WP 03/2019

The Impacts of Energy Efficiency Policies: Meta-analysis

Xavier Labandeira
José M. Labeaga
Pedro Linares
Xiral López-Otero

info@eforenergy.org
www.eforenergy.org
ISSN nº 2172/8437

The impacts of energy efficiency policies: Meta-analysis

Xavier Labandeira [a,d], José M. Labeaga [b], Pedro Linares [c,d], Xiral López-Otero [b]

[a] Rede, Universidade de Vigo, Facultade de CC.EE., Campus As Lagoas s/n, 36310 Vigo, Spain
[b] Departamento de Teoría Económica y Economía Matemática, UNED, Senda del Rey 11, 28040 Madrid, Spain
[c] IIT, Universidad Pontificia Comillas, Alberto Aguilera 23, 28015 Madrid, Spain
[d] Economics for Energy, Gran Vía 3, 3E, 36204 Vigo, Spain

Abstract

Public policies are a key instrument for increasing energy efficiency to slow the growth of energy consumption, thus being crucial for the transition to decarbonized economies. However, the design of these policies is not simple and their impacts depend on multiple factors. This is why many studies, both ex-ante and ex-post, have been conducted to try to determine the effects of different (real or hypothetical) policy options. This paper attempts to summarize quantitatively the existing empirical evidence on the effects of energy efficiency policies on energy demand and on the price of associated durable goods, as well as to identify the main factors that systematically affect the estimated impacts. To this end, a meta-regression analysis of the effects of energy efficiency policies is carried out on the basis of an extensive review of the existing literature, taking into account the econometric problems associated with this type of analysis (intra-class correlation, cross-sectional dependence, publication bias) in an attempt to obtain robust results. The results show that the studies that analyze the effects of energy efficiency policies estimate a significant impact of these policies on energy demand and the price of related durable goods.

Keywords: energy efficiency, meta-analysis, energy demand, price of durables

E-mails: xavier@uvigo.gal (X. Labandeira), jlabeaga@cee.uned.es (J.M. Labeaga), pedro.linares@comillas.edu (P. Linares), xiral@outlook.es (X. López-Otero)

General support from the Spanish Ministry of Science [projects RTI2018-093692-B-I00 (Xavier Labandeira and Xiral López-Otero) and ECO2015-70349-P (Jose M. Labeaga)] is gratefully recognized

1. Introduction

Energy saving is a key element to achieve decarbonization at a global level. Indeed, as the International Energy Agency has repeatedly indicated (e.g., IEA 2018), increased energy efficiency can provide up to 50% of the emission reduction required to meet the objectives of the Paris Agreement. Within the framework of this agreement, different countries commit to reducing emissions in this area through the objectives and actions collected in their Nationally Determined Contributions. However, numerous studies on the energy efficiency 'paradox' show that achieving large savings can be very difficult as the actual implementation of energy efficiency actions has been consistently below the (apparent) optimal level (Linares and Labandeira, 2010). The presence of several and persistent market failures and other barriers limiting the implementation of these efficiency measures create the need for public intervention to address these problems and achieve the desired levels of energy savings.

Yet, designing these public interventions is far from simple. Public intervention must respond to an identified market failure or barrier as effectively and efficiently as possible, which largely depends on the context in which these policies are applied. Although theory can help in policy design, in general the contexts in which energy efficiency policies are applied are second best at the very least, so the results do not necessarily correspond to those pointed out by the existing theoretical knowledge. Under these circumstances, it is essential to have solid empirical evidence that not only offers general patterns of effectiveness, but also makes it possible to identify the factors that may be behind the success or failure of the different policy actions.

There are a sizable and increasing number of academic papers, studies and reports by different organizations and institutions that analyze the effects of energy efficiency policies. They attempt to estimate the impact specific real or hypothetical policies, using ex-ante or ex-post information and varied methodologies. Several compilations of the main findings of this literature, in the form of surveys or meta-analysis, have been carried out to provide wider messages on policy impacts and on the factors likely to contribute to policy success or failure.

In this context, the aim of this paper is two-fold. First, it aims to complement existing literature by performing a meta-regression analysis on the effects of energy efficiency policies as a whole, rather than confining the analysis to a single type of policy as done by a (limited) number of papers so far. Moreover, seeking to provide greater robustness than related attempts in this area, the article uses a much larger and more comprehensive set of studies as a basis. The paper is thus organized in six sections, including this introduction. The following section deals with previous surveys and meta-analysis of energy efficiency policies. Section 3 describes de data used in this paper, prior to detailed methodological considerations (Section 4). Section 5 presents the main results from the study, followed by the main messages and policy discussions of the concluding section.

2. Previous surveys and meta-analysis on the effects of energy efficiency policies

There are a number of papers that attempt to compile and analyze the literature on energy efficiency policies such as Banerjee and Solomon (2003), who study the effects of ecological labeling programs; Gillingham et al. (2006), providing a review the literature on different types of energy efficiency policies (home appliance standards, financial incentive programs, information and volunteer programs and government energy use management); Barker et al., (2007), with an analysis of the literature on the macroeconomic effects of energy efficiency policies in the industrial sector; Ürge-Vorsatz et al. (2007) and Boza-Kiss et al. (2013), who study the cost-effectiveness of energy efficiency policies in the building sector; Mundaca and Neij (2010), who deal with modeling methodologies for ex ante evaluation of energy efficiency policies; Maidment et al. (2014), summarizing the health impact of energy efficiency measures in households; Frederiks et al. (2015) and Hahn and Metcalfe (2016), regarding the experimental literature on the impact of information provision and social norms on consumer energy behavior; Giraudet and Finon (2015), with a review existing assessments on white certificate schemes; Ramos et al. (2015), who analyze empirical evidence about the effectiveness of information instruments in the residential sector; Maki et al. (2016), with a meta-analysis of the impact of financial incentives on household behavior regarding energy conservation and energy efficiency in transportation; Scepanovic et al. (2017), who study the effect of energy efficiency policies in households with different socio-economic, cultural and political contexts; or Wiese et al. (2018) who review the literature on energy efficiency policy instruments and their interactions to evaluate their effectiveness, efficiency and feasibility.

Likewise, Table 1 shows a selection of literature that includes the impact (in percentages) of energy efficiency policies on energy demand or on the price of energy-efficient buildings/products. Noteworthy among these studies are those that carry out a meta-regression analysis (Stanley and Jarrell, 1989), although they are scarce and generally consider a relatively small number of studies and a single type of policy. Conversely, Delmas et al. (2013) introduce duration and quality indicators as additional explanatory variables to conduct a meta-analysis of experimental literature on the impact of information delivery strategy; Karlin et al. (2015) include frequency, the means for delivering the message, the type of message, its duration or its combination with other policies as explanatory variables to perform a meta-analysis about feedback policies and their impact on residential energy demand; Ankamah-Yeboah and Rehdanz (2014), Brown and Watkins (2015) and Fizaine et al. (2018) use meta-analysis to study the impact of green certificates on real estate price by geographical area, type of property, type of certificate, type of publication or the methodology as explanatory variables.

Table 1. Surveys and selected meta-analysis on the effects of energy efficiency policies

Study	Period	Articles considered	Energy Efficiency (EE) Policy	Effect on energy demand	Effect on property price
Nadel (1992)	1983-1992	54	Demand management programs	[-20%; -10%]	
Abrahamse et al. (2005)	1977-2004	38	Information feedback	[-21%; 2%] [-22%; 0%]	
Darby (2006)	1979-2005	38	Feedback energy consumption	[-27%, 0%]	
Fischer (2008)	1987-2007	26	Feedback energy consumption	[-20%;-1,1%]	
Ehrhardt-Martinez et al. (2010)	1974-2009	57	Feedback energy consumption	[-32%; 5,5%]	
Delmas et al. (2013)	1975-2012	156	Information	-7,4%	
McKerracher and Torriti (2013)	1979-2011	33	Feedback energy consumption	[-5%;-3%]	
Mudgal et al. (2013)	2007-2012	22	Energy efficiency certificates		[-5%; 31%]
Ankamah-Yeboah and Rehdanz (2014)	2008-2013	30	Energy efficiency certificates		7,6%
Brown and Watkins (2015)	2005-2015	17	Energy efficiency certificates		4,3%
Karlin and Zinger (2015)	1976-2010	42	Feedback energy consumption	-7,1%	
Ramos et al. (2015)	2010-2014	29	Energy efficiency certificates		[0%;29%]
Staddon et al. (2016)	2000-2015	22	EE policies at the workplace	[-50%; 0%]	
Andor and Fels (2018)	1982-2017	44	Energy labeling and information	[-30%; 8%]	
Fizaine et al. (2018)	1996-2015	54	Energy efficiency certificates		[3.5%; 4.5%]

Note: Meta-regression analyses are in **bold font**
Source: Own elaboration from the cited literature

3. Data

As aforementioned, this paper jointly analyzes several energy efficiency policies and considerably increases the number of studies under consideration to thereby extend the scope of previous meta-analyses. Indeed, the work selected to conduct our meta-analysis emerged from a comprehensive and detailed analysis of existing literature on the impact of energy efficiency policies. To this end, this analysis reviewed the literature, included in the surveys and meta-analyses presented in the preceding section, and used internet search tools such as Google, Google Scholar, Science Direct, Jstor, Springer and Scopus. Two criteria were considered when selecting a piece of work: first, that it studies the impact of one or more energy efficiency policies on energy demand and/or the prices of durable goods that consume energy[1]; and second, that the impact of energy efficiency policies is expressed in terms of the 'business as usual' energy demand/price of durable goods (or the article includes information that allows for the calculation of such impact) to make the results comparable. For this purpose, we selected 366 articles (see Appendix B) published between 1987 and 2019 and providing 1375 estimates of the impact of energy efficiency policies on energy demand and 108 estimates about the effects of such policies on the price of durable goods that consume energy (mainly buildings, but also appliances and vehicles).

Table 2 presents a statistical summary of the estimated impact of energy efficiency policies. It shows impacts on energy demand between -75.9% and 40%[2] with an average of -9.7% and a median of -6% and variations in the price of durable goods consuming energy between -1.2% and 50.7% with an average of 7.7% and a median of 5%. Figure 1 shows the density of the estimated impacts. Some estimated values are very extreme, generally as a result of small sample sizes[3], so we have excluded 5% of the sample from the meta-analysis (2.5% of the high-end values of the distribution and 2.5% of

[1] These two impacts were selected because they represent the quantitative effects of the most studied energy efficiency policies in the literature with enough observations to carry out the meta-analysis.

