California's Efficient Energy: Doing More Harm than Good?

A Closer Look at California's Energy Efficiency Measures and the Rebound Effect

Kenneth Green, Ph.D.

November 2013

PACIFIC RESEARCH INSTITUTE

Issue Brief

The Pacific Research Institute (PRI) champions freedom, opportunity, and personal responsibility by advancing free-market policy solutions. It provides practical solutions for the policy issues that impact the daily lives of all Americans, and demonstrates why the free market is more effective than the government at providing the important results we all seek: good schools, quality health care, a clean environment, and a robust economy.

Founded in 1979 and based in San Francisco, PRI is a non-profit, non-partisan organization supported by private contributions. Its activities include publications, public events, media commentary, community leadership, legislative testimony, and academic outreach.

Pacific Research Institute
One Embarcadero Center, Suite 350
San Francisco, CA 94111
Tel: 415-989-0833/ 800-276-7600
Fax: 415-989-2411
Email: info@pacificresearch.org
www.pacificresearch.org

November 2013

California's Efficient Energy: Doing More Harm Than Good?
Kenneth Green, Ph.D.

Nothing contained in this report is to be construed as necessarily reflecting the views of the Pacific Research Institute or as an attempt to thwart or aid the passage of any legislation.

©2013 Pacific Research Institute. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopy, recording, or otherwise, without prior written consent of the publisher.

Download copies of this publication at www.pacificresearch.org.

California's Efficient Energy: Doing More Harm than Good?

A Closer Look at California's Energy Efficiency Measures and the Rebound Effect

by Kenneth Green, Ph.D.

When it comes to saving the planet, some of the most popular weapons are policies to promote energy efficiency. As Tim Greeff, deputy legislative director of the League of Conservation Voters recently quipped, "Efficiency is always the cheapest, cleanest, safest, quickest way to cut down on both global warming and pollution" (Gies, 2008). Greeff isn't alone. Numerous key players in the energy community have put a great deal of faith in energy efficiency measures (which run the gamut in scope from green refrigerators to solar panels to electricity-saving televisions) as the torch that leads the way to a brighter, greener future. As an article from The Breakthrough Institute notes:

> Energy efficiency has frequently been cited as the single greatest contributor to emissions reduction and climate mitigation strategies, by everyone from the International Energy Agency and Intergovernmental Panel on Climate Change to consultants like Amory Lovins' Rocky Mountain Institute and McKinsey to efficiency advocates and environmental NGOs. The IEA counts on efficiency for roughly half of the emissions reductions needed in their "Blue Map" climate stabilization scenario (graphic below), for example, while President Obama told reporters in 2009 that with efficiency, 'we can save as much as 30 percent of our current energy usage' (Jenkins, 2011).

If energy efficiency is the weapon of choice in the fight for emissions reduction and climate mitigation, it's safe to say the state wielding it most vigorously is California. When the California Public Utilities Commission claims that, "California has led the nation in energy efficiency programs since the 1970s," it isn't boasting (California Public Utilities Commission, 2013).

California: Efficient Energy Crusade

In 1975, the *New York Times* reports, California, "introduced new regulations on appliances and buildings; and in 1982 it decoupled utility profits from electricity sales, instead offering incentives for conservation" (Gies, 2008). The rest of the country quickly followed California's lead. Since it's often expensive to make multiple product lines, one more energy efficient than the other, appliance companies began applying the Golden State's standards nationwide. "The impact," explains the *Times*, "can be seen clearly in refrigerator design and technology. In response to Californian efficiency standards, technology improvements from 1972 to 2002 cut the average energy consumption of refrigerators on the U.S. market by 75 percent—saving energy equivalent to the output of 40 one-gigawatt power plants, according to a report by Rosenfeld last year. At the same time refrigerator prices have declined in constant dollar terms and their size has increased" (Gies, 2008).

