DOCKETED

Docket Number:	15-AAER-01
Project Title:	Appliance Efficiency Rulemaking for Toliets, Urinals, Faucets, HVAC Air Filters, Fluorescent Dimming Ballasts, and Heat Pump Water Chilling Packages
TN #:	203667
Document Title:	Revised Standardized Regulatory Impact Assessment of 2014 Proposed Appliance fficiency Regulations
Description:	Regulations for Toilets, Urinals, Faucets, Dimming Ballasts, Air Filters, and Heat-Pump Water-Chilling Packages
Filer:	Patty Paul
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	2/13/2015 2:02:35 PM
Docketed Date:	2/13/2015

California Energy Commission

STAFF REPORT

REVISED STANDARDIZED REGULATORY IMPACT ASSESSMENT OF 2014 PROPOSED APPLIANCE EFFICIENCY REGULATIONS

Regulations for Toilets, Urinals, Faucets, Dimming Ballasts, Air Filters, and Heat-Pump Water-Chilling Packages

Docket number: 15-AAER-1

CALIFORNIA
ENERGY COMMISSION

Edmund G. Brown Jr., Governor

FEBRAUARY 2015

CEC-400-2015-006

CALIFORNIA ENERGY COMMISSION

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PREFACE

On March 14, 2012, the California Energy Commission issued an Order Instituting Rulemaking (OIR) to begin considering standards, test procedures, labeling requirements, and other efficiency measures to amend the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through Section 1608). In this OIR, the Energy Commission identified a variety of appliances with the potential to save energy and/or water. The goal of this pre-rulemaking was to develop the proposed appliance efficiency standards and measures to realize these energy savings opportunities.

On March 25, 2013, the Energy Commission released an "Invitation to Participate" to provide interested parties the opportunity to inform the Energy Commission about the product, market, and industry characteristics of the appliances identified in the OIR. Energy Commission staff reviewed the information and data received in the docket and hosted staff workshops on May 28 through 31, 2013, to vet this information publicly.

On June 13, 2013, Energy Commission staff released an "Invitation to Submit Proposals" to seek submissions for standards, test procedures, labeling requirements, and other measures to improve the efficiency and reduce the energy or water consumption of the appliances identified in the OIR.

Energy Commission staff reviewed all information received to determine which appliances were strong candidates for the development of efficiency standards and measures. Based on the analysis of the information received from stakeholders through webinars and workshops, the Energy Commission staff prepared this standardized regulatory impact assessment for toilets, urinals, faucets, dimming ballasts, air filters, and heat-pump, water-chilling packages.

Energy Commission staff finds that the proposed standards for toilets, urinals, faucets, dimming ballasts, air-filters, and heat-pump, water-chilling packages are technically feasible and cost-effective and would not result in any added total cost to consumers. Therefore, the standards meet the requirements of Public Resources Code Section 25402(c) (1) by reducing wasteful, uneconomic, inefficient, and unnecessary consumption of energy and water.

ABSTRACT

This standardized regulatory impact assessment (SRIA) analyzes the 2014 proposed and alternative appliance efficiency regulations for toilets, urinals, faucets, dimming ballasts, air filters, and heat-pump, water-chilling packages.

The proposed standards are designed such that appliances sold in California will use less energy or water and consumers benefit from the purchase of more efficient appliances. The standards also strive to minimize any negative effect to efficacy of the appliances. The proposed standards will reduce electricity, natural gas and water consumption. Reduced consumption results in conservation of electricity, natural gas and water makes them available for other purposes. Regulations will transform the market towards more cost-effective and energy-efficient appliances.

The proposed standards will provide water savings of about 460 billion gallons and monetary savings of $1.56 billion to California consumers over a 10-year period from the effective date of the regulations. The proposed regulations will reduce electricity consumption by about 10,993 gigawatt-hours (GWh between 2016 and 2025,) and provide consumer savings of $877 million over that period. Natural gas savings are estimated to be 1,410 million therms[1] and would save consumers $1.29 billion. Combined utility bill savings from the proposed regulations will be about $3.7 billion between 2016 and 2025.

Energy Commission staff used a macroeconomic model to estimate the effects of proposed and alternative regulations within the California economy. Estimated job years will increase by 279 in 2016 and 621 by the year 2025. Total job years over the decade are projected to increase by 5,668 under the proposed standards. In addition to the utility bill savings described above, the proposed standards are estimated to increase personal income by $9 million in 2016 and $56 million in 2025 as a result of employment impacts. The combined increase in personal income with the proposed standards is projected to be $375 million, which is beneficial for the California economy. The proposed regulations are estimated to avoid 263,000 tons of carbon dioxide (CO_2) in 2016, and 2.3 million tons in 2025.

Keywords: Appliance Efficiency Regulations, energy efficiency, toilets, urinals, faucets, dimming ballasts, air filters, and pump water chilling packages

Rider, Ken, Pierre duVair, Tuan Ngo, Harinder Singh, Jared Babula, Michael Murza. 2014. *Standardized Regulatory Impact Assessment of 2014 Proposed Appliance Efficiency Regulations*. California Energy Commission. CEC-400-2014-XXX.

[1] "Therm" is 100,000 British thermal units.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report was prepared to comply with the new rulemaking requirements for major regulations contained within Senate Bill 617[2] (Calderon/Pavley, Chapter 496, Statutes of 2011) and the standardized regulatory impact assessment (SRIA) described in the California Department of Finance (DOF) regulations. This assessment considers the economic impact of adopting regulations for six appliances: toilets, urinals, faucets, dimming ballasts, air filters, and heat-pump, and water chilling packages. For toilets, urinals, faucets, and dimming ballasts, new or more stringent levels of operating efficiency are being considered. For air filters and heat-pump, water chilling packages, requirements for testing, labeling, and certification are being proposed.

