEDataPortal.aspx, July 18, 2017

78 Navigant. Energy Efficiency Potential and Goals Study for 2018 and Beyond. June 2017.

Analysis

Ratepayer program savings may overlap with benchmarking energy savings because it is included in the measure list developed by Navigant as part of its IOU potential and goals study. There may also be savings double counting with local jurisdictions that already have a benchmarking program. Therefore, incremental energy savings will need to account for these overlaps to avoid double counting.

Results

Table 13: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Benchmarking and Disclosure

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	0	64.7	109.8	111.6	113.7	115.7	117.9	120.0	122.3	124.5	126.8	129.1	131.5
NG (MM therms)	0.0	0.0	0.0	0.7	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.5

Source: California Energy Commission staff.

Proposition 39

The Clean Energy Jobs Act, also known as Proposition 39, provides funding for planning and installing energy efficiency upgrades and clean energy generation at schools. The initiative changed California's corporate income tax code and allocates projected revenue to the General Fund and the Clean Energy Job Creation Fund for five fiscal years, annually from 2013-2014 until the 2017-2018 fiscal year. The funds for this program are awarded to local educational agencies (LEA) and California community colleges to upgrade existing facilities. LEAs include K-12 school districts, county offices of education, charter schools, and state special schools. The types of energy efficiency upgrades that can be done to a building vary greatly. Some examples of the measures include building envelope, insulation, HVAC, and cool roofs. Staff did not include energy storage or irrigation measures because they are outside the scope of the doubling goal. Solar thermal energy efficiency will be added into estimates in the draft commission report.

Methods

Staff collected data from the Proposition 39 database and workbook, including both community colleges and LEAs, and the annual report to the Citizens Oversight Board.[79] The Proposition 39 database provides the most up-to-date information on projects, including a list of measures to be applied, estimated electricity and gas savings for each measure, estimated utility-eligible electricity and gas savings for each measure, estimated total cost for each measure, estimated eligible utility incentive, and summaries at the project level and at the LEA level.

While Proposition 39 funding is expected to end in the 2017-2018 fiscal year with project close-out expected by June 2021 staff analysis assumes that Proposition 39 (or a similar program able to generate comparable savings) will be extended to 2030 for developing incremental savings projections that can be applied to SB 350. To project energy savings, staff initially generated high-level estimates from the available data. Annual energy savings data are normalized by the associated funding amount, which results in a GWh and MM therm per dollar value. The normalized values are extrapolated up to 2018 using the known funding amounts. A trend line is then drawn to fit the energy savings and projected through 2029.

Initial savings estimates are updated by applying corrections for market saturation. Solar PV was already removed from consideration but about 0.2 percent of savings could be attributed to solar thermal which must be taken into account in updates. Proposition 39 would exceed the number of schools available for upgrades at its current rate assuming that no customers repeat between now through 2029. This market saturation is factored in by

79 Antonio, Marites, Haile Bucaneg, Joji Castillo, Cheng Moua, Armando Ramirez, Elizabeth Shirakh, Michelle Vater. 2016. Proposition 39: California Clean Energy Jobs Act, K-12 Program and Energy Conservation Assistance Act 2015-2016 Progress Report. California Energy Commission, Efficiency Division. Publication Number: CEC-400-2017-001-CMF.

reducing program funding from 2019 onward. Additional scenarios can be run to account for changes in funding levels as more market data becomes available. Also, projects will continue to report energy savings to the Energy Commission so future updates of Proposition 39 savings will have more complete information.

Analysis

The energy savings that result from Proposition 39 upgrades are at risk of minimal double counting. Since the program has been in effect before and including the baseline forecast year, a small percentage of energy savings is likely captured by it. However, data on completed projects suggest only a small percentage of energy savings would contribute to demand reduction in the baseline demand forecast.[80] Moreover, overlap with ratepayer-funded programs occurs, because LEAs use a utility rebate to reduce costs of energy efficiency measures. This problem is more significant with the community colleges but those projects make up less of the overall funding and energy savings. Any energy savings captured through utility rebates should be tracked separately to prevent double counting. Incremental savings counted toward the goal of SB 350 must then be greater than any savings incorporated in the baseline or captured through utility programs.

Staff's assumption that Proposition 39 funding will continue through 2029 may not be realistic. A potentially more conservative approach would be to scale savings estimates to account for the uncertainty associated with program longevity. Recently passed legislation extends the life of Proposition 39 but it does not guarantee the same level of funding that the programs has received since its implementation.[81]

Results

Table 14: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Proposition 39

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	156	311	467	622	731	808	861	898	924	943	956	965	971	975	978
NG (MM therms)	1.4	2.7	4.1	5.4	6.4	7.0	7.5	7.8	8.0	8.2	8.3	8.4	8.4	8.5	8.5

Source: California Energy Commission staff.

80 "Proposition 39 Publicly Searchable Database," California Energy Commission, accessed June 12, 2017, http://prop39publicsearch.energy.ca.gov/

81 Public Resources Code § 26205.5(a).

Energy Conservation Assistance Act Loans

The Energy Conservation Assistance Act (ECAA) loans, as discussed earlier, are financed through the repayment of previous loans and with new influxes of funds from the State Legislature. Public facilities receive the funds for the upgrades which includes schools, cities, counties, special districts, public care facilities and hospitals. Education facilities, except universities, qualify for a zero percent interest loan, whereas cities, counties, and colleges and universities qualify for a 1 percent interest loan.[82] The loan is often used to upgrade the building envelope, electrical systems, HVAC, and/or lighting.[83]

Methods

Staff used data from the ECAA web page and database which included information on the measures applied during a project, the estimated energy savings, the estimated useful life, the cost of the project, and summaries of the project.[84] Using the available data, a top-down approach was used to find initial savings. This was done from project-level results, using savings captured per year to document trends in the savings that can be projected through 2029. However, the savings per year fluctuate wildly, due in part to the sporadic influxes of money from the Legislature.