Presently, California remains the forerunner in energy efficiency, with no signs of slowing down. In 2005, "California's energy policymakers and regulators established energy efficiency (EE) as California's highest priority resource for meeting future needs in a clean, reliable, and low-cost manner [and] in 2006, the California legislature and governor positioned energy conservation and efficiency as the cornerstone of the state's Global Warming Solutions Act. The Act mandates a 2020 statewide limit on greenhouse gas (GHG) emissions to 1990 levels (Mitchell, 2009). The state has also been a pioneer in cracking down in areas where other states and the federal government haven't yet dared to tread. In 2009, for example, California garnered attention when it was the first in the nation to impose efficiency standards on flat-panel televisions (Krauss, 2009).

To ensure that these standards exist in more than name only, California has toughened sanctions on noncompliance. In 2011, the state passed a law that enabled the California Energy Commission to fine manufacturers whose products didn't meet the state's energy efficiency standards (Mulkern, 2011). What's the cost for coloring outside the (energy) lines? Up to $2,500 per violation (California Senate Bill No. 454, 2011).

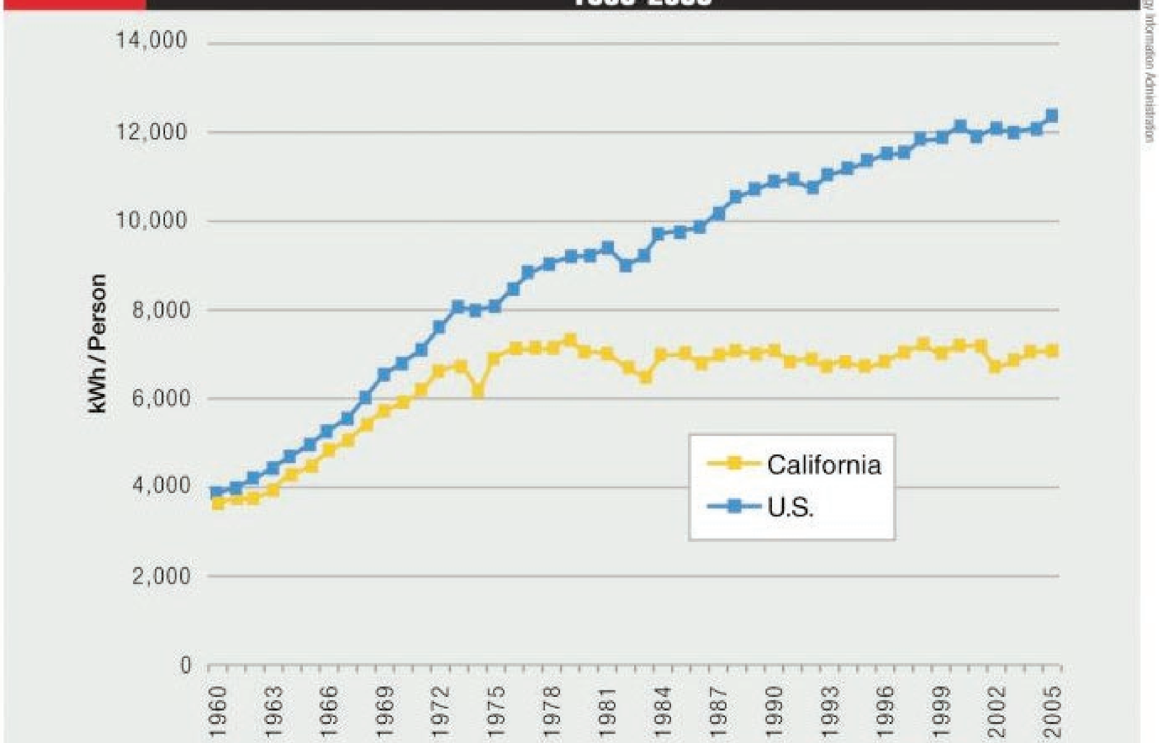
Beyond its notoriously tough efficiency standards on buildings and appliances, California offers a bevy of incentives that encourage consumers to take advantage of more energy efficient technology. In 2009, California's Sonoma County pioneered a program that allowed residents to gradually mitigate the high cost of transitioning to solar power through increased property taxes (as opposed to having to pay everything upfront) (Galbraith, 2009). In other instances, the state has funded rebates to consumers through retail stores to shorten the time it takes for their energy investments to pay off (Gies, 2008).