These regulations are the result of a public request for proposals to improve the efficiency of appliances sold in California in a cost-effective manner. A public workshop was held August 31, 2011, and comments were collected by September 30, 2011. The comments identified the appliances in the proposed regulations as cost-effective candidates for new regulations, and a subsequent order instituting rulemaking (OIR) was issued on March 14, 2012, directing rulemaking activity.

Energy Commission staff initiated a pre-rulemaking process, which includes extensive stakeholder outreach. On March 25, 2013, the Energy Commission released an invitation to participate to more than 1,000 identified potential stakeholders. The invitation encouraged stakeholder participation and included initial requests for detailed data regarding the appliances included in the proceeding. On June 13, 2013, the Energy Commission followed this activity with a request for proposals from any interested party that would outline ways for the Energy Commission to attain identified potential efficiency gains. Energy Commission staff provided a template that specifically requested information within proposals necessary to address the requirements of SB 617, and prepare a comprehensive SRIA.

Energy Commission staff used these proposals, data, and its own research to draft proposed regulations to further solicit feedback before entering the formal rulemaking stage of the proceeding. The Energy Commission issued two staff reports, one that addresses potential regulations for toilets, urinals, and faucets, and one that addresses dimming ballasts, air filters, and heat-pump water chilling packages. Commission staff held a public workshop to discuss the proposals, and written comments were encouraged and received.

Although solicited and encouraged, the Energy Commission received little specific economic impact information from manufacturers. Energy Commission staff therefore used its own research and professional judgment in conjunction with the written comments received from manufacturers, utilities, and other stakeholders to make reasonable assessments of the economic impacts necessary to complete this SRIA. In addition to impacts of the proposed

[2] Available at http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0601-0650/sb_617_cfa_20110912_111405_sen_comm.html.

regulations, the staff analyzed two alternatives: a regulations package with more stringent energy and water efficiency standards, and a regulations package with less stringent standards.

Information provided in Table ES-1 summarizes estimated economic impacts over the period 2016-2025 following implementation of the appliance efficiency regulations.

Table ES-1

Estimated Economic Impacts of Proposed and Alternative Standards

Type of Standards	Cumulative Water Savings (billion gallons)	Cumulative Electricity Savings (GWh)**	Cumulative Natural Gas Savings (mmTherms)	Savings To Consumers (billion dollars)	Jobs Impacts (job-yrs)	Jobs-Income Impacts (million dollars)	Gross State Product Impacts (million dollars) *
Proposed	460	10,993	1,410	$3.73	5,668	$375	-$912
Higher	651	15,668	1,969	$5.13	13,171	$240	-$772
Lower	451	10,897	1,410	$3.64	6,924	$387	-$783

Source: Energy Commission Staff

All monetary figures presented in $2014 net present values using a 3 percent annual discount rate.

* This modeled reduction in gross state product is the result of lower annual production and sales within the utilities sector (water, electricity, and natural gas) of the California economy. The REMI model does not take into account that conserved water will be used in other economically productive activities within California. A conservative approach was taken to reallocate water savings to farm output.

** The cumulative electricity savings include both the direct electricity savings and embedded energy savings from reduced water consumption.

CHAPTER 1:
Scenarios Analyzed

California Energy Commission staff analyzed three scenarios relative to a baseline without any new appliance efficiency regulations. For some of the appliances covered within this proposal, more or less stringent levels were proposed by stakeholders. In those cases, Energy Commission staff used the stakeholder suggestions as the alternative. In other cases, the staff chose a level that was significantly more or less stringent. For toilets and urinals, a level less stringent could not be reasonably chosen as it would conflict with statute, specifically Assembly Bill 715 [3](Laird, Chapter 499, Statutes of 2007). Products without an alternative remained at the "proposed levels" of efficiency in the more stringent and less stringent scenarios.

Table 1: Alternative Scenarios Analyzed

Appliance	Proposed Levels	More Stringent Levels	Less Stringent Levels
Toilets	1.28 gpf*	1.06 gpf	1.28 gpf
Urinals	0.125 gpf*	0.125 gpf	0.5 gpf
Faucets	1.5 gpm*	1.0 gpm	1.5 gpm
Dimming Ballasts	1 watt standby	0.5 watt standby	2.5 watt standby
Air Filters	Label	Label	Label
Heat-Pump, Water-Chilling Packages	Test and List	Test and List	Test and List

Source: Energy Commission Staff
Gpf is short for gallons per flush. Gpm is short for gallons per minute.

Baseline

The baseline that each level is compared to is a business-as-usual scenario modified to account for regulations and laws in place that would affect sales or consumption of a product.[4] These were developed, and provided for public comment through the pre-rulemaking process, and detailed in the staff report for toilets, urinals, and faucets[5] and the staff report for dimming

[3]Available at: http://www.water.ca.gov/urbanwatermanagement/docs/ab_715-Laird_chaptered.pdf
[4] For example Title 24 building code has changed such that dimming ballasts are far more encouraged.
[5] Specifically see Appendix B. Available at http://www.energy.ca.gov/2014publications/CEC-400-2014-007/CEC-400-2014-007-SD.pdf

ballasts, air filters, and heat-pump water-chilling packages.[6] The same baseline is used for each alternative. For modeling the California economic baseline REMI PI+ 1.6.7 statewide model was used.