More refined estimates of energy savings are found by using measure-level information. Measures, like HVAC equipment, have a decay value applied to them, which results in the energy efficiency to decrease over the lifetime of the measure. Measure decay and other variables considered like, building stock, stock turnover, and various funding and program penetration scenarios allow more detailed savings to be calculated. Staff will update the estimates given recent legislation allocating $100 million to the 0 percent loan program.

Analysis

ECAA energy efficiency projects must be demonstrated to be technically and economically feasible through the application process to ensure the long-term sustainability of the program. Simple payback and Estimated Useful Life (EUL) are the cost-effectiveness metrics applied by ECAA: 0 percent interest loans must meet a 20 year simple payback; 1 percent interest loans must meet a 17 year simple payback.[85] Projects meet the reliability definition by the fact they reduce GHGs and other harmful emissions improving public health and safety.

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82 "Energy Efficiency Financing," California Energy Commission, accessed June 12, 2017, http://www.energy.ca.gov/efficiency/financing/#application

83 *Ibid.*

84"ECAA Loan Pay-Back Project, Energy Savings Data," Excel Workbook, California Energy Commission, 2016.

85 "PON-13-401 Interest Rate 1% Loans Financing For Energy Efficiency & Energy Generation Projects," California Energy Commission," California Energy Commission, May 2016, accessed June 12, 2017, http://www.energy.ca.gov/contracts/PON-13-401/

ECAA loans are probably the program at greatest risk of double counting because the program has a long history, including the calibration year of the demand forecast. As ECAA loans continue to result in energy savings, they must do so above historical levels for it to be incremental and show up in the results. Energy savings also likely overlap with those claimed by ratepayer-funded programs. If a recipient of the loan also uses utility rebates to lower the cost of implementation, then there may be double counting. Staff has assumed that 10 percent of the energy savings potential from this program can be attributed to utility rebates, while the remaining 90 percent counts towards the program. Energy savings that count towards the goal of SB 350 must be greater than either of these two areas of overlap.

Results

No incremental savings could be estimated at this time. All energy savings are captured by the baseline demand forecast. Staff will update estimates in the draft commission report using new information from the recently passed SB 110 (2017).[86]

86 Public Resources Code § 26205.5(a)

Energy Savings Program

The Energy Savings Program operated by DGS, uses energy service companies (ESCOs) to implement energy upgrades in state buildings. Projects are funded by loans taken out by the state agency and paid back through the customers' energy savings. The common types of measures funded by the loan include lighting, HVAC, and retrocommissioning.

Methods

Staff used data from DGS' current projects, which included estimated energy savings, project costs, types of measures, and summaries of the status of each project. A final report on the sole completed project sheds light on the verification of savings and the way utility rebates are included.[87] Staff also needed to assume that the funding would remain in place to forecast energy savings.

Staff initially calculated the weighted average simple payback for the projects to determine the rate at which funds recycled into new projects. This information was then combined with a calculation of annual GWh or MM therm savings, which provided a baseline estimate of future energy savings. Next, these initial numbers were adjusted by a few assumptions: (a) that 10 percent of savings are attributable to IOUs and POUs; (b) no correction was necessary for market saturation due to the low annual improvement rate; (c) there is little-to-no natural construction turnover in the absence of additional financing. The last point assumes that replacement of outdated measures does not occur unless it is broken or funding is provided. Additional detailed estimates calculated different scenarios that show how energy savings may shift if more funding is available, or if improvements in technology allow more savings to be captured.

Analysis

This program has some risk of double counting energy savings. The projects may use utility incentives to reduce capital cost, which could result in double counting with ratepayer-funded programs. The exact amount is difficult to estimate, because only one project in the program has reached completion. This project used some utility incentives, which represented a small fraction of the total project cost and therefore are unlikely to represent a significant portion of the energy savings.

87 Enovity,"Final IGA Report-San Diego State Office Building", Prepared for the Department of General Services, March 2015.

Results

Table 15: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for the Energy Savings Program

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	5	10	15	17	19	20	22	24	26	28	29	31	33	35	37
NG (MM therms)	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5

Source: California Energy Commission staff.

Air Quality Management District Programs

California AQMDs and APCDs may require, or encourage Lead Agencies under the California Environmental Quality Act (CEQA) to mitigate environmental impacts of air pollution from building projects. A potential mitigation approach is to use energy efficiency measures, such as HVAC retrofits, retrocommissioning, envelope upgrades, and other whole building measures on existing buildings.[88]

Methods

Staff estimated energy savings from hypothetical, future use of energy efficiency as a CEQA mitigation strategy. The estimate is limited by the lack of verified or estimated energy savings data captured by mitigation efforts required by AQMDs. Staff's initial, rough approach to estimating energy savings assumed that mitigation efforts would result in an additional 0.5 percent electricity and natural gas savings projected for the *Building Energy Efficiency Standards* from 2016 through 2028. A more refined estimate assumed that through the CEQA process, building developers pay mitigation fees that are used to fund energy efficiency activities. Assuming a specific budget from average mitigation dollars paid to districts and the types of measures discussed in voluntary guidance by CAPCOA, energy savings are calculated in a similar fashion as the LIWP. This will be included in the upcoming draft Commission report.

Analysis

Note that there is a strong possibility for overlap of such energy efficiency under CEQA mitigation with utilities' energy savings claims, but no expected overlap with the baseline forecast. Energy efficiency projects as CEQA mitigation could also use utility incentives to reduce the capital cost of mitigation efforts. Current utility potential savings projections do not include districts as energy savings sources that are expected to occur. To date, there is no information on an energy efficiency program like this, so no energy savings are expected to be captured in the baseline forecast.

Results

Table 16: Electricity (GWh) and Natural Gas (MM therms) Savings Projected From 2015 Through 2029 for Air Quality Management District Programs

Energy Unit	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Elec (GWh)	0	0	2	8	14	22	34	47	61	80	98	118	142	167	194
NG (MM therms)	0.0	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.6	2.0	2.5	3.0	3.7	4.3	5.0

Source: California Energy Commission staff.