[2] Some studies obtain increased energy demand derived from energy efficiency policies due to the use of tiny sample sizes, the consideration of the rebound effect or the existence of negative feedback in financial incentive policies (for example, when saving energy in exchange for money is considered morally inappropriate, or when the feedback indicates reduced real consumption).

[3] For instance, the most extreme values (minimum and maximum) of the impacts on energy demand respectively arise from an article in which aggregate cross-sectional data is used (Xu et al., 2013) and an experiment with 118 households throughout the course of less than one year (Asensio and Delmas, 2016). On the other hand, in the case of the impact on the price of the durables, the most extreme values (minor and major) respectively correspond to a work that only has information on fewer than 300 buildings even though the panel data covers a period of 10 years (Devine and Kok, 2015), and to a study using cross-sectional data from 36 US states with less than 10 observations per state on average (Dermisi, 2009).

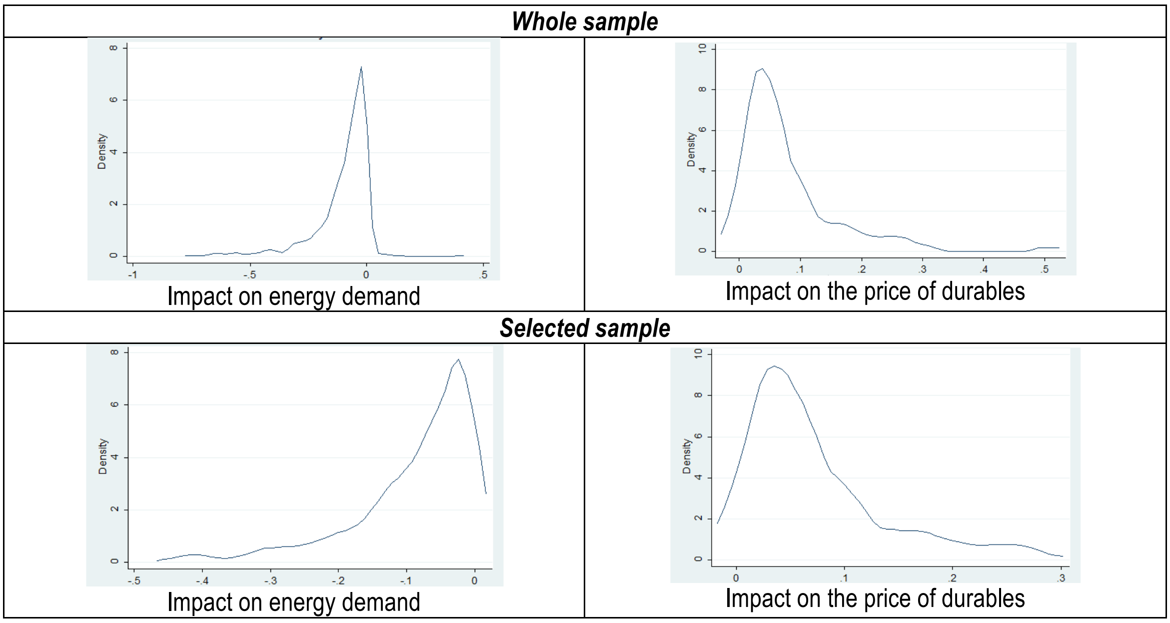
the low-end values) to eliminate outliers that could impact on the average results we want to adjust[4]. The second part of Table 2 presents the statistics of the selected sample, with impacts on energy demand between -45% and 0% (with an average of -8.8% and a median of -5.9%) and variations in the price of durable goods that consume energy between 0% and 28.5% (with an average of 7.2% and a median of 5%) while the second part of Figure 1 shows the density of the impacts in the selected sample. Thus, the elimination of outliers reduces the average impact of the policies, even though the median is hardly affected.

Table 2. Statistics on the impact of energy efficiency policies in the literature

Variable	Observations	Mean	Median	Standard Deviation	Minimum	Maximum
Whole Sample						
Impact on energy demand	1375	-0.0970	-0.0596	0.1193	-0.7590	0.4000
Impact on price of durable goods	108	0.0770	0.0500	0.0791	-0.0120	0.5070
Selected Sample						
Impact on energy demand	1311	-0.0877	-0.0590	0.0892	-0.4500	0
Impact on price of durable goods	105	0.0716	0.0500	0.0638	0	0.285

Source: Own elaboration

Figure 1. Density of energy efficiency policy impact. Whole and selected samples



Source: Own elaboration

[4] As we will see later, estimating the model by GLS (see sections 4.1 and 5.1) with the whole sample results in a significantly lower impact on energy demand than it does using the selected sample (-5.94% vs. -8.80%), for instance. Moreover, it reduces the significance of the estimated parameter (only significant at 10%). Regarding the impact on the price of durables, although it is similar (9.83% versus 9.74%), the use of the whole sample results only in a 10% parameter significance.

Given the heterogeneity of the selected works, which generates a significant variation in the estimated impacts, we have considered several factors that may affect the estimation of the effects from energy efficiency policies and are described below (and summarized in Table 3):

- Policy instrument

One of the main factors that influence the impact of energy efficiency policies is the type of instrument. Although there are multiple energy efficiency policy instruments, they can be grouped into three broad categories (see Markandya et al., 2015):

- *Standards* set mandatory norms for agents regarding the energy efficiency of products, services and activities that include building codes, minimum energy efficiency requirements for appliances, vehicles and fuels, and energy savings obligations. They generally force producers to provide energy efficient options whereas consumers must reduce energy consumption by installing or buying a certain product, so that minimum levels of energy efficiency can be attained (although not necessarily energy savings). However these instruments lack flexibility and usually provide no incentives to increase energy efficiency beyond the compliance threshold (see Linares and Labandeira, 2010; Wiese et al., 2018).
- *Economic instruments* seek to modify the energy behavior of the agents through economic incentives. They conform a flexible approach, through the decentralization of decisions to increase energy efficiency in consumers and producers. These instruments include taxes, generally on carbon dioxide (CO_2) emissions or energy consumption; markets for energy efficiency certificates (white certificates) that establish the reduction of energy demand among participating agents as an objective in absolute terms and allow them to trade this obligation via negotiable certificates (see Giraudet and Finon, 2015; Afshari and Friedrich, 2016); and subsidies and tax relief for investments in energy efficiency measures, such as building retrofitting or the acquisition of efficient appliances and vehicles, and for the reduction of energy consumption.
- *Information instruments* intend to address the problem of incomplete information associated to energy efficiency as well as specific barriers related to bounded rationality (Linares and Labandeira, 2010). These instruments include certificates and labels for household appliances, buildings and vehicles that provide information on their energy efficiency characteristics; energy audits that analyze the energy consumption of households or companies to provide information on cost-effective measures to improve energy efficiency; education programs on ways to save energy; smart meters, which allow agents to know their real-time energy consumption; or

information on the invoices concerning current consumption, its relation to past consumption as well as to that of similar consumers (see Ramos et al., 2015; Wiese et al., 2018).

Finally, energy efficiency policies frequently use a combination of instruments to take advantage of their synergies and increase policy effectiveness. This is because energy efficiency faces multiple market failures that a single instrument is unable to properly address (see Bennear and Stavins, 2007; Wiese et al., 2018) as well as the fact that the aforementioned instruments present both advantages and disadvantages, especially in terms of their practical implementation (Linares and Labandeira, 2010).

- Sector

Energy efficiency policies can be aimed at the entire economy or at certain groups of consumers. Since different types of consumers use energy for different purposes with different responses measured by elasticities, the impact of energy efficiency policies should also vary according to the type of consumer. Within this context, we distinguish between studies analyzing the effects of policies on the residential, industrial, and commercial or public sectors and those focusing on the economy as a whole.

- Energy product

Given that the consumers' relative share of spending and their reaction to changes in prices vary by energy product, they may also react differently in function of the energy product targeted by the energy efficiency policy. Thus, if we compare the average impact of energy efficiency policies on different energy products (Table 3) with their estimated elasticities in the meta-analysis of Labandeira et al. (2017), the effects on the demand of gas is higher than those on the demand for electricity and both are lower than the overall impact on energy demand (which corresponds to the lower short-term elasticity of electricity in relation to gas, and of both energy goods in relation to energy). In this context, we distinguish between studies that address policies aimed at energy consumption as a whole and energy efficiency policies aimed at electricity, gas (natural gas and LPG) or liquid fuels (gasoline, diesel and heating oil).

- Country

The effect of energy efficiency policies may vary by country. We have therefore considered two factors that may affect the results: the extent to which the country is a developed one and its energy dependence. In the first case, we use the Human Development Index (HDI) established by the UN to distinguish between highly developed countries (with an HDI rated as very high)[5] and the rest of the countries (see UNDP, 2019); in the second case, we use World Bank (2019) data to differentiate between exporting countries and net energy importers[6]. Likewise, we initially considered the introduction of the country's energy price level even though we finally decided to discard it[7].

- Scope

The impact of energy efficiency policies also depends on the spatial scope of the adopted measures. We therefore distinguish between subnational (local or regional) policies, national policies, and supranational policies.

- Data

The type of data is another important factor that may have influence on the results. We thus distinguish, on the one hand, between studies that use macroeconomic data, whose results are based on the existence of representative consumers, and those that use microeconomic data with information on the individual behavior of agents. On the other hand, we distinguish between studies that use cross-sectional data, time series data and panel data. Finally, we also distinguish between studies that estimate the impact of real energy efficiency policies and those that are experimentally conducted in laboratory conditions (with voluntary participation).