The toilets, urinals, and faucets baseline included the effects of regulations that are currently in effect. Current appliance efficiency standards for faucets is 2.2 gallons per minute (gpm), for toilets is 1.6 gallons per flush (gpf), and for urinals is 1.0 gpf. All three levels considered in Table 1 include a standard for each product that exceeds current minimums. The impact of the regulations for toilets, urinals, and faucets were evaluated relative to the existing stock and not solely the incremental improvement caused by the regulation. The purpose of this approach was to evaluate the level of impact relative to the levels of water and energy consumption today and does not parse credit between the levels evaluated and previous standards that have been implemented. The baseline does include the market transformation of current existing statutes and efficiency standards, however because toilets, urinals, and faucets have such a long product lifetime, many units have yet to be replaced. The savings were evaluated not as a percentage improvement, but by modeling stock with changing efficiency over time as regulations cause more efficient products to replace less efficient products.

The baseline for dimming ballasts was determined in a slightly different fashion. The electricity savings from the levels considered were derived purely from the incremental energy savings as compared to products available in the market today, with each model receiving equal market weight. The efficiency of the existing stock of ballasts was assumed to be as efficient as the current baseline of ballasts available for sale today. This will lead to a conservatively low estimate of energy savings because some of the existing ballast stock is likely less efficient. Most of the unit sales of dimming ballasts in the future are likely result of new construction codes that require their use.

Each product's baseline is composed of statewide stock, sales, and current performance. These are adjusted each year by an estimated cumulative annual growth rate based on stakeholder input, assumed population growth, and other factors. The proposed regulations and other levels evaluated were assumed to have no effect on these other parameters, such as product lifetime, with the primary difference being in energy and water consumption. The characteristics were established using existing studies, stakeholder comment, and staff research. The stock, sale, and expected lifetime for products with increased efficiency are available in the rulemaking staff reports. The baseline performance in some products is assumed to improve over time because of requirements that require manufacturers to improve performance. Because analysis is focused on incremental differences, the incremental cost of the baseline product is considered to be $0, and costs associated with an improved product consist solely of the incremental costs relative to baseline products. Utility spending was also evaluated on an incremental basis with baseline products saving zero kilowatt-hours, zero therms of natural gas, and zero gallons of water per year.

[6] Specifically see Appendices B and C. Available at http://www.energy.ca.gov/2014publications/CEC-400-2014-006/CEC-400-2014-006-SD.pdf.

Toilet and Faucet Alternative: Energy Commission staff selected the more stringent toilet levels from the June 6, 2014, IOU comment letter of 1.06 gpf. A less stringent level was not analyzed for toilets, as it would conflict with California statute AB 715 (Laird, 2007). A more stringent standard was considered for faucets at 1.0 gpm. A standard less than 1.5 gpm for faucets was not considered as faucets with higher flow are at efficiency levels consistent with existing regulations.

Urinal Alternatives: Energy Commission staff did not select a more stringent level for analysis as none were proposed by stakeholders. Furthermore, the Energy Commission does not have any information supporting the cost-effectiveness and feasibility of less water-consumptive products and, therefore, cannot show that the more stringent levels are feasible regulatory alternatives. The less stringent alternative was chosen based on the levels proposed in pre-rulemaking and described in *Staff Analysis of Toilets, Urinals, and Faucets*, April 2014.

Dimming Ballast Alternatives: The Energy Commission received several different proposals from stakeholders regarding dimming ballasts. The proposals for active efficiency differed primarily in format and not stringency. However, the proposals did differ significantly in standby mode. Energy Commission staff evaluated the standby mode of 0.5 watts proposed by the California investor-owned utilities (IOUs) as shown in their June 6, 2014 comments as the more stringent alternative. Energy Commission staff evaluated the standby mode power limit of 2.5 watts as proposed by the National Electrical Manufacturers Association (NEMA) in its June 18, 2014 comment as a less stringent alternative.

Air Filter Alternatives: No alternatives were analyzed for the air filter labeling proposal as none were submitted to the Energy Commission. Comments received focused on the information content of the labels. Evaluation of the proposed standard compares the label to a baseline of no-label, which is the only alternative. Staff found that proposed standards would not significantly increase or decrease price or energy savings based on the different labeling approaches and therefore did not analyze the economic impacts of alternative approaches to labeling.

Heat-Pump Water-Chilling Packages: No alternatives were analyzed for heat-pump water-chilling packages. The purpose of the proposal is to provide the minimum amount of information required to streamline compatibility of this equipment with Title 24 building codes. Stakeholders did not propose any alternatives, nor is Energy Commission staff aware of any alternatives, that would better meet the stated purpose standards.

CHAPTER 2:
Changes in California Jobs

Energy Commission staff evaluated the impact on jobs from implementation of proposed and alternate standards between 2016 and 2025. The number of potential jobs created in 2025 is an indicator of the steady state or long-term job change in the California economy from the proposed regulations. The 2016 to 2025 impact to employment over the first 10 years following hypothetical adoption of the proposed regulation is summarized in Table 2 for each scenario analyzed.

Table 2: Regulatory Impacts to Jobs

	Less Stringent	Proposed	More Stringent
Job-years in 2025	842	621	2,037
Total job-years 2016-2025	6,924	5,668	13,171

Source: Energy Commission Staff

Results from the economic modeling show that the more stringent standards case is better in terms of job impact. The proposed standards and the less stringent standards case have similar positive jobs results.

Utility sector jobs are expected to decrease from lower water, natural gas, and electricity retail sales. However, increases in personal disposable income and reduction in commercial operating costs of business more than offset this loss and yield the positive job growth numbers described in Table 2.

In terms of the California economy, the impact on jobs of the proposed and alternative standards is minor. The changes in jobs shown above in Table 2 represent less than one hundredth of one percent change from baseline employment levels.

The small increase in jobs leads to correspondingly small increases in personal income across all three levels of standards analyzed. The proposed standards yield an estimated $375 million increase in disposable personal income between 2016 to 2025. The more stringent standards and the less stringent standards lead to income increases of $240 million and $387 million, respectively.