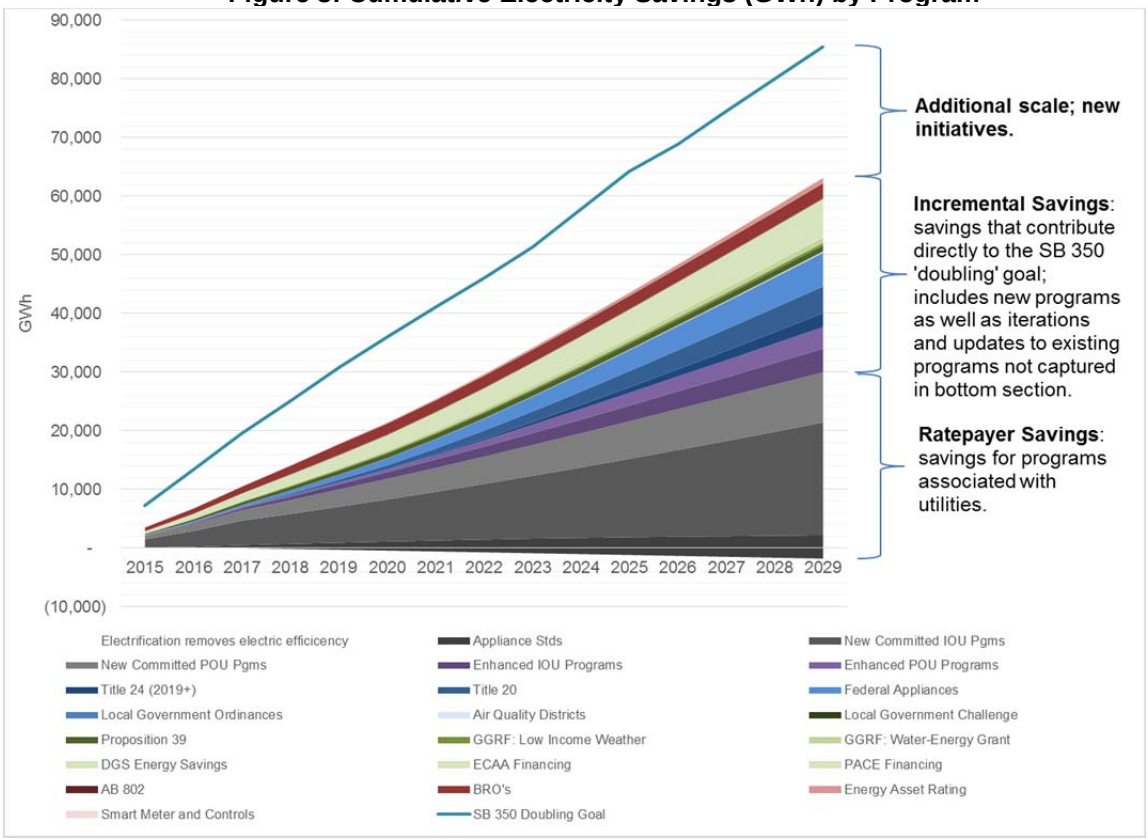
88 "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," California Air Pollution Control Officers Association, August 2010.

Chapter 4: Discussion

Energy Efficiency Savings Results

The electricity and natural gas savings from each program are added up to show the expected progress towards the doubling goal of SB 350 in Figures 3 and 4.[89] This analysis shows that the expected electricity savings will fall short of the goal absent additional market scale and new program initiatives (Figure 3). The programs not funded by utility ratepayers that are estimated to contribute the most electricity savings are PACE, the Federal Appliance Standards, and the Title 20 Appliance Regulations. Results of natural gas savings slightly exceed the goal between 2027 and 2029 and otherwise align well with the goal. The greatest contributors to reducing natural gas are fuel substitution, the Federal Appliance Standards, the *Building Energy Efficiency Standards*, and the Water-Energy Grant (Figure 4).