- Ex-ante vs. ex-post

The type of analysis performed in the cases under study may also have an impact on the results. In this sense, we distinguish between ex-ante studies that simulate the future impact of real or hypothetical

[5] Countries rated by the UN as having a very high HDI are Norway, Switzerland, Australia, Ireland, Germany, Iceland, Hong Kong, Sweden, Singapore, Holland, Denmark, Canada, USA, United Kingdom, Finland, New Zealand, Belgium, Liechtenstein, Japan, Austria, Luxembourg, Israel, South Korea, France, Slovenia, Spain, Czech Republic, Italy, Malta, Estonia, Greece, Cyprus, Poland, UAE, Andorra, Lithuania, Qatar, Slovakia, Brunei, Arabia Saudi, Latvia, Portugal, Bahrain, Chile, Hungary, Croatia, Argentina, Oman, Russia, Montenegro, Bulgaria, Romania, Belarus, Bahamas, Uruguay, Kuwait, Malaysia, Barbados and Kazakhstan (UNDP, 2019).

[6] When the article uses data from several countries, we consider the category to which most countries belong.

[7] Here we used the final energy price index of the IEA (2019), with a set level of 100 for 2015 in every country: therefore it allows the measurement of price deviations with respect to 2015, but not a complete comparison among regions. In any case, we discarded the introduction of this index because annual dummies already collect the effect of the sample period (see Period analyzed in this same section) and introducing the average index of the sample period corresponding to each work involves restricting the impact of the sample period to a single common parameter throughout the entire sample. Moreover, the use of a price index would imply assigning price effects to data lacking these effects (studies with cross-sectional data). As a continuous variable, it would also complicate the analysis of the average effects of energy efficiency policies, which would be sensitive to the considered price level. Alternatively, we also considered including the price index as a dummy (distinguishing between low, medium and high prices), although the estimated parameters were not significant.

energy efficiency policies and ex-post studies that calculate the impact of policies after they are implemented.

- Rebound effect

The rebound effect is a phenomenon that occurs when an improvement in energy efficiency does not result in a proportional reduction of energy demand, or it even causes an increase in energy demand (see Greening et al., 2000; Sorrell, 2007; Gillingham et al., 2016). Three fundamental reasons explain the rebound effect (Linares and Labandeira, 2010). On one side, improvements in energy efficiency cause a reduction in the cost of associated energy products and services, leading to an increase in consumption (direct rebound effect or price effect). On the other side, reduced energy costs lead to an increase in the disposable income of agents, allowing them to increase their demand for other products and services that consume energy (indirect rebound effect or income effect). Likewise, at the macroeconomic level a reduced energy cost brings about a change in the relative price of the different inputs of productions processes, leading to shifts in use that benefit the most energy-intensive sectors. Moreover, increased energy efficiency may stimulate economic growth, thus requiring additional energy consumption (macroeconomic effects). Within this context, the studies that do not contemplate the possible existence of rebound effects could overestimate policy impacts on energy demand. Thus, our analysis distinguishes between papers that consider a rebound effect and those that do not[8].

- Free riders

Another factor that may affect the estimated impact of energy efficiency policies is the presence of free riders: agents that would have carried out actions to improve their energy efficiency even if the policy had not been implemented. Although the presence of free riders has no impact on the absolute effect on energy demand, it does have effects on policy effectiveness and efficiency. Therefore, not taking the likely presence of free riders into account could mean overestimating impacts on energy demand resulting from policy implementations (see Train, 1994; Rosenow and Galvin, 2013). Thus, our analysis includes a dummy to differentiate between studies that do consider the presence of free riders and those that do not.

[8] A study takes into account the rebound effect if it explicitly indicates so or if it can be deduced from its results that it does so.

- Period analyzed

Given that technological progress is crucial on the availability of energy efficiency improvements, we introduce a series of dummies indicating the period in which the impacts of energy efficiency policies were estimated. Our application distinguishes between works that evaluate the effect of energy efficiency policies before 1990; from 1990 to 1999, 2000 to 2009, 2010 to 2019, 2020 to 2029; and from 2030 onward.

- Publication

Finally, we have considered the type of publication in which each of the analyzed studies appears. We distinguish between articles published in journals subject to a review process and those published in other formats, such as working papers or reports; additionally, we differentiate between journal articles published in the best academic journals in terms of impact factors (those that belong to Q1 in any JCR category) and the rest.

Table 3 summarizes the main factors considered and provides the average variations in energy demand and the price of durables shown by the studies considered in the paper. Some elements, already anticipated in the previous description, are noteworthy. Ex-post studies usually offer lower demand reductions, and they consider free riding. Prospective studies (which are ex-ante by definition as well as with uncertainty) generally offer much greater and probably unrealistic reductions. For its part, the large average variation of supranational studies is striking. The fact that most of these studies are ex-ante and post-2030 may explain this.

Table 3. Main factors that may influence the estimated effects of energy efficiency policies

Factor	Energy demand		Price of durables	
	Observations	Average variation	Observations	Average variation
Policy instrument				
Standard	559	-0.0983	4	0.0814
Economic	139	-0.0728	-	-
Information	308	-0.0663	101	0.0712
Combination	305	-0.0966	-	-
Sector				
Residential	730	-0.0867	60	0.0593
Industrial	87	-0.0640	-	-
Commercial/Public	219	-0.1140	45	0.0880
Total	275	-0.0768	-	-
Energy Product				
Electricity	655	-0.0843	6	0.0614
Gas	120	-0.0864	-	-
Liquid fuels	119	-0.0757	3	0.0639

Energy	409	-0.0968	96	0.0724
Country				
Highly developed	1141	-0.0805	105	0.0716
Rest	170	-0.1357	-	-
Net exporter of energy	110	-0.0919	6	0.0743
Net importer of energy	1201	-0.0873	99	0.0714
Scope				
Local/regional	604	-0.0734	11	0.0786
National	633	-0.0929	71	0.0791
Supranational	70	-0.1656	23	0.0451
Data				
Macroeconomic	708	-0.0957	-	-
Microeconomic	603	-0.0782	105	0.0716
Cross-section	687	-0.0920	77	0.0660
Time series	207	-0.0880	-	-
Panel	417	-0.0804	28	0.0869
Experiment	237	-0.0744	-	-
No experiment	1074	-0.0906	105	0.0716
Analysis				
Ex-ante	730	-0.1056	-	-
Ex- post	581	-0.0651	105	0.0716
Rebound effect				
Yes	207	-0.0824	-	-
No	1104	-0.0887	105	0.0716
Free riding				
Yes	120	-0.0601	-	-
No	1191	-0.0905	105	0.0716
Period				
Pre-1990	38	-0.0886	1	0.0158
1990-1999	128	-0.0550	-	-
2000-2009	463	-0.0710	73	0.0793
2010-2019	259	-0.0795	31	0.0554
2020-2029	230	-0.1030	-	-
Post-2030	193	-0.1419	-	-
Publication				
Journal Q1	408	-0.0957	39	0.0809
Journal no Q1	143	-0.1041	46	0.0749
Other	760	-0.0803	20	0.0461

Source: Own elaboration

4. Methodological approach

4.1. Basic methodology

Following Nelson and Kennedy (2009) and Stanley et al. (2013), we have performed a meta-regression analysis (Stanley and Jarrell, 1989), i.e., a regression analysis of the set of estimates included in the selected literature. Thus, the analysis aims to adjust the value of the effect of energy efficiency policies on energy demand, the price of energy-consuming durable goods, and to identify the main factors explaining the difference between different study results. To this end, we propose the following simple model:

$$b_i = \beta + \sum_{j=1}^{J} \alpha_j X_{ij} + e_i \qquad (i = 1,2, \dots, K) \tag{1}$$

with b_i being the estimated impact of energy efficiency policies on the *i*-th observation of our sample; X, the *J* explanatory variables indicating the relevant characteristics of the empirical work that influence the estimated impacts; α_j the parameters of these variables,; β, the unconditional average value of the impact of energy efficiency policies; e_j is the error term of the meta-regression; and *K* is the number of observations of the impacts on energy demand / price of durables in the sample (with different sample sizes, as shown by Table 3).

4.2. Econometric problems and their treatment

The simple model proposed can still present a number of econometric problems, which must be addressed to prevent biased estimates of parameters in Equation 1. First of all, in many cases our analysis considers several estimated impacts of energy efficiency policies from the same study. The average in the case of energy demand is 4.1 observations per paper and 2.4 results for the price of durables (see Table 4). Estimates from the same study generally share data, hypotheses and estimation methods, so they are likely to be correlated (Havranek and Kokes, 2015; Nelson and Kennedy, 2009). Correlation of this kind invalidates the results of any method in which the heterogeneous effects are random if they are not ruled out from the equation at the estimation step. A methodology to eliminate them (first differences, intra-groups, orthogonal deviations, etc.) could avoid this problem, although this procedure could not yield good results when within-groups or time variation is not enough to properly identify the parameters. We will therefore assume that random effects depend on some variables, checking via a Hausman test that compares fixed-effect and random-effect estimates (see Adkins and Hill, 2011). We assume, following Mundlak (1978), that random effects depend on the average of the variables with which they are correlated, and we estimate the model in levels including these sample means as additional variables[9].

In addition, cross-sectional dependence may be due to the use of several papers by the same author or authors from the same institution. This may cause correlation among the paper-effects of these studies.

[9] Of course, t-tests on individual variables (means) serve as checks of correlation. Moreover, a joint F-test is also a valid option. Of course, only time-varying variables are usable and we assume that their means approximate the correlation in an adequate way.

Thus, we check its presence by a test (see De Hoyos and Sarafidis, 2006), estimating Equation 1 with standard errors robust to intra-group correlation.

Another important problem associated with meta-analysis is the presence of publication bias (see Rothstein et al., 2005; Doucouliagos and Stanley, 2013; Havranek and Kokes, 2015), according to which certain results can be more easily accepted for publication[10]. Consequently, meta-analysis results based on this literature would be biased (Palmer et al., 2008). In this context, we analyze funnel plots relative to estimated effects and their standard errors and use the Egger test (Egger et al., 1997) to check publication bias. When we detect bias, we follow Feld and Heckemeyer, (2011) and include the standard error of estimated impacts to take it into account.