A description of economic modeling methods, data and assumptions is provided in Appendix B.

CHAPTER 3:
Changes in California Businesses

The proposed regulations will reduce costs to California businesses by lowering monthly utility bills for water, electricity, natural gas due to installation of more efficient appliances. The incremental cost to produce these appliances is small compared to the lifetime water and energy savings gained from their use of the appliances.

Staff estimates commercial businesses will save $12.7 million[7] on water bills in 2016, the first year of standards implementation. By 2025, California commercial businesses could be saving $117 million annually on their water utility bills, using a conservative assumption regarding water price increases over the next decade. In 2016, commercial businesses are estimated to save $2.8 million and $5.4 million, respectively, on electricity and natural gas bills. By 2025. and using conservative estimates of energy price increases, these annual bill savings figures rise to $30.6 million and $50.2 million.

The Regional Economic Models, Inc. Policy Insight + (REMI PI +) model (version 1.6.7) was used to estimate macroeconomic impacts of the proposed and alternative regulations. An important factor to consider with impacts to businesses is the effect regulations will have on prices. REMI model analysis of proposed and alternative regulations show that prices will change very little compared to a baseline with no change in appliance efficiency standards. In 2016, overall prices (Personal Consumption Expenditure index variable) change by less than one hundredth of a percentage point. A result of electricity and natural gas savings is that commercial business costs for these two commodities decrease by a small amount (electricity 0.34 percent and natural gas 1.15 percent) by 2025. Any decrease in retail energy prices will make California businesses more competitive.

The overall impact to California businesses will be positive: reduced water and energy utility bills, and a small reduction in energy prices throughout the economy.

7 All monetary figures presented in this report are net present values in $2014. All net present value calculations use a 3 percent annual discount rate.

CHAPTER 4:
Competitive Advantages and Disadvantages for California Businesses

The proposed regulations have advantages and disadvantages to retailers, manufacturers, and utilities in the state. The regulations would naturally give an advantage to manufacturers of more efficient appliances in California. Water and energy utilities will see a decrease in demand for water, electricity, and natural gas relative to a baseline forecast. Because energy utilities separate revenues from sales, these utilities will see a business advantage to the proposed regulations. Water utilities will not be at an advantage or a disadvantage as the demand for water in California exceeds the supply. The saved water will be redirected to other productive uses. Therefore, the Energy Commission expects that water utilities sales will not change.

The proposed regulations will, by design, give an advantage to manufacturers of more efficient products. The proposed performance standards are not based on any particular patent or technology and therefore give a broad advantage rather than a specific advantage. The distribution of compliant products is spread evenly among manufacturers.

The decrease in energy prices estimated with the macroeconomic model would create a slight competitive advantage for California businesses.

CHAPTER 5:
Changes in State Investment

Energy Commission staff estimates of water savings were combined with estimates of direct energy savings (electricity, natural gas) and indirect electricity savings (embedded energy in water supply) to model the macroeconomic impacts of proposed and alternative appliance efficiency standards to the overall California economy. The impacts were modeled over a 10-year period (2016-2025), although staff anticipates future appliance efficiency regulations will supersede the proposed standards well before 2025. If new standards are proposed in less than 10 years, then resulting economic effects would be less than those analyzed and reported within this SRIA.

The macroeconomic model used was REMI PI+ (Version 1.6.7) for California as a single statewide region. The overall macroeconomic impacts of the proposed and alternative appliance efficiency standards are very small in comparison to the size of California's economy. The staff prepared inputs to the model including reduced sales of water, natural gas, and electricity, as well as expected costs of implementing the new standards. The overall result of conserving water and energy with the proposed set of appliances is a small reduction in gross state product (GSP) and private domestic fixed investment. As noted earlier, the jobs impact is positive due to residential and commercial savings on utility costs being reallocated to other spending categories. In addition, real disposable personal income increases from $9 million in 2016 to $56 million in 2025.

The proposed regulations are estimated to reduce GSP by $10 million in 2016, and $181 million in 2025. This modeled reduction in GSP is the result of lower annual utility sales of water and energy. The REMI model does not take into account that conserved water will be used in other economically productive activities within California. The impact to GSP declined by 40 percent when a conservative approach to reallocating water savings to agricultural output was modeled. In addition, California imports about 90 percent of its natural gas and 30 percent of its electricity. The REMI default single "regional purchase coefficient" for utilities is 82.5 percent (percentage assumed produced in-state), which overstates the GSP and investment impact of regulations that reduce water and energy demand.

Energy Commission staff conducted a sensitivity model run without the commercial sector water demand reduction, as well as no reallocation of conserved water to additional farm output. The macroeconomic results were a fivefold increase in job-years, a positive $1.2 billion increase in GSP, a greater than 80 percent reduction in negative investment demand, and a fourfold increase in real personal disposable income. These results show the relative sensitivity of investment, GSP, jobs, and income using the REMI PI+ model with an exogenous reduction in water demand in California's commercial sector.

With the above caveats in mind regarding model limitations with respect to conservation of water and energy, the paragraph below describes model estimates of expected changes in levels

of domestic investment. The REMI model has a structural approach to how it calculates changes in investment. It involves residual calculations from changes to intermediate demand within capital-intensive industries (e.g., water and energy utilities.) This measure of investment is not the same as commonly held views of financial investment flows.