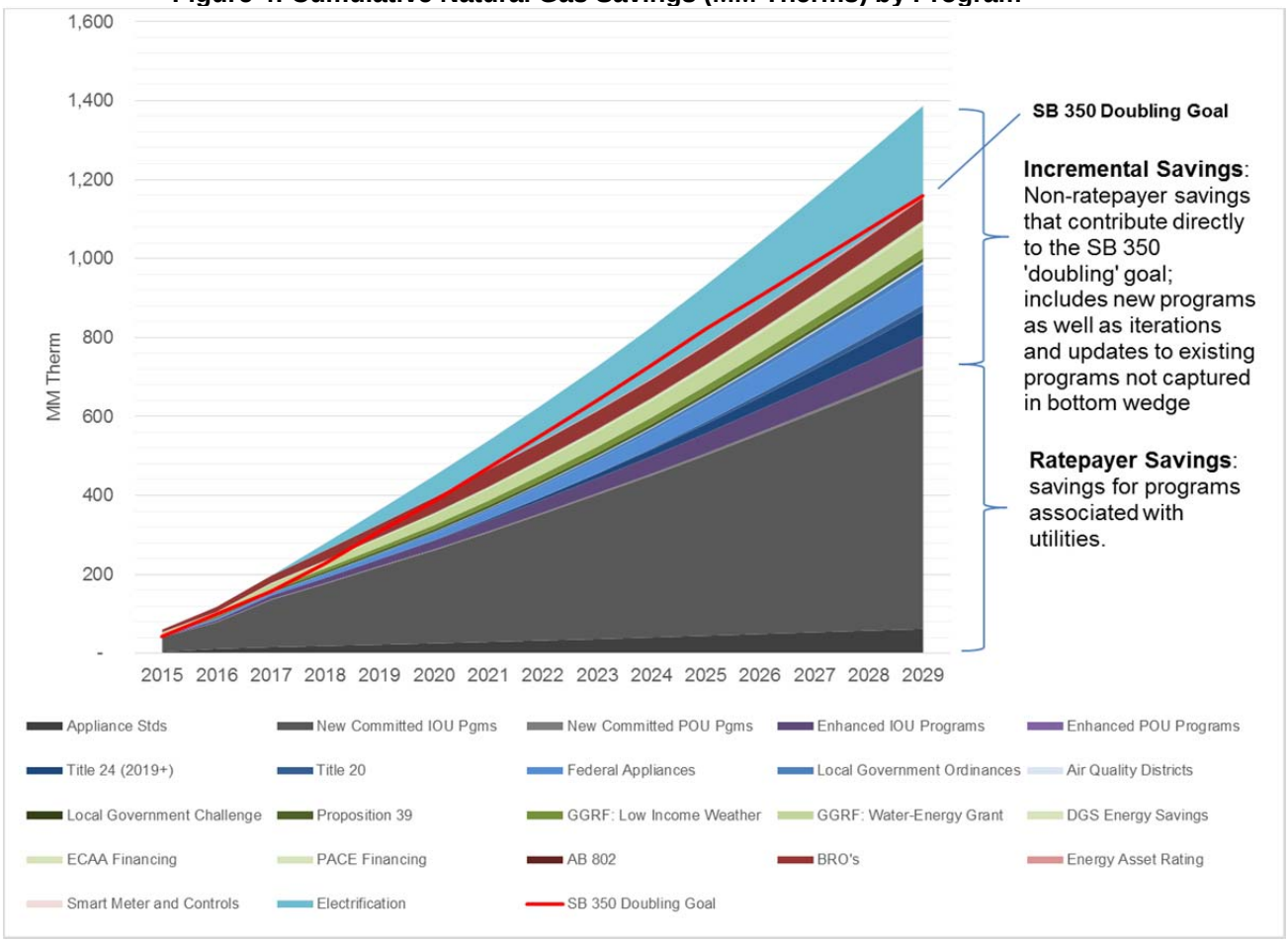
Figure 3: Cumulative Electricity Savings (GWh) by Program



Source: California Energy Commission staff.

89 Note that the lower collection of wedges, label Ratepayer Savings, is explained in detail in the Energy Assessments Division paper with the exception of the Appliance standards wedge.

Figure 4: Cumulative Natural Gas Savings (MM Therms) by Program



Source: California Energy Commission staff.

The program bins that contribute the greatest non-ratepayer sources of electricity and natural gas savings are shown in Figures 5 and 6, respectively.[90] Electricity is reduced the most by codes and standards (Figure 5), and natural gas is reduced the most by fuel substitution initiatives (Figure 6).

The electricity and natural gas savings are combined using a common unit of energy savings, quadrillion BTU (Quad BTU).[91] This permits staff to portray the savings in a common unit for reporting on progress toward meeting the annual goals. Figures 7 and 8 show the combined energy savings projections through 2029 as stacked programs and

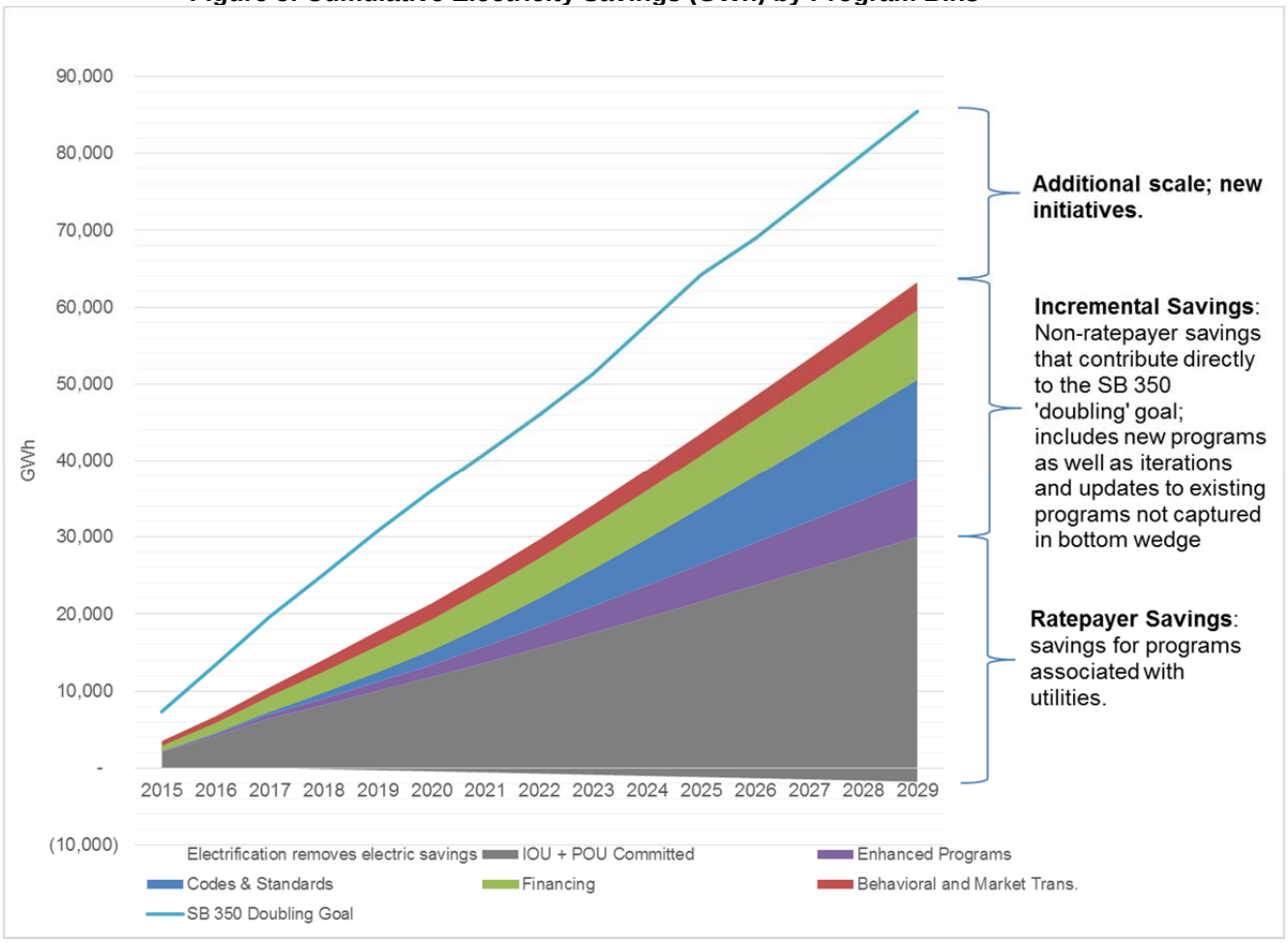
90 Note that the lower bin, label Ratepayer Savings, is explained in detail in the Energy Assessments Divisions paper.