What's been the result of such extensive investments in energy efficient policy? According to the California Public U tilities Commission and California Energy Commission:

> [California's energy efficient] efforts have saved more than 40,000 gigawatthours (GWh) of electricity and 12,000 megawatts (MW) of peak demand—avoiding the need to build 24 large (i.e., 500 MW) power plants, and equal to the energy required to power 3.8 million homes (Gies, 2008).

To illustrate just how effective the state's efficiency programs have been, California officials frequently refer to the following chart, which compares electricity use in California to the rest of the United States:

FIG. 2 **PER CAPITA ELECTRICITY USE IN THE UNITED STATES AND CALIFORNIA: 1960-2005**



Source: Mitchell, 2009

But are all these savings really attributable to policy changes and inventive programs? While it might seem so at first glance, a bevy of research is cropping up that sheds doubts on California's claim. To help separate fact from fiction, we take a closer look at two key reasons why energy efficient measures might be less powerful than is commonly believed: first, we examine the so-called "rebound effect" as it pertains to energy efficiency, and secondly, we consider alternate explanations for California's energy savings.

THE REBOUND EFFECT

Broadly speaking, the rebound effect explains "why actual energy savings fall short of expected energy savings" following the implementation of energy efficiency measures (Choi Granada et al., 2009) Though one might think it's a novel term coined by pundits or academia, it's actually been around for decades. Explains a forthcoming report on the topic, "The idea that some (or all) of the gains from energy efficiency will be lost because of behavioral responses—the so-called rebound effect—goes back to the mid nineteenth century. Stanley Jevons hypothesized that greater efficiency leads to even greater energy use because it causes people to consume more goods and services" (Gillingham et al., 2009).

A 2007 report from the UK Energy Research Centre presents two clear examples of said effect: "since fuel efficient vehicles make travel cheaper, consumers may choose to drive further and/or more often, thereby offsetting some of the energy savings achieved. Similarly, if a factory uses energy more efficiently it becomes more profitable encouraging further investment and greater levels of output" (Sorrell, 2007). In both instances, measures designed to save energy have caused energy consumers to alter their behavior in ways that might now cause them to use more energy than ever before. While troubling at this individual level, it's downright alarming if one considers the widespread implications of the rebound effect for states like California. Could it possibly be the case that the rebound effect renders California's energy efficiency policies not only ineffective, but actually prone to do more harm than good?

A recent Breakthrough Institute report sheds further light on this question through a detailed survey of literature on the subject. In doing so, it offers a deeper look at rebound effects on a variety of levels, breaking them down into three distinct categories: direct, indirect, and macroeconomic effects.

Direct Rebound Effects

According to the report, a direct rebound effect occurs, "when a below-cost energy efficiency improvement lowers the amount of energy required to provide an energy service, [which means that] the implicit or effective cost of the energy service will fall (all else being equal)" (Jenkins, Nordhaus, and Shellenberger, 2011). This change, "will drive both a direct increase in demand for that service (e.g., one might drive a more efficient car more often), known as an 'income effect,' and the substitution of the now-cheaper energy service for the enjoyment of other goods or services (e.g., more affordable dish washers may substitute for hand washing, or the more efficient use of energy in a production process may allow energy services to substitute for labor at a factory), known as a 'substitution effect.' (For producers, an 'output effect' replaces the 'income effect' for consumers) (Jenkins, Nordhaus, and Shellenberger, 2011).