Staff estimates that demand for gross private domestic fixed investment will decline by $26 million in 2016, and by $446 million in 2025. These levels of reduced capital investment demand are very small compared to the whole California economy and represent a 0.01 percent decline in 2016 and a 0.12 percent decline by 2025. In other words, the proposed regulations reduced demand for domestic private investment by less than two-tenths of 1 percent over the 10-year analysis period. Given the caveats above regarding limitations of the REMI model to account for a wide range of economic benefits of conserved water and energy, staff finds the overall effect of the regulations to investment in California to be very small compared to expected benefits of increased jobs, competitiveness, increased personal income, conservation of water and energy, improved air quality, and reduced greenhouse gas emissions.

CHAPTER 6:
Changes in Incentives for Innovation

The technologies necessary to meet the proposed and alternative standards are widely available. Past investments in research and development have made these technologies available. There are many product models across multiple manufacturers that currently comply with the proposed and alternative standards. The proposed standards will however cause the spread of existing technologies into products that may not currently contain them.

Future innovations in the products proposed to be regulated can be organized into three types: innovations that would decrease water or energy use, innovations that are neutral to water or energy use, and innovations that increase water or energy use. The proposed standards clearly provide incentives for technologies and innovations that can reduce the water and energy use of proposed covered products. The proposed regulations put pressure on manufacturers of existing products to adjust from status quo designs that would have difficulty meeting the performance standards. These changes lead to increased industry investment in technology that forms the core of innovation. This investment also generates expertise and fuels secondary innovation. In the case of heat-pump water-chilling packages, innovation is directly enhanced because the regulations are removing a market barrier for this product. These products do not have well-accepted efficiencies or a way to demonstrate efficiency consistently that can be used by building designers and inspectors. Therefore, implementation of the technology is unnecessarily hindered. The proposed standards would provide a platform to remedy this issue.

In some cases, innovation does not come with any change in water or energy use. For example, the shape of a toilet bowl may be adjusted to better handle waste. Generally, these types of innovations are neither promoted nor hindered by energy and water usage performance

standards. However, in the case of toilets, urinals, and faucets, there may be aspects of lower-water-using products that current consumers perceive to be less than desirable. Many of these aspects form the barrier to natural market adoption and form the basis for why a regulation is necessary to gain additional water savings. In this case, the proposed regulations form an incentive for innovation, as the demand for improved performance in lower water-using products will be increased.

Some innovations incorporate features that might require additional water or energy consumption in regulated products. The regulations mandate to lower water and energy consumption resulting in an upper limit for innovations that would increase the consumption of energy and water in general. The result of the innovation can be positive, neutral, or negative with regard to energy or water consumption. The proposed regulations have a neutral effect on innovations where increase in consumption does not exceed the performance standard. The proposed regulations would have a negative impact when the innovation would cause the consumption to exceed the performance standard resulting in manufacturers modifying innovation to conform with the performance standard in some circumstances forgoing the innovation.

The economic analysis of the proposed regulations shows an increase in personal disposable income. This type of income is the feedstock of innovation because it is disposable income that is used to buy products that are "new" and beyond what consumers would consider baseline. Further, the utility bills of California businesses would decrease from the proposed cost-effective regulations. That frees additional capital for those companies to spend on research and development (R&D) and other forms of innovation.

CHAPTER 7:
Benefits and Costs to Californians

The proposed and alternative regulations provide a wide range of benefits to California households and commercial businesses. The benefits that were quantified for this SRIA include water, electricity, and natural gas conservation, utility bill savings, jobs impact, changes in personal income, reduced air pollution, and reduced greenhouse gas emissions. Estimates were made for annual incremental costs to residential and commercial consumers of appliances. Annual administrative costs were also estimated and applied to the commercial sector.

Water Savings

The proposed and alternative standards will have significant impact on water consumption in California. Proposed standards over the next 10 years will conserve about 460 billion gallons of water or 1.41 million acre-feet. As California enters a fourth year of drought, every sector of the economy benefits from the conservation of water. The higher standards alternative would conserve 651 billion gallons over 10 years. The lower alternative standards would conserve 451 billion gallons.

Staff estimates the water utility bill savings from implementation of the proposed standards to total $903 million for households over 10 years. Commercial businesses would save roughly $661 million between 2016 and 2025. The residential sector water bill savings ramps up over time as more efficient faucets and toilets are installed in homes. The residential water bill savings are estimated to equal $17.4 million in 2016 and increases to $159 million by 2025. Commercial businesses will save $12.7 million in 2016 and $117 million by 2025.

Electricity Savings

Both the proposed and alternative standards would yield significant electricity savings within California. Electricity is conserved directly through reduced electric hot water heating load and installation of more energy-efficient dimming ballasts. Electricity is saved indirectly due to embedded energy savings throughout water supply and wastewater management processes. Total electricity savings are estimated to be 220 gigawatt-hours (GWh) in 2016 and rises to 1,996 GWh by 2025. The value of residential electricity bill savings is estimated to be $18.3 million in 2016 and up to $119 million in 2025. Commercial sector electricity bill savings over the same period go from $2.8 million to $30.6 million. Staff estimate the air quality and GHG benefits of conserving this amount of electricity (see page 21) but did not attempt to estimate a wider range of benefits to California such as those associated with improved grid reliability or avoided power plant or transmission line construction costs.

Natural Gas Savings

Estimates of natural gas savings from reduced hot water heating total 30 million Therms (mmTherms) in 2016, and increase to 252 mmTherms in 2025 under the proposed standards. Cumulative natural gas savings for the 10-year period is the same for proposed and low standards alternatives and equals 1,410 mmTherms. Natural gas savings increases to 1,969 mmTherms under the higher standards alternative.

Utility bill benefits to households total $23.7 million in 2016, and increase to $176 million in 2025. Total residential sector natural gas utility bill savings is $1.01 billion between 2016 and 2025. Businesses are estimated to save $5.4 million in 2016, and $50.2 million by 2025. Businesses will save a total of $281 million on natural gas bills over the 10 years.