91 Public Resources Code § 25310(c)(2).

program bins, respectively.[92] The combined energy savings show that at the time of this forecast, based on this study the State would be short of its goal to double energy efficiency by January 1, 2030.

Each figure in this section is based upon potential energy savings estimated from the 2015 Potentials and Goals Study,[93] and the 2013 POU potentials report. Therefore, once the new 2017 IOU energy efficiency potential targets and 2017 POU targets are incorporated, these wedges may shrink or grow.

Figure 5: Cumulative Electricity Savings (GWh) by Program Bins

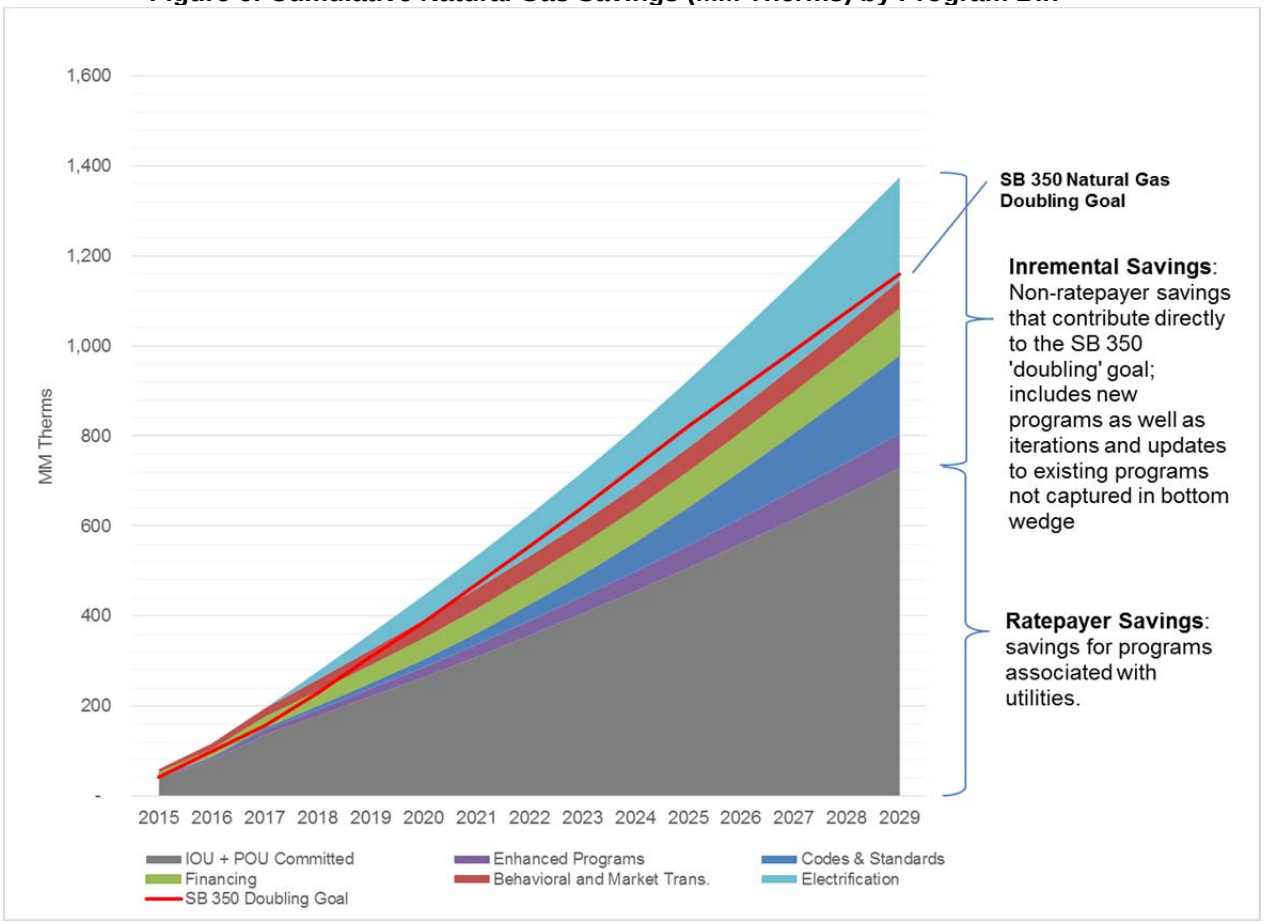


Source: California Energy Commission staff.

92 Note that the lower collection of wedges, label Ratepayer Savings, is explained in detail in the Energy Assessments Divisions paper.