In general, the Breakthrough Institute concludes that the direct rebound effect is between 10-30 percent in developed nations, meaning that it negates 10-30 percent of the potential savings from energy efficient measures. This conclusion is demonstrated in the chart on the next page:

TABLE 2.1:
Scale of Direct Rebound for Consumer Energy Services in Developed Nations – Summary

Energy Service	Range of Estimates	Best Guess	Degree of Confidence (Notes)
Automotive transport	5-87%	10-30%	HIGH *(Unmeasured in these studies are changes in automotive attributes, particularly heavier vehicles and more powerful engines.)*
Space heating	1.4-60%	10-30%	MEDIUM *(Unmeasured in these studies are increases in the space heated and an increase in thermal comfort.)*
Space cooling	0-50%	1-26%	LOW *(Unmeasured in these studies are increases in the space cooled and an increase in thermal comfort.)*
Water heating	<10-40%	??	VERY LOW *(Unmeasured in these studies are reports of increased shower length or purchase of larger water heating unit.)*
Other consumer energy services	0-49%	<20%	LOW

SOURCE: *Greening et al., 2000; Sorrell, 2007. All values based on studies conducted in developed nations. Rebounds likely to be higher in developing nations, but studies are lacking in non-OECD countries. Degree of confidence based on availability of evidence, which can be sparse for some energy services.*

Source: Jenkins, Nordhaus, and Shellenberger, 2011

Though the above chart seems to suggest that direct rebound effects are moderate, it's worth noting that the vast majority of studies to date have only focused on end users. As a best estimate, the authors put direct rebound effects in the productive sectors at 20-60 percent, and potentially greater for energy-intensive sectors. However, as the authors explain:

> Direct rebound effects in commercial and industrial sectors of the economy have received much less study than rebounds in end-use consumer energy services. The lack of study into rebound for producing sectors of the economy is notable, because the production of goods and services consumes roughly two-thirds of global energy use. Excepting one recent analysis…evidence to date is primarily limited to single-firm energy audits, and as such only captures short-run rebound effects. These studies are therefore likely to underestimate long-run direct rebounds by failing to capture slower capital turnover effects or industry-wide effects (Jenkins, Nordhaus, and Shellenberger, 2011).

For a state like California, known for offering millions in tax breaks to green businesses, high rebound effects in energy-intensive productive sectors would present a special threat (Lin and Donald, 2011; Roosevelt, 2011).

Indirect Rebound Effects

Though it may initially seem like the direct rebound effects are the sole potential threats to energy efficiency measures, further study reveals that they're only the beginning of the story. In recent years, a growing body of research has begun to examine other types of rebound effects, most notably indirect rebound effects.

According to the UK Energy Research Centre, indirect rebound effects stem from two sources: "The energy required to produce and install the measures that improve energy efficiency, such as thermal insulation, and the indirect energy consumption that results from such improvements" (Sorrell, 2007). Accordingly, indirect effects include embodied energy effects (which refer to the offsetting effects of the energy required to manufacture and install energy saving technologies and investments) and also re-spending and re-investment effects, which occur when consumers (and producers) take their cost savings from energy efficiency measures and spend or invest them in an area that uses more energy (Jenkins, Nordhaus, and Shellenberger, 2011).

Given the California government's emphasis on steering consumers towards energy efficient products (recall from above that the government has been known to fund rebates on green products through retail stores to help consumers receive a faster return on energy investments), one could easily see this taking place in the Golden State.

Though reports on indirect rebound effects are scattered and inconclusive, there is evidence that suggests they're far from insignificant. For example, a study that examined the U.S. forest products industry from 1954 to 1984 found that, "the embodied energy associated with capital equipment offset the direct energy savings from that equipment by as much as 83 percent" (Sorrell, 2007). But, as the UK Energy Research Centre notes, "since their methodology is crude and the results specific to the US context, this study provides little indication of the magnitude of these effects more generally" (Sorrell, 2007).

More exact estimates of indirect rebound effects are highly difficult to find, due in large part to the varied nature of studies on said effects to date. A recent report by the International Risk Governance Council notes that:

> The literature has identified both large positive (greater than 100 per cent) as well as negative drivers of the indirect rebound effect. However, the indirect rebound effect is likely to depend on the economy under study and most of these drivers have not been thoroughly investigated across a broad number of economies. In addition, prior work has been largely parametric; empirical research on the magnitude of elasticities relevant to indirect rebound effects is needed (International Risk Governance Council, 2013).