Job Effects

Job effects of the proposed and alternative standards were estimated using the REMI PI+ (Version 1.6.7) model for California as a single region. The cumulative 10-year jobs impact is positive for all levels of standards analyzed but significantly larger for the higher standards alternative. The reduced spending by households and businesses on utility bills is reallocated to spending on other goods and services. The reallocation of spending more than offsets reduced economic activity within the utilities sector of the California economy.

Total job-years over the decade will increase by 5,668 under the proposed standards. Estimated job-years rise from 279 in 2016, to 621 by 2025. Under the lower standards alternative, total job-years increase by 6,924 over the 10 years. The higher standards alternative yields the greatest increase in jobs, totaling 13,171 job-years over the decade. These levels of jobs effects are small in comparison to the full California economy. The jobs effects represent less than one-hundredth of one percent change in California's employment level.

Personal Income

In addition to utility bill savings, the proposed standards will increase real disposable personal income by $9 million in 2016, and $56 million in 2025, as a result of employment effects. The cumulative increase in personal income with the proposed standards is $375 million, which is beneficial for the California economy. This increase in personal income results from consumers and commercial businesses saving money on utilities and spending it on other goods and services, leading to a small gain in employment levels. Due to significantly increased costs of the higher standards alternative, cumulative gains in personal income falls to $240 million. Under the lower standards, personal disposable income rises by $387 million between 2016 and 2025.

Air Quality

Air quality benefits of both the proposed and alternative regulations are quite significant as a result of avoided electricity generation. Proposed regulations over the next 10 years will reduce PM 2.5 emissions by about 193 tons, NO_x emissions by 4,446 tons, and oxides of sulfur (SO_x) emissions by about 64 tons. Benefits of reducing these criteria emissions were estimated using the U.S. EPA's COBRA Model. Additional benefits of reducing carbon monoxide and volatile organic compounds (VOCs) were not estimated. The higher standards alternative had slightly higher criteria emissions benefits, while the lower alternative had significantly lower emissions benefits. These emission reductions will support local air quality mandates to reduce criteria air pollutants.

The COBRA Model provides a high and low estimate of avoided public health impacts due to reductions in criteria emissions. The proposed standards are estimated to avoid between $1.0 million and $2.3 million in health impacts during the first year of implementation in 2016. By 2025, the range of avoided public health impacts increases to $5.8 million to $14.8 million. The 10-year cumulative estimated air quality benefit of proposed regulations is between $36 million and $90 million.

Greenhouse Gas Emissions

The proposed regulations are estimated to avoid 0.26 million tons of carbon dioxide (CO_2) in 2016 and 2.3 million tons in 2025. The cumulative benefit of CO_2 reductions for the proposed standards is 12.6 million tons. The higher alternative standard increases this value to 16.9 million tons, while the lower alternative cuts the CO_2 benefit to 11.9 million tons. This emission reduction contributes to AB 32 goals to reduce greenhouse gas production.

Two types of benefits were estimated for the carbon dioxide emissions reductions. The first is an estimate of avoided global damages using a federal social cost of carbon value of $43 per ton. Total avoided damages for the 10-year period under proposed standards equals $429 million. A second value estimated is the avoided cost of purchasing CO_2 allowances for California's Cap-and-Trade Program. The value for CO_2 allowance savings was estimated to be $120 million, based upon an assumed allowance value of $12 per ton.

Costs

The proposed appliance standards are estimated to cost residential sector consumers $0.6 million per year in incremental costs over the 10-year period of analysis from 2016 to 2025. The estimated annual incremental costs for commercial sector consumers range from $1.6 million in 2016, to $2.7 million in 2025, in nominal undiscounted 2014 dollars.

The annual administrative costs were estimated and applied to the commercial sector for analysis of macroeconomic impacts. Administrative costs in 2016 were estimated to be $1.87 million, while subsequent administrative costs were estimated to be $0.25 million between 2017 to 2025.

Figures in Table 3 are presented in 2014 dollars and net present values using a 3 percent nominal annual discount rate. Costs for the higher standards alternative are significantly larger due to estimated costs of lower gallon per flush toilets. Currently toilets that would comply with the more stringent standards cost more than those that comply with the proposed standards.

Table 3

Estimated Costs of Proposed and Alternative Standards

Type of Standard	Residential Consumers (million dollars)		Commercial Consumers (million dollars)		Cumulative Administrative Costs (million dollars)	Cumulative Residential Consumers (million dollars)	Cumulative Commercial Consumers (million dollars)
	2016	2025	2016	2025			
Proposed	$0.56	$0.43	$1.50	$1.94	$3.60	$4.92	$20.67
Higher	$0.56	$54.6	$1.69	$2.19	$3.60	$420.38	$22.93
Lower	$0.56	$0.43	$1.32	$1.71	$3.60	$4.92	$18.69

Source: Energy Commission Staff

CHAPTER 8:
Conclusion and Summary

Staff finds that the proposed standards for toilets, urinals, faucets, dimming ballasts, air-filters, heat-pump water-chilling packages are technically feasible, cost-effective, and would not result in any added total cost to consumers. Therefore, the standards meet the requirements of Public Resources Code Section 25402(c) (1) by reducing wasteful, uneconomic, inefficient, and unnecessary consumption of energy and water.

Specifically, over the 10-year period from the effective date, the proposed standards save about 460 billion gallons of water and provide bill savings of $1.56 billion to consumers. The proposed standards would reduce electricity consumption by about 10,992 GWh, and provide consumer bill savings of $877 million. Implementation of the proposed standards would save about 1,410 mmTherms of natural gas and save consumers $1.29 billion. Combined dollar savings from the proposed regulations will be about $3.7 billion.