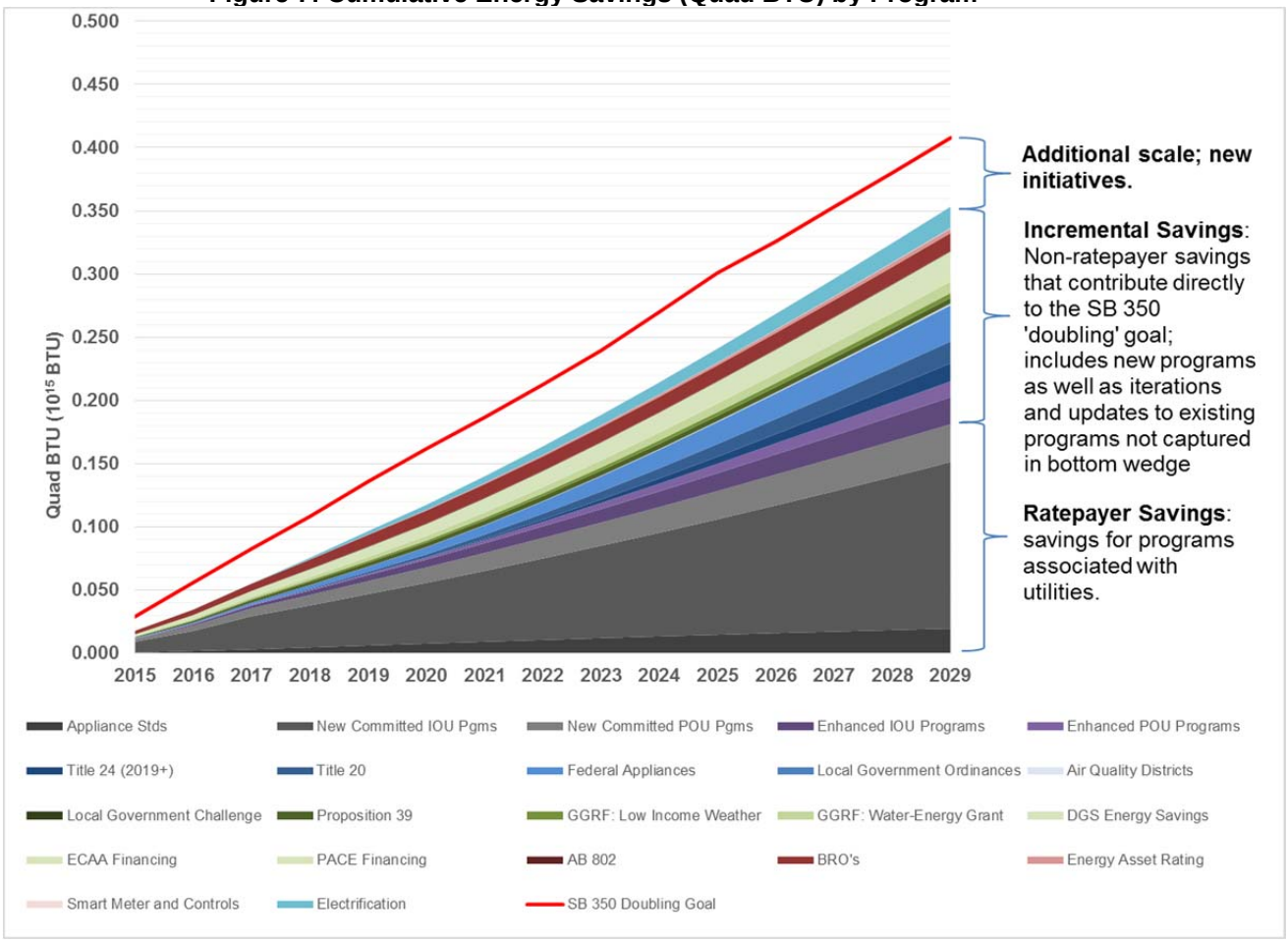
93 Navigant. *Energy Efficiency Potential and Goals Study for 2015 and Beyond.* 2015.

Figure 6: Cumulative Natural Gas Savings (MM Therms) by Program Bin



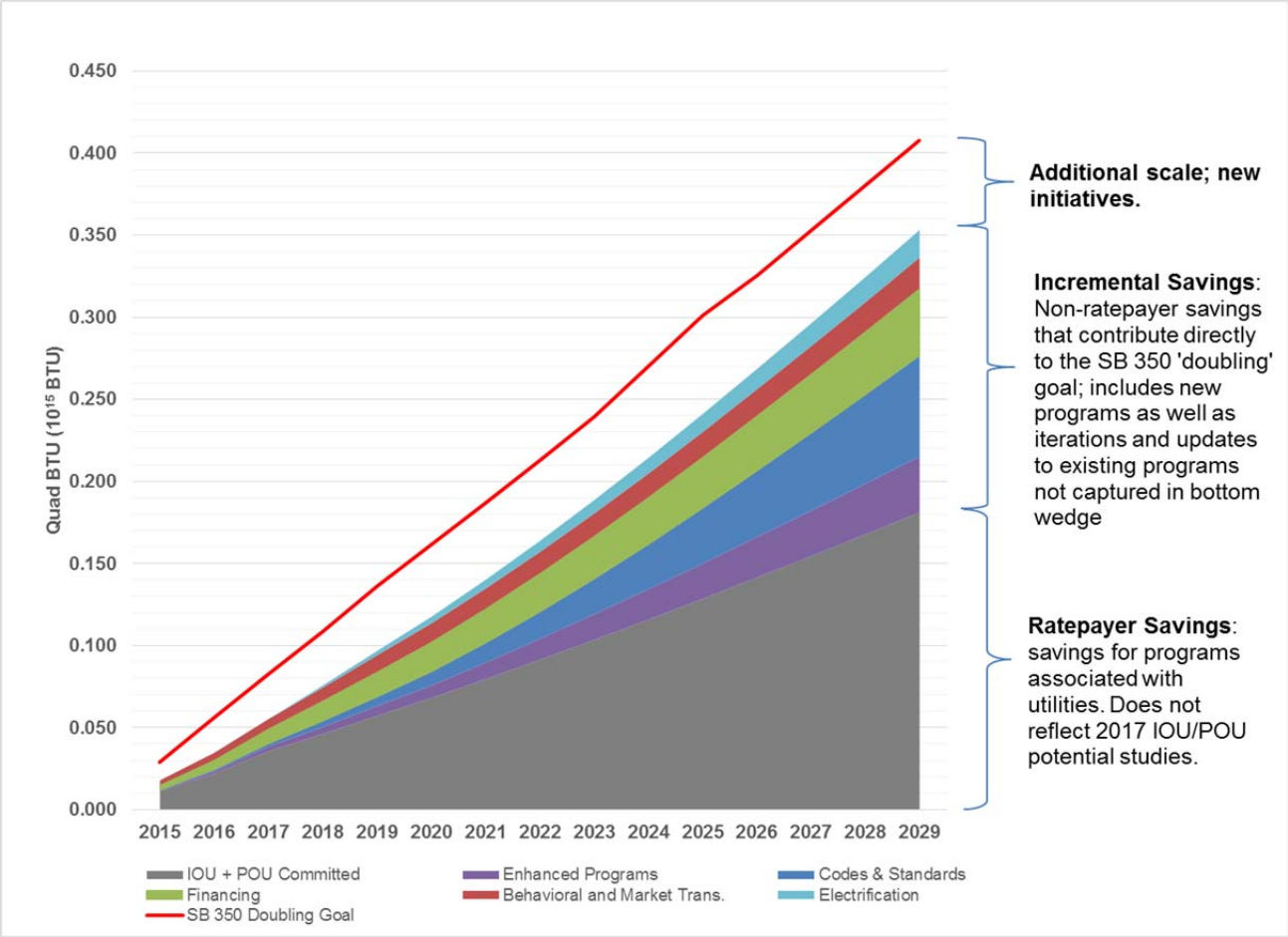
Source: California Energy Commission staff.