Echoes the UK Energy Research Centre: "The…limited number of studies available provides an insufficient basis to draw any general conclusions. The most important insight from these studies is that the magnitude of the effect depends very much upon the sector with the energy efficiency improvement takes place and is sensitive to a number of variables" (Sorrell, 2007). At present, then, the only sure conclusion that may be drawn regarding indirect rebound effects is the need for further inquiry and study.

ADDITIONAL REBOUND POTENTIAL

Beyond the direct and indirect effects highlighted above, there are numerous other types of broader rebound effects that ought to be considered. The Breakthrough report, for example, points to what it calls "macro-economic effects," which is simply a catch-all term for the variety of broad economic shifts that could occur when the microeconomic forces discussed above collide to make bigger impacts. A clear example might be an increased demand for oil consuming products, after improvements in vehicle fuel economy of US vehicles drive down prices on world oil markets (Jenkins, Nordhaus, and Shellenberger, 2011).

The International Risk Governance Council report also highlights "economy-wide" rebound effects, explaining that "energy efficiency investments lead to changes in prices of goods and services, which lead to structural changes in the economy, resulting in a new equilibrium in the consumption of energy and other goods and services (International Risk Governance Council, 2013). Other reports point to the "Khazzoom-Brookes" postulate, a concept coined by Harry Saunders in the early 1990s that claims "economy-wide rebound effects exceed unity, so that energy efficiency improvements lead to backfire" (Sorrell, 2007).

While there's less concrete evidence available to help analyze these types of effects, the models that do exist seem to suggest that there's serious cause for concern. According to the Breakthrough report, "A number of CGE modeling studies…typically find macroeconomic rebounds across a relatively wide range of national economies to be on the order of 30-50 percent or greater, with a surprising number projecting backfire rebound greater than 100 percent" (Jenkins, Nordhaus, and Shellenberger, 2011). The chart below substantiates these claims, demonstrating a variety of alarming estimates for economy-wide rebound effects across various countries:

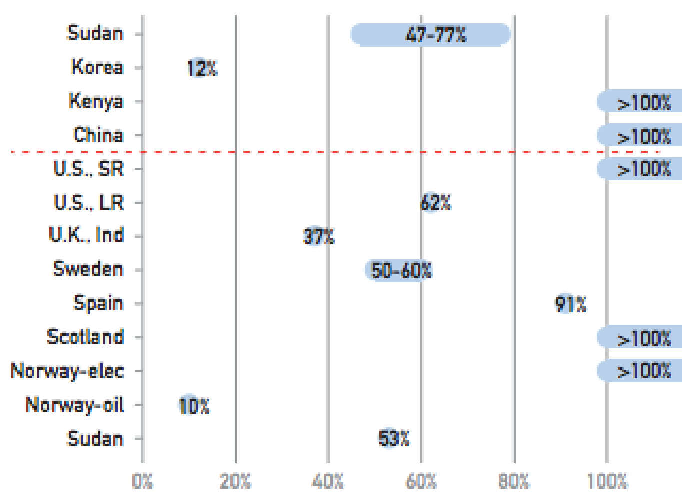


Figure 1. Economy-wide rebound estimates vary by country

Source: International Risk Governance Council, 2013

CONSUMER IRRATIONALITY?

Another fallacy that supports energy-efficiency regulation is the idea that consumers are essentially irrational: That they discount future savings on energy when they make their purchases, and that they must be made to save money on energy by having their choices made for them by government.

The Mercatus Center at George Mason University recently released a long but interesting study by Ted Gayer and W. Kip Viscusi looking at this latter fallacy. They do not find signs of consumer irrationality in energy efficiency:

> Taken as a whole, the engineering and empirical literature on the energy-efficiency gap does not provide strong, credible evidence of persistent consumer irrationality, and the literature on behavioral economics with respect to energy efficiency is still limited and unable to consistently demonstrate the magnitude of the contribution of behavioral deviations from rationality (Gayer and Viscusi, 2012).