Table 4. Observations by study included in the meta-analysis

	Number of studies	Number of observations per paper				
		Average	Median	Standard Deviation	Minimum	Maximum
Studies analyzing the impact on energy demand	321	4.08	2	7.48	1	94
Studies analyzing the impact on the price of durables	44	2.39	2	1.94	1	9

Source: Own elaboration

5. Results

5.1. General model and robustness test

First, we estimate Equation 1 for each of the impacts (energy demand and price of durables) using GLS to take into account heteroscedasticity and correlation. We additionally consider the estimation of Equation 1 using the panel structure of our data, whose dimensions are the type of energy efficiency policy and the study (Panel 1) or, alternatively, the type of energy product and the study (Panel 2) to try to control for specific unobservable factors in each study. In this case, the specification model is:

[10] Sometimes results may be akin to those of previous publications; but the results may also be counterintuitive or more innovative, especially in the best academic journals (in terms of impact).

$$b_{ik} = \beta + \sum_{j=1}^{J} \alpha_j X_{ikj} + \eta_i + \varepsilon_{ik} \quad (2)$$

with b_{ik} being the estimation of the impact of energy efficiency policies on the *i*-th observation of the type of policy/product *k*; η_i the unobservable individual effect, and ε_{ik} the idiosyncratic error term.

Table 5 shows the average effects of energy efficiency policies resulting from estimating the model of Equation 1 under different methods (Table A1 in Appendix A provides the full parameter estimates). Energy efficiency policies are observed to have a significant impact on energy demand and on the price of durable goods, causing an average reduction in energy demand between 10.5% and 8.8%, while its effect on the price of associated durable goods is a change between 9.6% and -9.7%.

Table 5. Average impact of energy efficiency policies in empirical literature

	GLS	Panel 1	Panel 2
Energy demand	-0.0880***	-0.1046***	-0.1027***
Durables price	0.0974***	0.0974***	0.0964***

Note: *** 1% significance
Source: Own elaboration

However, given that the meta-regression analysis can present some econometric problems (see section 4.2), we have performed a series of robustness tests to detect them and correct the estimates if necessary[11]. First, the analysis of our database shows intra-class correlation of 55.7% in studies analyzing energy demand impact, while intra-class correlation is only 10.9% in the case of impacts on the price of durables; there is a correlation problem between the results of the same study in the first case, but not in the second. We address this by assuming that the random effects depend on the average of the variables with which they are correlated (we test it through a Hausman test), estimating the model that includes these averages as additional variables (see Tables A2 and A3). The first row of Table 6 shows the average impact of policies with estimates robust to intra-class correlation. We observe a lower impact on energy demand using Panel 1 (with a similar result for Panel 2).

The Pesaran test (2015) detects cross-sectional dependence in both panels (see Table A4), so we estimate Equation 1 with robust standard errors (Table A5). This estimate makes no change in the

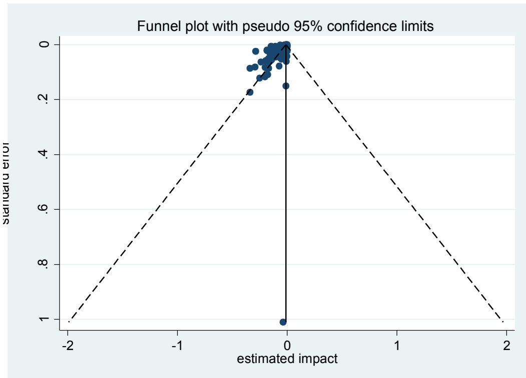
[11] Appendix A (Tables A2-A8) reports the complete results of the different estimates and tests.

estimated values of the effects of energy efficiency policies, as expected, although it does modify the significance of the explanatory factors.

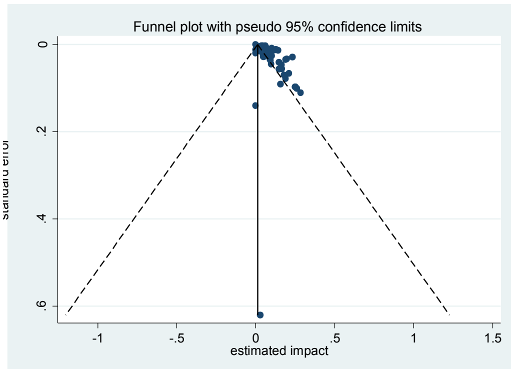
Finally, in terms of publication bias, an asymmetry in funnel plots relates estimated effects and standard errors[12] (Figure 2), especially in the case of effects on the price of durables, which could indicate database publication bias. We have used the Egger test to determine its presence and its results reveal publication bias in the case of energy demand if only articles published in journals are considered (Table A6). However, including other types of publications in the analysis can correct it. On the contrary, publication bias is present when dealing with the price of durable goods even when all the papers are included. Following Feld and Heckemeyer (2011), we take account of it by including the standard error of the effect on the price (see Table A7).

Figure 2. Funnel plots on the impact of energy efficiency policies

Papers/Articles published in Journals

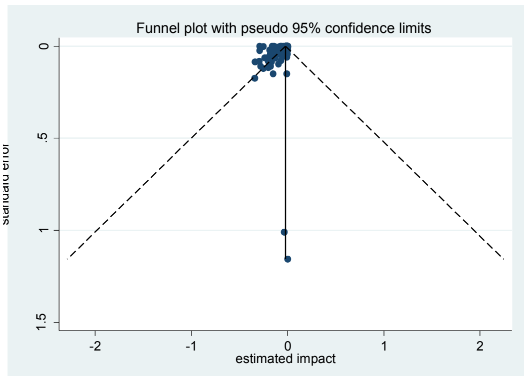


Impact on energy demand

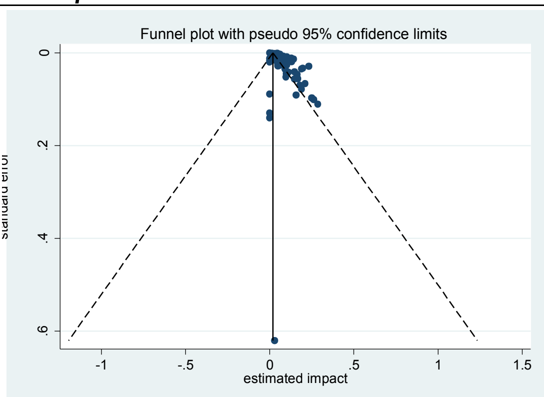


Impact on the price of durables

Total selected sample



Impact on energy demand



Impact on price of durables

Source: Own elaboration

12 We only have information on the standard error and/or the t-statistic for 237 estimates concerning the effects on energy demand and 101 estimates concerning the effects on the price of durables. We therefore limit our analysis to these observations, assuming they represent the whole sample.

The second column of Table 6 presents the estimated effects of energy efficiency policies on energy demand if only articles published in journals are considered (see Table A8). This shows that taking no heed of other types of literature would generally lead to overestimating the average impact of these policies (except in Panel 2). On the other hand, the last column of Table 6 presents the impact on the price of the durables considering publication bias. The impact of durable price policies is overestimated when publication bias is not considered.

Table 6. Average impact of energy efficiency policies in the empirical literature

		GLS	Panel 1	Panel 2
Energy demand	Robust to intra-class correlation	-	-0.0885***	-0.1044***
	Articles published in journals	-0.0994***	-0.1147***	-0.0988***
Price of durables	Robust to publication bias	0.0702***	0.0962***	0.0957***

Note: *** 1% significance
Source: Own elaboration

5.2. Final results and explanatory factors

Once we analyze the econometric problems associated with meta-analysis, we perform a meta-regression robust to these problems. The results, depicted in Table 8, show that studies analyzing the impacts of energy efficiency policies estimate a significant impact of these policies on the energy demand and the price of durable goods that results in an average reduction in energy demand of between 10.5% and 8.8% and an increase of between 7% and 9.6% in the price of associated durable goods, depending on the method used. Although these studies focus on a specific type of energy efficiency policy rather than on the set of existing policies, the results are slightly larger than those obtained in the previous meta-regression analyses.

In any case, these results represent the average impact considering all the studies and depend on the other variables included in the regressions. Table 7 presents the average impacts on energy demand (obtained from the results of Table 8) of the papers published in the best journals in terms of impact (Q1 of JCR) that perform an ex-post analysis and take into account both free riding and the rebound effect. This approach provides robustness to the results as we feel that they estimate the impact of energy efficiency policies more precisely[13]. Energy efficiency policies thus have an average impact on energy demand in the range [-5.2%; -3.2%] in the best-published studies on the subject. Therefore, the meta-analysis that analyzes all the existing literature overestimates the true impact of these policies.

Regarding the factors that influence the estimated impact of energy efficiency policies on the energy demand in the literature, a combination of instruments generates a significantly larger impact on energy demand with respect to the use of a single economic instrument. This confirms the advantage of the synergies among different instruments, as previously indicated. The choice of instrument does not seem to be significant except in the case of information instruments that, interestingly, can lead to a lower reduction in demand (perhaps associated with its lower persistence).

Table 7. Average impact of energy efficiency policies in studies published in journals Q1 JCR, ex-post, with rebound and free riding

	GLS	Panel 1	Panel 2
Energy demand	-0.0323***	-0.0505***	-0.0517***

Note: *** 1% significance

Source: Own elaboration

In addition, studies analyzing energy efficiency policies applied on the residential and commercial sectors (especially the latter) estimate significantly greater demand reductions than do policies aimed at the economy as a whole[14], while policies on the industrial sector have significantly lower impacts. This result is interesting because, in general, residential and commercial energy demand shows lower elasticities and, therefore, one would expect fewer reductions in these sectors. One possible explanation is that, as the industrial sector is more elastic, energy efficiency policies are not as necessary or, rather, the policy's energy saving potential is lower. The residential and commercial sectors, less elastic but with many barriers to energy efficiency adoption, show better conditions for higher response to policies.

Concerning the country and the moment the policy is applied, reductions in energy demand are significantly higher when the efficiency level is lower (developing countries relative to the more

[13] We limit this analysis to the impact on energy demand given that observations concerning the effect on the price of the durable performing an ex-post analysis, considering the rebound effect and/or taking into account free riding are unavailable to us while the parameter of studies in Q1 JCR journals is insignificant.

[14] This can be explained by the fact that by definition these studies cannot take the macroeconomic rebound effect into account, while studies on impacts on the economy as a whole can do so.

developed countries and pre-1990 studies relative to current ones). Likewise, our results indicate that ex-post analyses show significantly smaller reductions than do ex-ante studies; thus, they overestimate the effects of energy efficiency policies. Moreover, studies that analyze future impacts of energy efficiency policies (2020-2029 and post-2030) show significantly larger reductions and increasing ex-ante bias.