Figure 7: Cumulative Energy Savings (Quad BTU) by Program



Source: California Energy Commission staff.

Figure 8: Cumulative Energy Savings (Quad BTU) by Program Bin



Source: California Energy Commission staff.

Energy Efficiency Savings Challenges

Energy Savings Estimates

Each program's energy savings are based on certain assumptions that may result in overestimation or underestimation. The programs with the least amount of detail will naturally lend themselves to having the most uncertain energy savings projections. These programs generally fall within the behavioral and market transformation bin. For example, BROs savings programs are relatively new and untested; therefore, the energy savings associated with them are best guesses at the effect and penetration of the various measures. Similarly, PACE, while not a new program, has very limited published data regarding energy savings. This results in a model heavy approach using the types of measures that a home or building might implement or relying heavily on energy savings from a few reported projects. Both PACE and BROs contribute greatly to the projected energy efficiency savings, therefore, it will be necessary going forward to refine those results and, in the case of PACE, obtain access to more data.

Continued Funding for Financing Programs

The various financing programs have similar uncertainty regarding the continuation of funding. Programs like the LIWP, Water Energy Grant, Proposition 39, and so forth, are assumed to receive the same level of funding through 2029 as they do now. Should these programs receive more funding in the future, it is reasonable to expect an increase in the energy efficiency they capture. However, if the funding for these programs lessens or is removed completely, then the annual SB 350 targets will become more difficult to reach or will require new programs to be introduced to make up the gaps.

Code Compliance Assumptions

Staff has also made assumptions about the compliance levels of codes and standards. The energy savings estimated for the standards, appliance regulations (both state and federal), and *CalGreen* assume 100 percent compliance. Staff recognizes that the actual compliance levels may be much lower but the intent is present all possible energy savings. For example, Navigant's Potential and Goals Study forecasts 83 percent compliance.[94] Staff may update assumptions about compliance based on additional data and stakeholder input.

Enhanced IOU and POU Savings

As discussed in the methods of the various programs, staff attributes about 10 percent of the projected energy savings to IOU and POU overlap. This overlap is shown as enhanced IOU and POU wedges on the various figures. The enhanced programs are supposed to account for the high probability of energy savings overlap between the program and a ratepayer-funded equivalent or a program, for example, which may allow the use of both a utility incentive and a state-funded grant. These enhanced IOU/POU program savings may already be covered by energy efficiency potential studies, and therefore, be in the lower wedge, or be reflected by increased participation in a utility program, which was not accounted for in those studies. In future discussions with CPUC and other stakeholders, staff will determine if they should be left in as incremental wedges or removed.

Staff Recommendations to Achieve Doubling Goal

The projected energy efficiency savings for incremental programs fall short of the annual targets set by SB 350. To reach those annual targets and the doubling of energy efficiency by January 1, 2030 staff recommend the following:

1. Maintain funding for current programs.

   The energy efficiency projections for many of the programs assume that the funding remains the same through 2029. As discussed above, this means any loss of funding will increase the energy savings gap that exists. Therefore, it is necessary that the Energy Commission first work to maintain the current levels of funding through outreach and coordination with other state agencies and stakeholders.

94 Navigant. *Energy Efficiency Potential and Goals Study for 2018 and Beyond.* June 2017.

2. Extend the life of programs expected to end.

Several programs including the Water Energy Grant, LIWP, and Proposition 39 have unclear funding situations going forward. The Water Energy Grant and LIWP receive funding from the GGRF, however, this is not guaranteed and must be designated for funds by the Governor's budget. Staff recommends these programs be guaranteed funding levels each year to help reach the goals of SB 350. Proposition 39 is expected to accept final applications during the 2017-2018 fiscal year and close out projects by 2021. Staff assumes that this program will continue through 2029, so finding a replacement program or extending the current life of Proposition 39 is necessary to achieve the projected energy savings. SB 110 (2017) continues the life of Proposition 39 but it does not guarantee an annual funding level comparable to that between 2013-2017.[95]

3. Increase funding for ECAA

This Energy Commission-run program currently has no incremental energy savings to count toward the doubling goal. While the program has historically relied on loan paybacks and irregular influxes of funds from the Legislature, staff proposes a steady increase in the money available to distribute for ECAA loans. Each year the amount of money available is used up, which means any applicant who is not provided with a loan, will likely wait to perform any energy upgrades. SB 110 (2017) provides ECAA-Ed with $100 which will greatly increase the potential energy savings of the program.