And without the ability to claim that government regulations are remedying consumer irrationality and saving people money, the cost of energy-efficiency regulations outweighs their benefit considerably. Gayer and Viscusi look at energy-efficiency regulations relating to cars, trucks, appliances, and even the dreaded incandescent light bulb, and find:

> The impetus for the new wave of energy efficiency regulations has little to do with externalities. Instead, the regulations are based on an assumption that government choices better reflect the preferences of consumers and firms than the choices consumers and firms would make themselves. In the absence of these claimed private benefits of the regulation, the costs to society dwarf the estimated benefits. (Gayer and Viscusi, 2012).

The authors do find some irrationality in the situation however:

> Perhaps the main failure of rationality is that of the regulators themselves. Agency officials who have been given a specific substantive mission have a tendency to focus on these concerns to the exclusion of all others. Thus, fuel efficiency and energy efficiency matter, but nothing else does. If other attributes matter, it is assumed they either are irrelevant or will be included at no additional cost in the post-regulation products. In effect, government officials act as if they are guided by a single mission myopia that leads to the exclusion of all concerns other than their agency's mandate (Gayer and Viscusi, 2012).

OTHER FACTORS AT PLAY?

The potential for rebound effects aside, it is worth noting that some economists attribute California's remarkable energy savings to factors entirely separate from energy efficient policies.

According to Georgetown economist Arik Levinson, the relative stagnancy in California's electricity use since the 1970s could be attributable to the state's temperate climate, shifts in migration, and other demographic and geographic factors. Following a detailed examination of each factor independently, he concludes that:

> Fifteen percent of the apparent electricity changes [in California] can be explained by the U.S. population shift to the Southwest, ignoring all of the other changing differences between Californians and residents of other states. Another 20 percent can be attributed to the fact that nationwide income growth did less to increase energy demand in California's temperate climate, again ignoring all of the other changing differences. And a remaining 61 percent comes from a collection of demographic changes, such as California's rising relative household sizes, ignoring changing relative climates and household incomes (Levinson, 2013).

While it would be tempting, Levinson notes, "to add the three parts together and say that 95 percent of California's apparent electricity savings can be explained by coincidental trends," it would also be highly inaccurate, "because the three parts interact" (Levinson, 2013). To get a true measure of their combined impact, Levinson explains, one would need a consistent collection of data on energy use and household characteristics in California dating back to the 1960s. Since such a collection of data doesn't exist, he uses an alternate analytical technique (first used, he notes, by Oaxaca and Blinder in the early 1970s) to discern which changes in California's energy use are truly attributable to regulatory policy. From this analysis, he concludes that:

> California's absolute difference in residential energy consumption per capita in 2009 can also largely be explained by household and regional characteristics unrelated to energy efficiency…The vast majority of California's apparent conservation relative to the rest of the country comes from coincidental features of the geography and demographics. They have nothing to do with energy efficiency, are not replicable by other states or countries, and have no lessons for the rest of the world (Levinson, 2013).

With regard to broader implications, Levinson is quick to note that his findings don't necessarily "mean that California's regulations have not been effective or beneficial". Instead, he, explains, they simply mean that the impressive figures often tossed around by politicians and government officials with regard to California's energy savings (see, for example, the chart on page three of this paper) are "uninformative as to those benefits" (Levinson, 2013). As he notes in a recent *Wall Street Journal* article, "The figure with California's energy consumption flat and the rest of the country's going up—which is often cited by the press and other organizations, including the World Bank, to show the effectiveness of energy-efficiency standards—is uninformative…I think that energy efficiency standards are a very poor way of targeting the problems associated with energy use" (Safdar, 2013).