Estimated job-years rise from 279 in 2016, to 621 by 2025. Total job-years over the decade will increase by 5,668 under the proposed standards. The increase in jobs with proposed standards will also increase real disposable personal income by $9 million in 2016, and $56 million in 2025. The cumulative increase in personal income with the proposed standards is $375 million, plus utility bill savings of $2.6 billion, for a total of $3 billion in benefits to California households. The proposed regulations are estimated to avoid 263,000 tons of carbon dioxide in 2016 and 2.3 million tons in 2025.

APPENDIX A:
Method for Costs and Benefit Inputs

Appendix A discusses the information and calculations used to characterize proposed regulations in California, their current consumption (water or natural gas or electricity), and potential savings. The information and data for analysis were received from the stakeholder's proposals for each topic.

Stock and Sales

The sales are estimated by using the compound annual growth rate (CAGR) rates and first-year sales. The equations for sales express as follows:

$$Sales\ year_{2nd} = Sales_{First\ year} \times (1 + CAGR_{year2nd})$$

$$Sales_{year\ n} = Sales_{first\ year} \times \left(1 + CAGR_{year2nd}\right)^2 \times \left(1 + CAGR_{year\ n}\right)^2$$

Stock = First year sales+ 2nd year sales+…+nth year sales

For SRIA analysis, the stock and sales estimates and associated CAGR were taken from the stakeholders' proposals.

Compliance Rates

Compliance rate is the percentage of compliant units over the total stock units, or compliance rate = (number of compliant units/total stock) x 100.

The SRIA analysis incorporates the compliance rates estimated based on the stakeholders' proposals.

Design Life

The design life is an estimate of the length of the typical operation usefulness of a product. The design life figures were taken from the stakeholders' proposal. Generally the stock figure is near the product of sales and product life.

Duty Cycle

Appliance duty cycle = sum of daily use/unit consumption of water or natural gas or electricity usage.

The duty cycle is an estimate of consumer behavior for each type of appliance. It is directly tied to how often a product is used.

The duty cycles represent current average usage to make meaningful estimates of product energy consumption and savings.

Duty cycle data for the appliances discussed in SRIA were taken from the stakeholder's proposals.

Baseline Energy Use

The baseline average consumption for each appliance unit is an estimate of water, natural gas, or electricity used by the market-representative ratio of compliant and noncompliant units.

The per-unit consumption assumptions for each type of appliance are derived from the stakeholders' proposal. Baseline energy use is calculated by multiplying the per unit consumption with duty cycle and existing stock.

Compliant Energy Use

The power consumption of compliant products is estimated based on minimum requirements to meet the proposed regulations.

The annual energy consumption is calculated by using the average consumption for each appliance unit that is represents the market ratio of compliant and noncompliant units.

Costs and Savings

The cost assumptions for this table are from the stakeholders' proposals. The unit energy savings are calculated by subtracting the compliant energy use from the baseline energy use.

$$E_{annual\ savings} = E_{annual\ baseline} - E_{annual\ compliant}$$

Unit cost savings (benefits) are calculated by multiplying the annual water, natural gas or electricity savings by the discounted design life.

$$B_{energy\ savings} = \$0.14 \times E_{annual\ savings} \times L_{discounted\ design}$$

Net unit savings are calculated by subtracting costs from benefits.

$$B_{net} = B_{energy\ savings} - C_{compliance}$$

Current stock consumption is calculated for each product by multiplying its annual baseline energy consumption by its first year stock.

$$E_{stock} = E_{annual\ baseline} \times N_{first\ year\ stock}$$

Stock energy savings are calculated for each product by multiplying the unit energy savings of the product by the first year stock and by the noncompliance rate. The noncompliance rate is 100 percent minus its compliance rate.

$$B_{stock} = B_{energy\ savings} \times N_{first\ year\ tock} \times (1 - R_{compliance})$$

The energy savings of first year sales is calculated in a similar manner to stock energy savings except by using second-year sales rather than first-year stock.

$$B_{stock} = B_{energy\ savings} \times N_{first\ year\ sales\ Sales} \times (1 - R_{compliance})$$

Benefit-to-cost ratio is calculated by dividing the unit cost savings by the unit cost of compliance.

APPENDIX B:
Macroeconomic Modeling: Methods and Assumptions

Provided below is a brief description of methods and assumptions used to assess the macroeconomic impacts of proposed and alternative appliance efficiency standards for this standardized regulatory impact analysis. The impacts associated with jobs, investment, income, gross state product, and prices were estimated using the most current version of REMI PI+ Model (Version 1.6.7)[8] that was provided to the Energy Commission on September 5, 2014. Staff used the single statewide region model (Build 3735) to assess these macroeconomic impacts.

Impacts were estimated for a 10-year period from 2016 through 2025. It is possible that new appliance efficiency standards might replace the proposed standards before 2025. A shorter impact analysis period would reduce the estimated effects provided within this assessment. A lengthy period of assessment is justified given that some appliances, such as toilets and urinals, take a longer period to reach higher levels of installation within existing homes and buildings.

The inputs used to run the macroeconomic model include:

- Reduced consumer spending on utilities (water, electricity, natural gas)
- Reduced commercial sector spending on utilities (water, electricity, natural gas)
- Increased costs to consumers for the appliances
- Increased costs to commercial businesses for the appliances
- Reduced sales of water, electricity, and natural gas within the commercial sector
- Conserved water available for agricultural production

Eleven variables were used to model the macroeconomic effects of three alternative levels of appliance efficiency standards (REMI model variables referenced):

— Consumer Spending – Electricity (variable: 638)

— Consumer Spending – Natural Gas (variable: 639)

— Consumer Spending – Water Supply (variable: 637)

— Consumer Reallocation - All Categories (variable: 78)

— Consumer Price – Household Appliances (variable: 405)

[8] See REMI, Inc. website for general description of PI+ model at http://www.remi.com/resources/documentation.