Regarding the type of data used in the analysis, the use of aggregate and cross-section data leads to significantly lower demand reductions, while some evidence signals that studies based on experimental economics obtain larger reductions in energy demand probably due to the sample selection process. Likewise, studies that take the presence of free riders into account obtain significantly lower impacts on energy demand, with papers that take no heed of them overestimating policy impacts. Finally, in terms of the type of publication, articles published in journals show significantly larger reductions in energy demand, although some evidence points out that those published in journals Q1 JCR provide smaller reductions. The publications in Q1 journals also reflect a slightly larger standard deviation and a slightly smaller minimum[15].

Although most of the factors influencing the impact of energy efficiency policies on the price of associated durable goods are non-significant because of the small sample size, the model outcomes reinforce the results of the meta-analysis concerning the effects on energy demand. Considering that policies with the largest impact on the price of durables are expected to be those generating larger energy demand reductions, the meta-regression results indicate a larger impact in terms of prices on the commercial sector relative to the residential sector. This effect was also found in the case of energy demand, with a larger demand reduction from policies on the commercial sector relative to the residential sector.

[15] Although the estimated coefficient of the dummy proxying Q1 papers is only significant in GLS estimation.

Table 8. Final estimated parameters. Impact of energy efficiency policies on energy demand and the price of durables

Regressor	GLS		Panel 1		Panel 2	
	Energy demand	Price of durables	Energy demand	Price of durables	Energy demand	Price of durables
$\hat{\beta}$	-0.0880***	0.0702***	-0.0892***	0.0961***	-0.1045***	0.0954***
Standard	0.0031	0.0308	-	-	-0.0024	0.0332
Information instrument	0.0191**	-	-	-	0.0045	-
Instrument combination	-0.0001	-	-	-	-0.0257**	-
Residential	-0.0181***	-0.0178	-0.0026	-0.0330**	-0.0160**	-0.0289**
Industrial	-0.0032	-	0.0226**	-	0.0178**	-
Commercial/Public	-0.0384***	-	-0.0063	-	-0.0385***	-
Electricity	0.0077	0.0099	0.0022	0.0167	-	-
Gas	-0.0090	-	-0.0014	-	-	-
Liquid fuels	-0.0061	0.0283	0.0059	0.0110	-	-
Developing country	-0.0448***	-	-0.0401***	-	-0.0763***	-
Net energy exporting country	-0.0172*	0.0018	-0.0142	-0.0059	-0.0123	-0.0133
Local	0.0065	0.0196	0.0073	0.0303	0.0103	0.0249
Supranational	-0.0391**	-0.0082	-0.0685***	-0.0110	-0.0575***	-0.0208
Aggregate data	0.0042	-	0.0062	-	0.0226***	-
Cross section	0.0084	-0.0191	0.0394	-0.0219	0.0141**	-0.0218
Time series	0.0030	-	-0.0027	-	-0.0043	-
Experiment	-0.0150**	-	-0.0054	-	-0.0044	-
Ex-post	0.0142**	-	0.0192**	-	0.0298***	-
Rebound effect	-0.0091*	-	-0.0096	-	-0.0046	-
Free rider	0.0357***	-	0.0168**	-	0.0156**	-
Pre-1990	-0.0398***	-	-0.0275*	-0.0934**	-0.0162	-0.1107**
1990-1999	-0.0025	-	-0.0113	-	-0.0070	-
2000-2009	-0.0090*	0.0096	-0.0031	0.0038	-0.0006	0.0021
2020-2029	-0.0478***	-	-0.0158	-	-0.0267***	-
Post-2030	-0.0497***	-	-0.0638***	-	-0.0503***	-
No journal	0.0328***	-0.0330	0.0318***	-0.0130	0.0319***	-0.0042
Journal Q1	0.0148*	0.0063	0.0123	0.0202	0.0120	0.0237
Standard Error	-	0.5660***	-	0.1244	-	0.1560
Average (Residential)	-	-	-0.0128	-	-	-
Average (Commercial)	-	-	-0.0476***	-	-	-
Average (Aggregate data)	-	-	0.0068	-	-	-
Average (Cross section)	-	-	-0.0318	-	-	-
Average (2020-2030)	-	-	-0.0304	-	-	-
Average (Post-2030)	-	-	0.0186	-	-	-
Average (Developing Country)	-	-	-	-	0.0415	-
Joint significance	F(40,1320) = 28.5 (p-value = 0.000)		Wald$\chi^2(43)$ = 3009.6 (p-value = 0.000)		Wald$\chi^2(37)$ = 2690.7 (p-value = 0.000)	
R^2	0.46		0.34		0.34	

Notes: *** 1% significance; ** 5% significance; * 10% significance; For the sake of not losing efficiency, impacts on energy demand and the price of durables were jointly estimated while the regressor interacts with dummies for the type of study (energy demand / durable price). Total sector, energy, highly developed country, energy importing country, national scope, microeconomic and panel data, no experiment, ex-ante, no rebound effect, no free riding, 2010-2019 and journal no Q1 are the economic instrument base.

Source: Own elaboration

6. Conclusions and policy implications

Given the importance of energy savings for a successful transition to low-carbon societies and the existence of numerous barriers to their achievement, particularly in the residential and commercial sectors, it is imperative to design and implement intense public policies to promote energy efficiency. This design must consider the context in which these policies are applied to ensure their effectiveness and efficiency. In this respect, solid empirical evidence is fundamental because many of the interventions occur in suboptimal contexts in which theory is not always capable of correctly predicting results.

We believe that the results of this paper may contribute to a proper design and implementation of energy efficiency policies as, on the one hand, it provides information on the energy abatement potential of these policies. On the other hand, the paper identifies the factors that seem to contribute most to the reduction of energy demand.

Summing up, the first conclusion of the paper is that public policies in the energy efficiency domain are effective. The evidence shows that it is possible to achieve an 8-10% reduction in energy demand and a 7-9% increase in the price of durable goods through energy efficiency policies. However, it is important to emphasize that these results may be overestimated, mainly due to ex-ante biases, the rebound effect, and free riding. When we only use the results published in the best academic journals in terms of impact (with presumably higher reviewing standards) with ex-post approaches that take into account the rebound and free riding effect, we obtain a more robust estimation of energy demand reduction (between 3 and 5%). In this sense, our analysis points to the importance of considering the rebound and free riding effect when evaluating the expected effects of energy efficiency policies, as well as the need for ex-post evaluations that provide more realism and allow for more precise estimates of impacts that may be useful for customary policy adjustments.

It is striking that, for the considered sample, the choice of policy instrument has no impact, in clear contrast with the case of instruments that are combined to achieve synergies. The sector on which policies are applied does, however, make an impact. It seems to be much more effective to address residential and commercial sectors, which are more receptive to public policies promoting energy savings probably due to the prevalence of numerous barriers to their achievement. It is interesting to remember that many of these barriers may not necessarily be economic, and can therefore be addressed with low-cost information instruments even though further research on their persistence is required (see Ramos et al, 2015).

Finally we must point out that, despite the importance of the considered factors, we are unable to explain more than 50% of the impact of energy efficiency policies. Therefore, there is plenty of room to analyze other possible factors (such as the heterogeneity of consumers, technological availability, the interaction between design elements, etc.) that may determine the success or failure of these policies. Clearly further research is required in this area, which is sometimes undervalued against supply policies, crucial for a successful transition to a decarbonized energy system.

References

Abrahamse, W., Steg, L., Vlek, C., Rothengatter, T., 2005. A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology, 25, 273-291, https://doi.org/10.1016/j.jenvp.2005.08.002.

Adkins, L.C., Hill, R.C., 2011. Using Stata for Principles of Econometrics. Fourth Edition. John Wiley & Sons, New York.

Afshari, A., Friedrich, L., 2016. A proposal to introduce tradable energy savings certificates in the emirate of Abu Dhabi. Renewable and Sustainable Energy Reviews, 55, 1342-1351, https://doi.org/10.1016/j.rser.2015.05.086.

Andor, M.A., Fels, K.M., 2018. Behavioral economics and energy conservation – A systematic review of non-price intervention and their causal effects. Ecological Economics, 148, 178-210, https://doi.org/10.1016/j.ecolecon.2018.01.018.

Ankamah-Yeboah, I., Rehdanz, K., 2014. Explaining the variation in the value of building energy efficiency certificates: a quantitative meta-analysis. Kiel Working Paper nº1949, Kiel Institute for the World Economy.

Asensio, O.I., Delmas, M.A., 2016. The dynamics of behavior change: evidence from energy conservation. Journal of Economic Behavior& Organization, 126, 196-212, https://doi.org/10.1016/j.jebo.2016.03.012.

Banerjee, A., Solomon, B.D., 2003. Eco-labeling for energy efficiency and sustainability. Energy Policy, 31, 109-123, https://doi.org/10.1016/S0301-4215(02)00012-5.

Barker, T., Ekins, P., Foxon, T., 2007. Macroeconomic effects of efficiency policies for energy-intensive industries: The case of the UK Climate Change Agreements, 2000-2010. Energy Economics, 29, 760-778, https://doi.org/10.1016/j.eneco.2006.12.008.

Bennear, L.S., Stavins, R.N., 2007. Second-best theory and the use of multiple policy instruments. Environmental Resource Economics, 37, 111-129, https://doi.org/10.1007/s10640-007-9110-y.

Boza-Kiss, B., Moles-Grueso, S., Ürge-Vorsatz, D., 2013. Evaluating policy instruments to foster energy efficiency for the sustainable transformation of buildings. Current Opinion in Environmental Sustainability, 5, 163-176, https://doi.org/10.1016/j.cosust.2013.04.002.

Brown, M.J., Watkins, T., 2015. The “green premium” for environmentally certified homes: a meta-analysis and exploration. Working paper, available in: http://martinjohnbrown.net/wp-content/uploads/2016/02/green-premium-metaanalysis-2015-10-24-for-researchgate.pdf

Darby, S., 2006. The effectiveness of feedback on energy consumption. A review for DEFRA of the literature on metering, billing and direct displays. Environmental Change Institute, University of Oxford. https://www.eci.ox.ac.uk/research/energy/downloads/smart-metering-report.pdf (accessed 9 July 2019).

