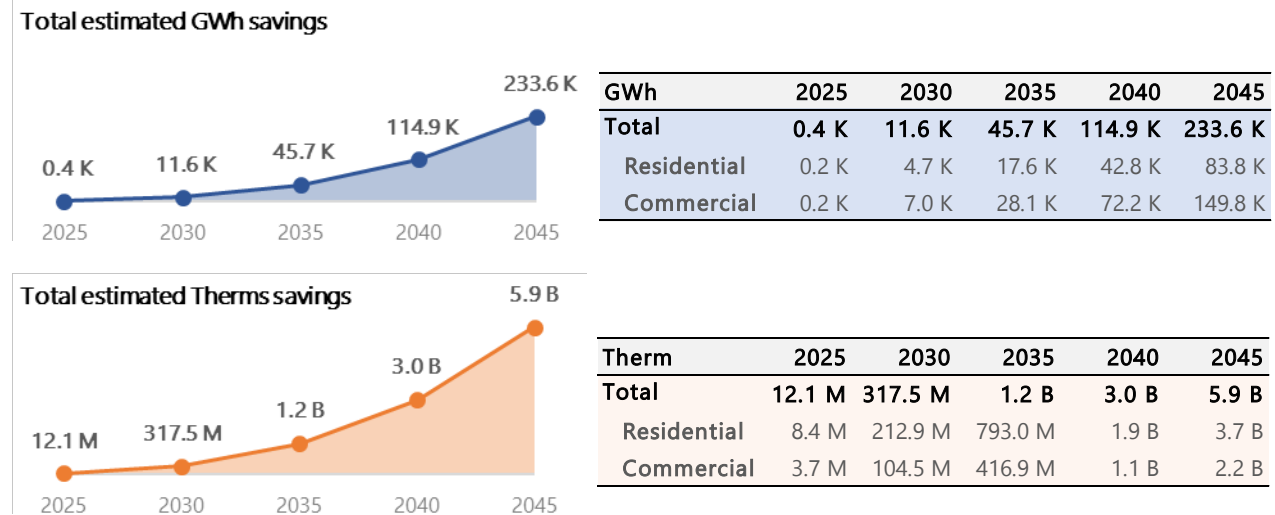


## CALIFORNIA ENERGY COMMISSION EPIC BENEFITS: BUILDING ENERGY EFFICIENCY

### Gross Benefits: not isolated to EPIC’s financial contribution – Delphi Results

#### Energy Savings

The energy savings estimates presented here reflect predicted cumulative energy savings between 2025-2045; by 2045 we estimate **233,600 GWh** and **5.9 Billion therms** of savings across all 19 EPIC-supported technologies.



The 19 grants included in this analysis reflect EPIC investments made between 2014-2018 that had validated technical potential information and generally encompassed a single technology or approach (see last page for list of grants included). The Commission and its consultant, IEc, used a Delphi panel to forecast market share for each technology through 2045; panelists provided market share predictions for new construction and renovations, and for residential, multi-family, and commercial sectors. We then applied market share forecasts for each technology to relevant construction forecasts, for relevant climate zones in CA, to estimate energy savings. These energy savings are used to calculate the monetary benefits presented below.

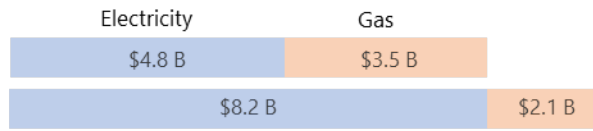
#### Savings to Ratepayers and Utilities

Financial cost savings are anticipated to accrue to two primary groups: rate payers (on-bill savings) and utilities (system-level avoided costs). For these categories, we use a 7% discount rate applied to the energy savings; a 7% discount rate reflects a typical cost of capital for investor-owned utilities and a typical borrowing rate for ratepayers. All savings are presented in 2020 dollars.

### \$ On-bill Savings

On-bill savings reflect savings to rate payers based on estimated avoided energy use from implementing EPIC-supported technologies.

On-bill Savings	Electricity	Gas
<b>Total</b>	<b>\$13.0 B</b>	<b>\$5.6 B</b>
Residential	\$4.8 B	\$3.5 B
Commercial	\$8.2 B	\$2.1 B



\$ Total estimate for all markets and energy sources at 7% discount rate:  
**\$18.6 Billion**



### System-Level Avoided Costs

Values reflect two broad categories of avoided costs to utilities: avoided energy procurement (including losses and ancillary services) and peak load reduction benefits (including avoided capital costs for new generation capacity, transmission, and distribution). All hourly analysis is based on the System-Level Savings Calculator, which uses hourly marginal cost inputs from CPUC's Avoided Cost Calculator.

System Level Avoided Costs	
<b>Total</b>	<b>\$7.8 B</b>
Residential	\$2.9 B
Commercial	\$4.9 B



\$ Total estimate for all markets with 7% discount rate:  
**\$7.8 Billion**



### First Costs

IEc was unable to conduct a true first cost analysis for Building EE technologies due to the varied technologies included in the Building EE Delphi panel; the limited existing information on first costs; and difficulty in projecting the trajectory of cost reductions as these varied technologies gain market share. Instead, we assumed two scenarios. In the low-cost scenario, we assumed that first costs per kWh and per therm are equal to those currently paid by California DSM programs; the resulting estimate is **\$4.4 billion**. In the high scenario, we assumed that the cost would be double current DSM program costs, or **\$8.9 billion**. These figures are also both discounted at 7%.