— Electricity Fuel Costs – All Commercial Sectors (variable: 82)

— Natural Gas Fuel Costs – All Commercial Sectors (variable: 86)

— Production Costs – Water (variable: 50)

— Exogenous Final Demand – Electric Power Generation (variable: X6409)

— Exogenous Final Demand – Natural Gas Distribution (variable: X6410)

— Exogenous Final Demand – Water, Sewer and Other Systems (variable: X6411)

The electricity and natural gas savings estimates were converted to estimates of utility bill savings to consumers and commercial businesses using population and utility provider-based weighted averages of residential and commercial electricity and natural gas prices. Estimates of retail energy rates by service provider were obtained from the Energy Commission's 2014-2024 Baseline Final Forecast – Mid Demand Case. [9]

The residential electricity price ($2014) ranged from $165,951 per GWh in 2016 to $182,862 per GWh in 2025. Commercial sector electricity rates were slightly lower than residential rates and ranged from $150,995 per GWh in 2016, to $166,403 in 2025. These electricity rates have a conservative annual increase in price of between 0.8 percent and 1.5 percent, averaging 1.1 percent per year. The natural gas retail rates for the residential sector ranged from $1.033 million per million therms in 2016 to $1.257 million per million therms in 2025. Commercial sector rates ranged from $0.988 million to $1.197 million per million therms over the same period. Natural gas price increases ranges from 0.9 percent to 6.2 percent, averaging 2.2 percent per year.

Residential water supply cost was estimated to be $2,820 per million gallons in 2016. The commercial water supply rate was estimated to be $7,420 per million gallons in 2016. For SRIA document, these retail water rates were escalated at 2 percent per year to account for a small amount of inflation over the period of analysis.

The REMI PI+ is a macroeconomic model that is unable to separate impacts to consumers and businesses that do not both incur the incremental cost of appliances and receive the utility bill savings. Net water bill savings to commercial businesses was spread across all non-farm production using the production cost variable 50 (annual bill savings amount as percentage of total annual non-farm output).

9 The Energy Commission's 2014-2024 Baseline Final Forecast – Mid Demand Case, available at http://www.energy.ca.gov/2013_energypolicy/documents/demand-forecast/mid_case.

Economic impacts resulting from estimated changes in criteria air pollutant emissions were estimated using the U.S. Environmental Protection Agency's COBRA Model. [10] Emissions reductions were estimated based upon electricity savings between 2016 and 2025 using basic assumptions about avoided generation resources and heat rate. Emission reduction benefits were modeled for 2017 and then discounted using a 3 percent social discount rate to estimate net present value. The air pollutants modeled include: particulate matter (PM 2.5), sulfur dioxide (SO_2), and oxides of nitrogen (NO_x).

A macroeconomic effect associated with reduced greenhouse gas emissions as a result of the proposed regulations was estimated using a social cost of carbon of $43 per metric ton of CO_2.[11] The economic benefit of avoided demand for California Cap-and-Trade Program carbon allowances was estimated using a value of $12 per metric ton of CO_2.

All economic impact values reported in this analysis are in 2014 dollars. All net present value calculations use a 3 percent social discount rate.

Reduced water demand from commercial businesses is entered as an "exogenous" final demand reduction, and the model does not reallocate water savings to other productive uses within the California economy. Energy Commission staff reallocated all water savings to agricultural or farm output. A value of $633 per acre-foot of water was obtained from a UC Davis study on the value of lost agricultural output due to the recent drought.[12] This value was used to estimate an increase in annual farm output based upon annual water conservation.

The above figure is likely conservatively low, as water transfers within California are happening at this value, and water is only one input to agricultural production value. Inclusion of this variable for water reallocation within REMI PI+ under the proposed standards scenario leads to a 36 percent reduction in estimated GSP loss by 2025.

A second caveat regarding quantified impacts relates to air quality emission reduction benefits. Air quality benefits of the proposed regulations are likely understated due to the quantification of only three types of criteria air pollutant reductions: PM2.5, SO_2, and NOx, resulting from reduced electricity generation. Omitted air quality benefits arise from reduced carbon monoxide and volatile organic compounds associated with some sources of electricity power generation. In addition, no air quality benefits were estimated for reductions in consumption of natural gas.

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10 The U.S. Environmental Protection Agency's COBRA Model, available at http://epa.gov/statelocalclimate/resources/cobra.html.

11 A macroeconomic impact associated with reduced greenhouse gas emissions as a result of the proposed regulations was estimated using a social cost of carbon of $43 per metric ton of CO_2, available at http://www.epa.gov/climatechange/EPAactivities/economics/scc.html.

12 A value of $633 per acre-foot of water was obtained from a UC Davis study on the value of lost agricultural output due to the recent drought available at https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.

Air emissions benefits would occur throughout the life cycle of natural gas production and consumption.

A third caveat relates to unquantified economic impacts that are expected to result from implementation of the proposed appliance efficiency standards but were too difficult to estimate for this analysis. No estimates are provided for electricity or natural gas system benefits of reduced demand between 2016 and 2025 as a result of the proposed standards. Electricity demand will be reduced by 1,996 GWh per year in 2025, and the cumulative reduction over that period is almost 11 terawatt hours. Unquantified natural gas system benefits would be less than electricity, but with a cumulative reduction of approximately 1,400 million Therms, there can be some system benefits omitted in this analysis.