4. Conduct research and estimate energy savings for the agricultural sector

Staff will estimate the contribution to the SB 350 doubling goal from agricultural programs not funded through utility ratepayers in the draft Commission report. Staff recommends in the future collaborating with agricultural stakeholders to better understand areas of energy savings. This may also include suggestions for programs to be facilitated by the Energy Commission.

5. Conduct research and estimate energy savings for the industrial sector

Staff will estimate the contribution to the SB 350 doubling goal from industrial programs not funded by utility ratepayers in the draft Commission report. Staff recommends collaborating with industry stakeholders to better understand opportunities for energy savings. This may also include suggestions for programs to be facilitated by the Energy Commission.

6. Collect additional energy savings data from non-utility programs

Staff recommends that additional energy savings data be made available from non-utility programs. This is particularly important for PACE because a significant portion of

95 Public Resources Code § 26205.5(a).

estimated energy savings come from this program, however, there is little data available. Staff strongly recommends easier access to energy savings data from other agencies, state, regional, or local. This will result in more confident estimates of energy savings and facilitate easier adjustments to estimates in future updates. Staff recommends this be done in Phase 2 of the Energy Commission's Title 20 data collection regulations update.[96]

7. Increase funding for workforce training

To maximize the full potential of energy efficiency equipment and appliances, they must be installed correctly. In line with both the recommendations of the Low Income Barriers Report[97] and the *EBEE Action Plan*,[98] staff suggests expanding the workforce training available to improve the quality of energy efficiency equipment installation. This can be done most effectively through continued coordination with relevant stakeholders.

8. Increase funding for outreach and education to improve code compliance

Staff assumes that there is 100 percent compliance with the standards and appliance regulations to show the full potential impact. For this assumption to be realized there needs to be increased compliance across the State. This can be done through additional outreach and education by the Energy Commission at local level, especially local building permit offices.

9. Work with other state agencies to create new energy efficiency programs

The energy savings gap may not be filled just by increasing funding for current programs or by additions from the agricultural and industrial sector. Staff suggests that new energy efficiency programs be developed and adopted that would capture additional savings through collaboration between the Energy Commission and other state agencies.

Next Steps

Staff suggests that the first step upon completion of this paper is for it to be combined with the companion paper prepared by the energy assessments division. Following this, staff

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96 Docket #17-AAER-05 found at: http://www.energy.ca.gov/appliances/2017-AAER-05/

97 Scavo, Jordan, Suzanne Korosec, Esteban Guerrero, Bill Pennington, and Pamela Doughman. 2016. *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-income customers and Small Business Contracting Opportunities in Disadvantaged Communities*. California Energy Commission. Publication Number: CEC-300-2016-009-CMF.

98 California Energy Commission, *Existing Buildings Energy Efficiency Action Plan*, California Energy Commission, Sacramento, California, 2015, Page i, Publication Number: CEC-400-2016-023SD, Available at: http://www.energy.ca.gov/ab758/

recommends the Energy Commission adopt the energy efficiency savings targets for utility sources and non-utility sources. Staff will begin to address the potential for agricultural and industrial energy efficiency savings in the upcoming draft Commission report. These two sectors represent together a significant portion of the States' energy consumption and need to be considered to have a complete understanding of the savings gap moving forward. Unless the Energy Commission objects, staff plans to carry out further research as recommended for specific programs and for improving energy efficiency savings realizations in the staff paper.

Chapter 5: Conclusion

SB 350 requires the Energy Commission to establish annual targets that will achieve a cumulative to doubling of the statewide energy efficiency savings in electricity and natural gas final end uses of retail customers by January 1, 2030. These targets are constrained by considerations of cost effectiveness, feasibility, and not adversely impacting public health and safety. Staff identified programs not funded by ratepayers that can contribute to SB 350's objective of cumulatively doubling energy efficiency savings, they are: *Building Energy Efficiency Standards* (Title 24 Part 6); Future Reach Codes (Title 24 Part 11); Future California Appliance Regulations (Title 20); Future Federal Appliance Regulations; Low-Income Weatherization Program; Water-Energy Grant; Local Government Challenge; PACE; Proposition 39; Energy Savings Program; Benchmarking; Energy asset rating; Behavioral, retrocommissioning, and operational programs; Fuel substitution; Air quality management districts' programs; smart meters and controls.

The projected energy savings from each program were calculated through a mixture of energy modeling and refined top-down approaches. The programs with the greatest estimated potential impact in terms of reducing energy are PACE, various codes and standards, and fuel substitution for electricity and natural gas. Staff acknowledges that there is considerable uncertainty with the estimated energy savings for several programs, due to a lack of available data and time to collect additional information. To address these uncertainties and to close the savings gap that exists, staff has made a number of recommendations. These include:

- To extend the life of programs expected to end.
- To expand the funding and therefore savings potential of programs that overlap with the baseline significantly, like the Energy Conservation Assistance Act loans.
- To maintain the funding for all other existing programs.
- To pursue agricultural and industrial energy savings potential and work with stakeholders from the agricultural and industrial sectors to understand the potential for and costs of improvements.
- To collect additional energy savings data from non-utility programs.
- To increase funding for workforce training to improve energy efficiency measure installation.
- To increase funding for outreach and education of building energy efficiency standards and appliance efficiency regulations to improve compliance.
- To work with other state agencies to create new energy efficiency programs.

Staff's immediate focus for the draft Commission report will be to research agricultural and industrial energy efficiency savings. Efficiency Division's paper will be combined with Energy Assessments Division's paper on energy savings from ratepayer-funded programs into a draft commission report in fall 2017. Energy savings targets will be updated every two years as part of the IEPR process. With these updates, Energy Commission staff expects to report progress towards achieving the doubling goal and to present new programmatic recommendations.