De Hoyos, R.E., Sarafidis, V., 2006. Testing for cross-sectional dependence in panel-data models. The Stata Journal, 6, 482-496, https://doi.org/10.1177/1536867X0600600403.

Delmas, M.A., Fischlein, M., Asensio, O.I., 2013. Information strategies and energy conservation behavior: A meta-analysis of experimental studies from 1975 to 2012. Energy Policy, 61, 729-739, https://doi.org/10.1016/j.enpol.2013.05.109.

Dermisi, S., 2009. Effect of LEED ratings and levels on office property assessed and market values. Journal of Sustainable Real Estate, 1, 23-47, https://doi.org/10.5555/jsre.1.1.m5767u246873523q.

Devine, A., Kok, N., 2015. Green certification and building performance: implications for tangibles and intangibles. The Journal of Portfolio Management, 41, 151-163, https://doi.org/10.3905/jpm.2015.41.6.151.

Doucouliagos, C., Stanley, T.D., 2013. Are all economic facts greatly exaggerated? Theory competition and selectivity. Journal of Economic Surveys, 27, 316-339, https://doi.org/10.1111/j.1467-6419.2011.00706.x.

Egger, M., Davey Smith, G., Schneider, M., Minder, C., 1997. Bias in meta-analysis detected by a simple, graphical test. British Medical Journal, 315, 629–634, https://doi.org/10.1136/bmj.315.7109.629.

Ehrhardt-Martinez, K., Donnelly, K.A., Laitner, J.A., 2010. Advanced metering initiatives and residential feedback programas: a meta-review for household electricity-saving opportunities. Report number E105, American Council for an Energy-Efficient Economy.

Feld, L.P., Heckemeyer, J.H., 2011. FDI and taxation: a meta-study. Journal of Economic Surveys, 25, 233-272, https://doi.org/10.1111/j.1467-6419.2010.00674.x.

Fischer, C., 2008. Feedback on household electricity consumption: a tool for saving energy? Energy Efficiency, 1, 79-104, https://doi.org/10.1007/s12053-008-9009-7.

Fizaine, F., Voye, P., Baumont, C., 2018. Does the literature support a high willingness to pay for green label buildings? An answer with treatment of publication bias. Revue D'Économie Politique, 128, 1013-1046, https://doi.org/10.3917/redp.285.1013.

Frederiks, E.R., Stenner, K., Hobman, E.V., 2015. Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour. Renewable and Sustainable Energy Reviews, 41, 1385-1394, https://doi.org/10.1016/j.rser.2014.09.026.

Gillingham, K., Newel, R., Palmer, K., 2006. Energy efficiency policies: a retrospective examination. Annual Review of Environment and Resources, 31, 161-192, https://doi.org/10.1146/annurev.energy.31.020105.100157.

Gillingham, K., Rapson, D., Wagner, G., 2016. The rebound effect and energy efficiency policy. Review of Environmental Economics and Policy, 10, 68–88, https://doi.org/10.1093/reep/rev017.

Giraudet, L.-G., Finon, D., 2015. European experiences with white certificate obligations: A critical review of existing evaluations. Economics of Energy and Environmental Policy, 4, 113-130, https://www.jstor.org/stable/26189477.

Greening, L.A., Greene, D.L., Difiglio, C., 2000. Energy efficiency and consumption – the rebound effect – a survey. Energy Policy, 28, 389-401, https://doi.org/10.1016/S0301-4215(00)00021-5.

Hahn, R., Metcalfe, R., 2016. The impact of behavioral science experiments on energy policy. Economics of Energy and Environmental Policy, 5, 27-44, http://dx.doi.org/10.5547/2160-5890.5.2.rhah.

Havranek, T., Kokes, O., 2015. Income elasticity of gasoline demand: A meta-analysis. Energy Economics, 47, 77–86, https://doi.org/10.1016/j.eneco.2014.11.004.

IEA (2018). World Energy Outlook 2018. IEA Publications, Paris.

IEA (2019). World Energy Prices 2019. IEA Publications, Paris.

Karlin, B., Zinger, J.F., Ford, R., 2015. The effects of feedback on energy conservation: a meta-analysis. Psychological Bulletin, 141, 1205-1227, http://dx.doi.org/10.1037/a0039650.

Labandeira, X., Labeaga, J.M., López-Otero, X., 2017. A meta-analysis on the price elasticity of energy demand. Energy Policy, 102, 549-68, https://doi.org/10.1016/j.enpol.2017.01.002.

Linares, P., Labandeira, X., 2010. Energy efficiency: economics and policy. Journal of Economic Surveys, 24, 573-592, https://doi.org/10.1111/j.1467-6419.2009.00609.x.

Maidment, C.D., Jones, C.R., Webb, T.L., Hathway, E.A., Gilbertson, J.M., 2014. The impact of household energy efficiency measures on health: A meta-analysis. Energy Policy, 65, 583-593, https://doi.org/10.1016/j.enpol.2013.10.054.

Maki, A., Burns, R.J., Ha, L., Rothman, A.J., 2016. Paying people to protect the environment: A meta-analysis of financial incentive interventions to promote pro-environmental behaviors. Journal of Environmental Psychology, 7, 242-255, https://doi.org/10.1016/j.jenvp.2016.07.006.

Markandya, A., Labandeira, X., Ramos, A., 2015. Policy instruments to foster energy efficiency, en Ansuategi, A., Delgado, J., Gallarraga, I. (eds.), Green Energy and Efficiency. An Economic Perspective. Springer, Heidelberg.

McKerracher, C., Torriti, J., 2013. Energy consumption feedback in perspective: integrating Australian data to meta-analyses on in-home displays. Energy Efficiency, 6, 387-405, https://doi.org/10.1007/s12053-012-9169-3.

Mudgal, S., Lyons, L., Cohen, F., Lyons, R., Fedrigo-Fazio, D., 2013. Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries. Final report prepared for European Commission (DG Energy). https://ec.europa.eu/energy/sites/ener/files/documents/20130619-energy_performance_certificates_in_buildings.pdf (accessed 9 July 2019).

Mundaca, L., Neij, L., 2010. A meta-analysis of bottom-up ex-ante energy efficiency policy evaluation studies. Proceedings of the 2010 International Energy Program Evaluation Conference, Paris, France.

Mundlak, Y., 1978. On the pooling of time series and cross section data. Econometrica, 46, 69-85, https://doi.org/10.2307/1913646.

Nadel, S., 1992. Utility demand-side management experience and potential – A critical review. Annual Review of Energy and the Environment, 17, 507-535, https://doi.org/10.1146/annurev.eg.17.110192.002451.

Nelson, J.P., Kennedy, P.E., 2009. The use (and abuse) of meta-analysis in environmental and natural resource economics: an assessment. Environmental Resource Economics, 42, 345-377, https://doi.org/10.1007/s10640-008-9253-5.

Palmer, T.M., Peters, J.L., Sutton, A.J., Moreno, S.G., 2008. Contour-enhanced funnel plots for meta-analysis. The Stata Journal, 8, 242-254, https://doi.org/10.1177/1536867X0800800206.

Pesaran, M. H. 2015. Testing weak cross-sectional dependence in large panels. Econometric Reviews 34, 1089-1117, https://doi.org/10.1080/07474938.2014.956623.

Ramos, A., Gago, A., Labandeira, X., Linares, P., 2015. The role of information for energy efficiency in the residential sector. Energy Economics, 52, S17-S29, https://doi.org/10.1016/j.eneco.2015.08.022.

Rosenow, J., Galvin, R., 2013. Evaluating the evaluations: Evidence from energy efficiency programmes in Germany and the UK. Energy and Buildings, 62, 450-458, https://doi.org/10.1016/j.enbuild.2013.03.021.

Rothstein, H. R., Sutton, A. J., Borenstein, M. (eds), 2005. Publication Bias in Meta-Analysis: Prevention, Assessment and Adjustments. John Wiley & Sons, Chichester, UK.

Scepanovic, S., Warnier, M., Nurminen, J.K., 2017. The role of context in residential energy interventions: A meta review. Renewable and Sustainable Energy Reviews, 77, 1146-1168, https://doi.org/10.1016/j.rser.2016.11.044.

Sorrell, S., 2007. The rebound effect: An assessment of the evidence for economy-wide energy savings from improved energy efficiency. UK Energy Research Centre, London.

Staddon, S.C., Cycil, C., Goulden, M., Leygue, C., Spence, A., 2016. Intervening to change behaviour and save energy in the workplace: A systematic review of available evidence. Energy Research and Social Science, 17, 30-51, https://doi.org/10.1016/j.erss.2016.03.027.

Stanley, T.D., Doucouliagos, H., Giles, M., Heckemeyer, J.H., Johnston, R.J., Laroche, P., Nelson, J.P., Paldam, M., Poot, J., Pugh, G., Rosenberger, R.S., Rost, K., 2013. Meta-analysis of economics research reporting guidelines. Journal of Economic Surveys, 27, 390-394, https://doi.org/10.1111/joes.12008.

Stanley, T.D., Jarrell, S.B., 1989. Meta-regression analysis: a quantitative method of literature surveys. Journal of Economic Surveys, 3, 161-170, https://doi.org/10.1111/j.1467-6419.1989.tb00064.x.

Train, K.E., 1994. Estimation of net savings from energy-conservation programs. Energy, 19, 423-441, https://doi.org/10.1016/0360-5442(94)90121-X.

United Nations Development Program (UNDP), 2019. Human development index trends. http://hdr.undp.org/en/composite/trends (accessed 9 July 2019)

Ürge-Vorsatz, D., Koeppel, S., Mirasgedis, S., 2007. Appraisal of policy instruments for reducing buildings' CO_2 emissions. Building Research and Information, 35, 458-477, https://doi.org/10.1080/09613210701327384.

Wiese, C., Larsen, A., Pade, L.-L., 2018. Interaction effects of energy efficiency policies: A review. Energy Efficiency,11, 2137-2156, https://doi.org/10.1007/s12053-018-9659-z.