Levinson is not alone in his opinion. A recent study released by *Energy Economics* points to factors beyond energy efficiency in explaining the state's energy savings. Notes the study, "We found that California is different from the rest of the United States in several other aspects (i.e., in addition to the scope of its EE programs) that could help account for some of the difference in consumption trends. These are: the price of residential electricity; climate; household size; housing mix; conservation ethic; and the structure of the economy" (Mitchell et al., 2013). Perhaps the clearest example comes from the study's examination of climate. As Cynthia Mitchell and her coauthors explain:

> Not surprisingly, the weather also is a strong driver of per capita electricity use. We conducted an analysis of the relationship between the number of cooling degree days (CDDs) in California against per capita residential electricity consumption. This analysis showed that years with higher numbers of CDDs, are associated with higher levels of per capita electricity consumption. This is in large part due to the electricity demands of air conditioners in years with warm summers.
>
> We also found that California tends to experience fewer CDDs than the United States as a whole. The state's relatively moderate climate greatly affects the amount of residential electricity that is used for space cooling in the summer. Heating is less of an issue because of the dominance of gas heating in the state. A good summary measure of the difference between California and the United States as regards climate is the annual number of CDDs each experiences. For the period between 1975 and 2005, California had an average of 932 CDDs annually. This is substantially less than the U.S. average of 1,274 CDDs, and represents an average difference of 342 CDDs, or 27 percent fewer. While there is limited evidence of a divergence between California and the United States in terms of the number of CDDs over the past 30 years, it is likely that part of the reason for California's relatively low per capita residential electricity consumption is due to the state's lower average number of CDDs. California's relatively mild climate means that the demand for air conditioning is likely to have increased les than in the United States as a whole, despite the rising income levels in the state (Mitchell et al., 2013).

With regard to broader implications, Mitchell and her colleagues also note that their findings do not necessarily mean California's energy efficiency programs have been meaningless. Instead, their chief conclusion is simply that we must be more reticent in attributing California's remarkable energy savings to regulatory policy, and subsequently wary of attempting to replicate California's policy programs elsewhere. Note the authors:

> A number of factors distinguish California from the rest of the United States, and may have contributed to keeping the state's electricity consumption relatively stable. Understanding the role of these factors, as well as savings from EE programs and standards, will allow for a better assessment of the extent to which the California model successfully can be transplanted to other states, regions, or countries (Mitchell et al., 2013).

CONCLUSIONS

Levinson and Mitchell's words serve as a cautionary tale for anyone who sees California's energy regulations as a single bullet in the fight against pollution and climate change. In addition to their studies of other factors at play, the previous analysis above reminds us that even the most effective policies can potentially wind up doing harm even as they do good, as their pernicious rebound effects come back to bite well-intentioned policymakers.

Moving forward, legislators and manufacturers in California and elsewhere ought to perhaps take a closer look at the rebound effects of energy efficiency measures as they craft laws and products of the future.

Perhaps, then, California would be better off investing what it's given away in tax breaks (or all those $2,500 fines it's collected from those in violation of its energy efficiency standards) in further research on rebound effects.

SOURCES

California Public Utilities Commission (2013). *Energy Efficiency*. California Public Utilities Commission. <**http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/**>, as of October 31, 2013.

Choi Granade, Hannah, et al. (2009, July). *Unlocking Energy Efficiency in the U.S. Economy*. McKinsey & Company. <**http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy**>, as of October 31, 2013.

Galbraith, Kate (2009, May 9). Ambitious California Program Aids Renewables, Efficiency and Water. *New York Times Green blog.* <**http://green.blogs.nytimes.com/2009/05/08/ambitious-california-program-aids-renewables-efficiency-and-water/?gwh=2C93A48D3B347A27DE5EE51432DF1D1B**>, as of October 31, 2013.

Gayer, Ted, and W. Kip Viscusi (2012, July). *Overriding Consumer Preferences with Energy Regulations.* Mercatus Center, George Mason University. <**http://mercatus.org/sites/default/files/Energy_regulations_GayerViscusi_WP1221_1.pdf**>, as of October 31, 2013.