*Therefore, even if we assume that the first costs of EE from these technologies is double what ratepayers and utilities in the State currently pay, on-bill savings and system-level savings from these EPIC investments will surpass first costs.*


House icon First costs estimate with 7% discount rate:  
**\$4.4 – 8.9 Billion**

### Social Welfare Benefits: Benefits to Society

Two primary societal benefits are considered: health effects and the social cost of carbon. The social welfare benefits reflect society’s willingness-to-pay for reductions in human health and climate risks due to the reductions in air pollutant and GHG emissions. The social welfare benefits are a measure of *economic value* whereas the system-level avoided costs describe *financial costs*. These social welfare values should not be summed with the dollar values for savings to rate payers and utilities. Values reflect present value (PV) benefits at a 3% discount rate (2025-2045). This is a commonly applied discount rate for benefit-cost analysis of health outcomes and is recommended by the U.S. Office of Management and Budget as an estimate of the social rate of time preference, which defines the rate at which society values the present relative to the future. Social discount rates are used for discounting when future costs and benefits are experienced broadly or by the public in general. Total social welfare benefits are expected to range between **\$89.3 and \$197.4 billion**.

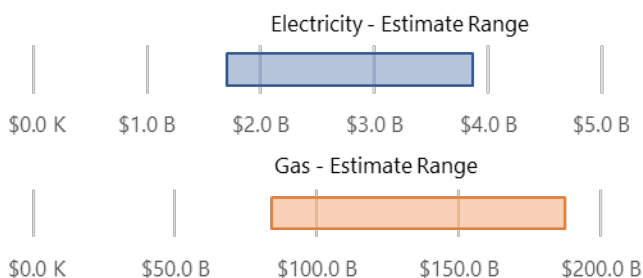
#### Health Effects

Health Effects calculates the reductions in human health risks (as avoided mortalities and morbidities) due to the reduction of PM 2.5, NOx, and SO<sub>2</sub> associated with lower energy use. The range in the value of health effects from the EPIC Health Benefits Calculator is driven by a range in the epidemiological risk coefficient used to estimate the relationship between PM2.5 exposure and mortality. The range in PM2.5 mortality effects reflects the uncertainty in the literature on this relationship. The EPIC Health Benefits Calculator accordingly includes the range recommended by EPA’s benefit-per-ton emissions value guidance.

 Total estimate for all markets and energy sources at 3% discount rate:  
**\$85.9 - 191.0 Billion**


#### Health Effects - All Pollutants and Sectors

	Low	High
<b>Total</b>	<b>\$85.9 B</b>	<b>\$191.0 B</b>
Electricity	\$1.7 B	\$3.9 B
Gas	\$84.2 B	\$187.2 B



#### Social Cost of Carbon

The EPIC Social Cost of Carbon (SCC) Calculator evaluates the socioeconomic benefits of EPIC investments that reduce or mitigate greenhouse gas (GHG) emissions (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O). The social cost of carbon reflects societal willingness-to-pay for reduced risks of global climate change-related damages—including effects to agricultural productivity, energy use, health, infrastructure, and ecosystem services—resulting from marginal changes in atmospheric carbon levels.

 Total estimate for all markets and energy sources at 3% discount rate:  
**\$3.4 Billion**

**Social Cost of Carbon**

	2.5%	3%	5%	95th Per.	
<b>Total</b>	<b>\$2.2 B</b>	<b>\$3.4 B</b>	<b>\$527.6 M</b>	<b>\$6.7 B</b>	
Electricity	\$857.2 M	\$1.3 B	\$206.7 M	\$2.6 B	3% Discount Rate
Gas	\$1.3 B	\$2.1 B	\$320.9 M	\$4.1 B	\$1.3 B
					\$2.1 B

Due to the increasing magnitude of future climate-related damages over time, social cost estimates are highly sensitive to the chosen discount rate. Best practices generally dictate estimating the effects using the full range of discount rates and climate risk scenarios to reflect this uncertainty. Thus, social cost values are presented at 2.5%, 3%, and 5% discount rates, as well as a 95th percentile estimate reflecting high climate risk scenario.

**Building EE Grants Included in Analysis**

Number	Title
EPC-14-012	Comparing Attic Approaches for Zero Net Energy Homes
EPC-15-019	Low cost helical coil Ground Heat Exchanger
EPC-15-024	Zero Net Energy Plug Loads
EPC-14-009	Optimizing Radiant Systems for Energy Efficiency and Comfort
EPC-16-013	Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort
EPC-15-027	Electric Plug Load Savings Potential of Commercial Foodservice Equipment
EPC-14-010	Solar-Reflective "Cool" Walls: Benefits, Technologies, and Implementation
EPC-14-013	Very Low-cost MEMS-based Ultrasonic Anemometer for Use Indoors and in HVAC Ducts
EPC-18-003	Ultra-thin Flexible LED Lighting Panels
EPC-16-032	Leading in Los Angeles: Demonstrating Scalable Emerging Energy Efficient Technologies for Integrated Façade, Lighting and Plug Loads
EPC-14-021	Development and Testing of the Next Generation Residential Space Conditioning System for California
EPC-18-025	Scale-up of magnetocaloric Materials for High Efficiency Magnetic Refrigeration
EPC-14-066	High-Performance Integrated Window and Façade Solutions for California Buildings
EPC-14-017	Developing Flexible, Networked Lighting Control Systems That Reliably Save Energy
EPC-15-037	Smart Ventilation for Advanced California Homes
EPC-15-021	Mobile Efficiency for Plug Load Devices
EPC-18-019	Low-GWP, high-efficiency heat pump and air conditioner
EPC-18-006	Radiative Sky Cooling-Enabled Efficiency Improvements on Commercial Cooling Systems
EPC-18-004	Accelerating Commercialization of Advanced Energy Efficient Windows