World Bank, 2019. Energy imports, net (% of energy use). https://data.worldbank.org/indicator/EG.IMP.CONS.ZS (accessed 9 July 2019)

Xu, L., Liu, J., Pei, J., Han, X., 2013. Building energy savings potential in hot summer and cold winter (HSCW) zone, China – Influence of building energy efficiency standards and implications. Energy Policy, 57, 253-262, https://doi.org/10.1016/j.enpol.2013.01.048.

ANNEX A. Estimation results

Table A1. Estimated parameters Impact on energy demand and the price of durables

Regressor	GLS		Panel 1		Panel 2	
	Energy demand	Price of durables	Energy demand	Price of durables	Energy demand	Price of durables
$\hat{\beta}$	-0.08797***	0.09736***	-0.10457***	0.09746***	-0.10273***	0.09642***
Standard	0.00315	0.02619	-	-	-0.00235	0.03180
Information instrument	0.01915**	-	-	-	0.00450	-
Instrument combination	-0.00008	-	-	-	-0.02617***	-
Residential	-0.01807***	-0.02885*	-0.01226*	-0.03442	-0.01679**	-0.02990
Industrial	-0.00319	-	0.01585	-	0.01731*	-
Commercial/Public	-0.03839***	-	-0.03385***	-	-0.03917***	-
Electricity	0.00769	0.03067	0.00278	0.02005	-	-
Gas	-0.00902	-	-0.00098	-	-	-
Liquid fuels	-0.00608	0.02569	0.00745	0.01074	-	-
Developing country	-0.04483***	-	-0.03645***	-	-0.03803***	-
Net energy exporting country	-0.01723*	-0.01458	-0.01156	-0.00357	-0.01224	-0.01219
Local	0.00646	0.03394	0.00451	0.03058	0.01042*	0.02535
Supranational	-0.03915**	-0.01788	-0.06179***	-0.00803	-0.05463***	-0.01829
Aggregate data	0.00418	-	0.01525**	-	0.02225***	-
Cross section	0.00840	-0.02795	0.01148	-0.02252	0.01427*	-0.02246
Time series	0.00298	-	-0.00312	-	-0.00379	-
Experiment	-0.01497**	-	-0.00374	-	-0.00439	-
Ex-post	0.01419**	-	0.02701***	-	0.02946***	-
Rebound effect	-0.00912*	-	-0.00717	-	-0.00488	-
Free rider	0.03575***	-	0.02002**	-	0.01556*	-
Pre-1990	-0.03984***	-	-0.02652*	-0.09753	-0.01662	-0.11070
1990-1999	-0.00250	-	-0.01006	-	-0.00733	-
2000-2009	-0.00903*	0.01196	-0.00125	0.00685	-0.00103	0.01837
2020-2029	-0.04776***	-	-0.03319***	-	-0.02726***	-
Post-2030	-0.04967***	-	-0.05047***	-	-0.05035***	-
No journal	0.03278***	-0.03615	0.03185***	-0.01432	0.03138***	-0.00378
Journal Q1	0.01485*	0.01010	0.01400*	0.02217	0.01180	0.02662
Joint significance	$F(39,1321) = 27.8$ (p-value=0.0000)		Wald$\chi^2(36)$=715.2 (p-value=0.0000)		Wald$\chi^2(35)$=720.7 (p-value=0.0000)	
R^2	0.43		0.33		0.34	

Notes: *** 1% significance; ** 5% significance; *10% significance. To avoid efficiency loss, energy demand and the price of durable goods were jointly estimated for each methodology while the regressors interacted with dummies for the type of study (energy demand/price of durable goods).

Table A2. Hausman Test. Fixed effects vs. random effects

Regressor	Difference (fixed effects-random effects)	
	Panel 1	Panel 2
Standard	-	-0.00760
Information instrument	-	-0.00343
Instrument combination	-	-0.00400
Residential	0.01536***	0.00759
Industrial	0.00490	0.01497
Commercial/Public	0.01574**	0.01010
Electricity	-0.00405	-
Gas	-0.00765	-
Liquid fuels	0.00227	-
Developing country	0.00373	0.01837**
Net energy exporting country	-0.00521	-0.00108
Local	-0.00227	0.00341
Supranational	-0.00551	0.00175
Aggregate data	0.01998***	-0.00638
Cross section	-0.01046*	0.00639
Time series	-0.01107	0.01334
Experiment	-0.00546	0.00685
Ex-post	-0.00097	-0.00243
Rebound effect	-0.00656	0.01079
Free rider	0.00412	0.00176
Pre-1990	-0.01126	-0.00676
1990-1999	-0.00946	0.00050
2000-2009	-0.00225	0.00331
2020-2029	-0.01483*	-0.00977
Post-2030	-0.01853**	0.00486
No journal	0.00537	0.01380*
Journal Q1	0.00523	0.00276

Note: *** 1% significance; ** 5% significance; * 10% significance

Table A3. Impact on energy demand. Estimated parameters robust to intra-class correlation

Regressor	Panel 1	Panel 2
$\hat{\beta}$	-0.08846***	-0.10441***
Standard	-	-0.00217
Information instrument	-	0.00462
Instrument combination	-	-0.02553***
Residential	-0.00092	-0.01608**
Industrial	0.02308**	0.01031*
Commercial/Public	-0.00496	-0.03862***
Electricity	0.00212	-
Gas	-0.00168	-
Liquid fuels	0.00598	-
Developing country	-0.04024***	-0.07680***
Net energy exporting country	-0.01436	-0.01234
Local	0.00680	0.01023*
Supranational	-0.06810***	-0.05756***
Aggregate data	0.00865	0.02274***
Cross section	0.03828	0.01398*
Time series	-0.00278	-0.00457

Experiment	-0.00539	-0.00453
Ex-post	0.01877**	0.02983***
Rebound effect	-0.00988	-0.00476
Free rider	0.01645*	0.01567*
Pre-1990	-0.02773*	-0.01608
1990-1999	-0.01132	-0.00707
2000-2009	-0.00299	-0.00069
2020-2029	-0.01613	-0.02659***
Post-2030	-0.06395***	-0.05031***
No journal	0.03171***	0.03182***
Journal Q1	-0.01250	0.01204
Average (Residential)	-0.01445	-
Average (Commercial)	-0.04849***	-
Average (Aggregate data)	0.00418	-
Average (Cross section)	-0.03114	-
Average (2020-2030)	-0.03036	-
Average (Post-2030)	0.01838	-
Average (Developing country)	-	0.04179
Joint significance	Wald$\chi^2(30)$=307.0 (p-value=0.0000)	Wald$\chi^2(30)$=333.4 (p-value=0.0000)
R^2	0.19	0.21

Note: *** 1% significance; ** 5% significance; *10% significance

Table A4. Pesaran test for weak cross-sectional dependence

	Energy		Durables price	
	Panel 1	Panel 2	Panel 1	Panel 2
CD	154.633	241.923	11.874	9.603
p-value	0.000	0.000	0.000	0.000

Note: Ho errors are weakly cross-sectional dependent

Table A5. Estimated parameters robust to cross-sectional dependence

Regressor	Panel 1		Panel 2	
	Energy demand	Price of durables	Energy demand	Price of durables
$\hat{\beta}$	-0.10457***	0.09746***	-0.10273***	0.09642***
Standard	-	-	-0.00235	0.03180
Information instrument	-	-	0.00450	-
Instrument combination	-	-	-0.02617***	-
Residential	-0.01226	-0.03442**	-0.01679**	-0.02990**
Industrial	0.01585*	-	0.01731*	-
Commercial / Public	-0.03385***	-	-0.03917***	-
Electricity	0.00278	0.02005	-	-
Gas	-0.00098	-	-	-
Liquid fuels	0.00745	0.01074	-	-
Developing country	-0.03645***	-	-0.03803***	-
Net Energy Exporting Country	-0.01156	-0.00357	-0.01224	-0.01219
Local	0.00451	0.03058	0.01042	0.02535
Supranational	-0.06179***	-0.00803	-0.05463***	-0.01829
Aggregate data	0.01525*	-	0.02225***	-
Cross section	0.01148	-0.02252	0.01427**	-0.02246
Time series	-0.00312	-	-0.00379	-
Experiment	-0.00374	-	-0.00439	-

Ex-post	0.02701***	-	0.02946***	-
Rebound effect	-0.00717	-	-0.00488	-
Free rider	0.02002***	-	0.01556**	-
Pre-1990	-0.02652*	-0.09753**	-0.01662	-0.11070**
1990-1999	-0.01006	-	-0.00733	-
2000-2009	-0.00125	0.00685	-0.00103	0.01837
2020-2029	-0.03319***	-	-0.02726***	-
Post-2030	-0.05047***	-	-0.05035***	-
No journal	0.03185***	-0.01432	0.03138***	-0.00378
Journal Q1	0.01400	0.02217	0.01180	0.02662
Joint significance	Waldχ^2(36)=2930.2 (p-value=0.0000)		Waldχ^2(35)=2693.8 (p-value=0.0000)	
R^2	0.33		0.34	

Notes: *** 1% significance; ** 5% significance; *10% significance. To avoid efficiency loss, energy demand and the price of durable goods were jointly estimated for each methodology while the regressors interacted with dummies for the type of study (energy demand/price of durable goods).

Table A6. Egger's test for small-study effects

	Energy demand		Price of durables	
	Journals	All the sample	Journals	All the sample
Bias	-3.3987***	-4.4757	4.2290***	3.6395***

Note: ***1% significance

Table A7. Impact on the price of durables. Estimated parameters robust to publication bias

Regressor	GLS Price of durables	Panel 1 Price of durables	Panel 2 Durables price
$\hat{\beta}$	0.07021***	0.09618***	0.09567***
Standard	0.03079	-	0.03338
Residential	-0.01785	-0.03316	-0.02921
Electricity	0.00992	0.01529	-
Liquid fuels	0.02833	0.01089	-
Net energy exporting country	0.00180	-0.00482	-0.01360
Local	0.01957	0.03016	0.02551
Supranational	-0.00822	-0.01088	-0.02055
Cross section	-0.01913	-0.02189	-0.02216
Pre-1990	-	-0.09181	-0.11102
2000-2009	0.00965	0.00401	0.00225
No journal	-0.03300	-0.01338	-0.00398
Journal Q1	0.00629	0.02036	0.02393
Standard error	0.56601***	0.11936	0.15505
Joint significance	F(40,1320) =28.5 (p-value=0.0000)	Waldχ^2(37)=715.6 (p-value=0.0000)	Waldχ^2(36)=722.6 (p-value=0.0000)
R^2	0.46	0.33	0.34

Notes: *** 1% significance; ** 5% significance; *10% significance. To avoid efficiency loss, energy demand and the price of durable goods were jointly estimated for each methodology while the regressors interacted with dummies for the type of study (energy demand/price of durable goods).