Gies, Erica (2008, November 29). California Points the Way, in the United States, to an Energy-Efficient Future. *New York Times*. <**http://www.nytimes.com/2008/10/29/business/worldbusiness/29iht-renconserv.17348128.html?pagewanted=all**>, as of October 31, 2013.

Gillingham, Kenneth, et al. (2013). *The Rebound Effect and Energy Efficiency Policy.* <**http://www.yale.edu/gillingham/ReboundEffectLongForm.pdf**>, as of October 31, 2013.

International Risk Governance Council (2013). *The Rebound Effect: Implications of Consumer Behaviour for Robust Energy Policies.* International Risk Governance Council. <**http://www.irgc.org/wp-content/uploads/2013/04/IRGC_ReboundEffect-FINAL.pdf**>, as of October 31, 2013.

Jenkins, Jesse (2011, February 25). *FAQ: Rebound Effects and the "Energy Emergence" Report*. Breakthrough Institute. <**http://thebreakthrough.org/archive/faq_rebound_effects_and_the_en**>, as of October 31, 2013.

Jenkins, Jesse, Ted Nordhaus, and Michael Shellenberger (2011, February). *Energy Emergence: Rebound & Backfire as Emergent Phenomena*. Breakthrough Institute. <**http://thebreakthrough.org/blog/Energy_Emergence.pdf**>, as of October 31, 2013.

Krauss, Clifford (2009, November 18). California Imposes Rule for Efficiency on Some TVs. *New York Times*. <**http://www.nytimes.com/2009/11/19/us/19televisions.html?gwh=2CEBC28B504D6DA5A6AFBCA2515C796B**>, as of October 31, 2013.

Levinson, Arik (2013, October 17). *California Energy Efficiency: Lessons for the Rest of the World, or Not?* Georgetown University and National Bureau of Economic Research. <**http://www9.georgetown.edu/faculty/aml6/pdfs&zips/CaliforniaEnergy.pdf**>, as of October 31, 2013.

Lin, Judy and Brooke Donald (2011, October 18). California's Green Tax Breaks in Question. *San Jose Mercury News*. <**http://www.mercurynews.com/ci_19134411**>, as of October 31, 2013.

Mitchell, Cynthia, et al. (2009, March). Stabilizing California's Demand. *Fortnightly*. <**http://www.fortnightly.com/fortnightly/2009/03/stabilizing-californias-demand**>, as of October 31, 2013.

Mulkern, Anne (2011, October 20). California Toughens Enforcement of Rules on TVs and Other High-Energy Products. *New York Times*. <**http://www.nytimes.com/cwire/2011/10/17/17climatewire-california-toughens-enforcement-of-rules-on-98824.html?pagewanted=all**>, as of October 31, 2013.

Roosevelt, Margot (2011, January 2). California's New Eco-Laws: Curbs on Toxics, Tax Breaks for Green Businesses. *Los Angeles Times*, *Greenspace blog*. <**http://latimesblogs.latimes.com/greenspace/2011/01/environmental-legislation-2010-california.html**>, as of October 31, 2013.

Safdar, Khadeeja (2013, June 18). Did Regulation Cause Drop in California Energy Consumption? *Wall Street Journal, Real Time Economics blog.* <**http://blogs.wsj.com/economics/2013/06/18/did-regulation-cause-drop-in-california-energy-consumption/?KEYWORDS=california+energy+efficiency**>, as of October 31, 2013.

Sorrell, Steve (2007, October). *The Rebound Effect: An Assessment of the Evidence for Economy-Wide Energy Savings from Improved Energy Efficiency.* UK Energy Research Centre. <**http://www.ukerc.ac.uk/Downloads/PDF/07/0710ReboundEffect/0710ReboundEffectReport.pdf**>, as of October 31, 2013.

State of California (2011, February 16). California Senate Bill No 454. <**http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_0451-0500/sb_454_bill_20110216_introduced.pdf>,** as of October 31, 2013.