Table A8. Impact on energy demand (articles published in journals). Estimated parameters

Regressor	MCG	Panel 1	Panel 2
$\hat{\beta}$	-0.09936***	-0.11470***	-0.09875***
Standard	0.00575	-	-0.00779
Information instrument	-0.01204	-	0.00413
Instrument combination	-0.02221	-	-0.03015**
Residential	-0.00966	0.00930	-0.00741
Industrial	-0.00353	0.04618**	0.04457**
Commercial/Public	-0.04091**	-0.03895**	-0.04490***
Electricity	0.01902*	0.01646	-
Gas	0.00026	0.00572	-
Liquid fuels	0.00278	0.01158	-
Developing country	-0.04572***	-0.03912***	-0.03593***
Net energy exporting country	0.02224**	0.03082**	0.03309**
Local	-0.01161	-0.01766	-0.01599
Supranational	-0.09312***	-0.13090***	-0.11998***
Aggregate data	0.02221*	0.03786***	0.04378***
Cross section	-0.00272	-0.02291**	-0.02069*
Time series	-0.11723	-0.04926***	-0.04277***
Experiment	-0.01693	-0.01149	-0.00741
Ex-post	0.04267***	0.03754***	0.03472**
Rebound effect	-0.01405	-0.02168**	-0.01956*
Free rider	0.01640	0.02118*	0.02006
Pre-1990	-0.04413***	-0.04297**	-0.02750
1990-1999	-0.00279	-0.00555	0.00166
2000-2009	-0.00318	-0.00041	0.00253
2020-2029	-0.02900*	0.01115	0.01168
Post-2030	-0.05552***	-0.05934***	-0.06070***
Journal Q1	0.01572*	0.02341**	0.01626*
Joint significance	$F(26, 517) = 6.4$ (p-value=0.0000)	Wald$\chi^2(23)$=225.2 (p-value=0.0000)	Wald$\chi^2(23)$=224.8 (p-value=0.0000)
R^2	0.24	0.29	0.30

Note: *** 1% significance; ** 5% significance; *10% significance

ANNEX B. Literature used in the meta-analysis

Abeelen, C., Harmsen, R., Worrell, E., 2013. Implementation of energy efficiency projects by Dutch industry. Energy Policy, 63, 408-418.

Abrahamse, W., Steg, L., Vlek, C., Rothengatter, T., 2007. The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. Journal of Environmental Psychology, 27, 265-276.

Adan, H., Fuerst, F., 2016. Do energy efficiency measures really reduce household energy consumption? A difference-in difference analysis. Energy Efficiency, 9, 1207-1219.

Af Wahlberg, A.E., 2007. Long-term effects of training in economical driving: fuel consumption, accidents, driver acceleration behavior and technical feedback. International Journal of Industrial Ergonomics, 37, 333-343.

Afshari, A., Friedrich, L., 2016. A proposal to introduce tradable energy savings certificates in the emirate of Abu Dhabi. Renewable and Sustainable Energy Reviews, 55, 1342-1351.

Agarwal, S., Rangarajan, S., Sing, T.F., Yang, Y., 2017. Nudges from school children and electricity conservation: evidence from the “project carbon zero” campaign in Singapore. Energy Economics, 61, 29-41.

Alahmad, M.A., Wheeler, P.G., Schwer, A., Eiden, J., Brumbaugh, A., 2012. A comparative study of three feedback devices for residential real-time energy monitoring. IEE Transactions on Industrial Electronics, 59, 2002-2013.

Alberini, A., Bareit, M., Filippini, M., 2014. Does the Swiss car market reward fuel efficient cars? Evidence from hedonic pricing regressions, matching and a regression discontinuity design. Economics Working Paper series 14/190, CER-ETH.

Alberini, A., Gans, W., Towe, C., 2016. Free riding, upsizing, and energy efficiency incentives in Maryland homes. Energy Journal, 37, 259-290.

Aldy, J., Houde, S., Nazar, H., 2013. Did the stimulus benefit the environment? New evidence from cash for appliances. Working paper, available at: https://web.stanford.edu/group/SITE/SITE_2013/2013_segment_6/2013-segment_6_papers/houde.pdf

AlFaris, F., Juaidi, A., Manzano-Agugliano, F., 2016. Improvement of efficiency through an energy management program as a sustainable practice in schools. Journal of Cleaner Production, 135, 794-805.

Allcott, H., 2011. Social norms and energy conservation. Journal of Public Economics, 95, 1082-1095.

Allen, D., Janda, K., 2006. The effects of household characteristics and energy use consciousness on the effectiveness of real-time energy use feedback: a pilot study. Proceedings of the ACEEE summer study on energy efficiency in buildings.

Apex Analytics, 2016. Energy Trust of Oregon smart thermostar pilot evaluation. Report prepared for Energy Trust of Oregon.

Architectural Energy Corporation, 2007. 2008 update to the California energy effiency standards for residential and nonresidential buildings. Report prepared for California Energy Commission.

Arimura, T.H., Li, S., Newell, R.G., Palmer, K., 2012. Cost-effectiveness of electricity energy efficiency programs. Energy Journal, 33, 63-99.

Aroonruengsawat, A., Auffhammer, M., Sanstad, A.H., 2012. The impact of state level building codes on residential electricity consumption. Energy Journal, 33, 31-52.

Aroul, R., Hansz, J.A., 2012. The value of “green”: evidence from the first mandatory residential green building program. Journal of Real Estate Research, 34, 27-49.

Arvola, A., Uutela, A., Anttila, U., 1993. Billing feedback as means to encourae household electricity conservation: a field experiment in Helsinki. Summer study of the European Council for an Energy-Efficient Economy.

Asensio, O.I., Delmas, M.A., 2016. The dynamics of behavior change: evidence from energy conservation. Journal of Economic Behavior & Organization, 126, 196-212.

Asensio, O.I., Delmas, M.A., 2015. Nonprice incentives and energy conservation. Proceedings of the National Academy of Sciences, 112, E510-E515.

Augustus de Melo, C., de Martino Jannuzzi, G., 2010. Energy efficiency standards for refrigerators in Brazil: a methodology for impact evaluation. Energy Policy, 38, 6545-6550.

Austin, D., Dinan, T., 2005. Clearing the air: the costs and consequences of higher CAFE standards and increased gasoline taxes. Journal of Environmental Economics and Management, 50, 562-582.

Aydin, E., Brounen, D., 2019. The impact of policy on residential energy consumption. Energy, 169, 115-129.

Aydin, E., Kok, N., Brounen, D., 2017. Energy efficiency and household behavior: the rebound effect in the residential sector. RAND Journal of Economics, 48, 749-782.

Ayres, I., Raseman, S., Shih, A., 2013. Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage. The Journal of Law, Economics, and Organization, 29, 992-1022.

Bager, S., Mundaca, L., 2017. Making 'smart meters' smarter? Insights from a behavioural economic pilot field experiment in Copenhagen, Denmark. Energy Research & Social Science, 28, 68-76.

Barbetta, G.P., Canino, P., Cima, S., 2015. The impact of energy audits on energy efficiency investment of public owners. Evidence from Italy. Energy, 93, 1199-1209.

Barbose, G.L., Goldman, C.A., Hoffman, I.M., Billingsley, M., 2013. The future of utility customer-funded energy efficiency programs in the USA: projected spending and savings to 2025. Energy Efficiency, 6, 475-793.

Barker, T., Ekins, P., Foxon, T., 2007. Macroeconomic effects of efficiency policies for energy-intensive industries: the case of the UK climate change agreements, 2000-2010. Energy Economics, 29, 760-778.

Bekker, M.J., Cumming, T.D., Osborne, N.K.P., Bruining, A.M., McClean, J.I., Leland, L.S., 2010. Encouraging electricity savings in a university residential hall through a combination of feedback, visual prompts, and incentives. Journal of Applied Behavior Analysis, 43, 327-331.

Belzer, D.B., Cort, K.A., Winiarski, D.W., Richman, E.E., Friedrich, M., 2002. Analysis of potential benefits and costs of adopting ASHRAE standard 90.1-1999 as building energy code in Illinois jurisdictions. PNNL-13870, Pacific Northwest National Laboratory.

Bento, A.M., Goulder, L.H., Jacobsen, M.R., von Haefen, R.H., 2009. Distributional and efficiency impacts of increased US gasoline taxes. American Economic Review, 99, 667-699.

Berry, D., 2008. The impact of energy efficiency programs on the growth of electricity sales. Energy Policy, 36, 3620-3625.

Beusen, B., Broekx, S., Denys, T., Beckx, C., Degraeuwe, B., Gijsbers, M., Scheepers, K., Govaerts, L., Torfs, R., Panis, L.I., 2009. Using on-board logging devices to study the longer-term impact of an eco-driving course. Transportation Research Part D, 14, 514-520.

Bezdek, R.H., Wendling, R.M., 2005. Potential long-term impacts of changes in US vehicle fuel efficiency standards. Energy Policy, 33, 407-419.

Bjørner, T.B., Jensen, H.H., 2002. Energy taxes, voluntary agreements and investment subsidies – a micro-panel analysis of the effect on Danish industrial companies' energy demand. Resource and Energy Economics, 24, 229-249.

Bjørnstad, E., Helgesen, P.I., 2013. Long term market transformation from a short term subsidy: energy savings from residential air-to-air heat pumps in Norway. Paper presented at the 2013 International Energy Program Evaluation Conference, Chicago.

Bond, S.A., Devine, A., 2016. Certification matters: is green talk cheap talk? The Journal of Real Estate Finance and Economics, 52, 117-140.

Bongardt, D., Kebeck, K., 2006. Evaluation of the ACEA agreement. AID-EE Project, Ecofys.

Boogen, N., Datta, S., Filippini, M., 2017. Demand-side management by electric utilities in Switzerland: analyzing its impact on residential electricity demand. Energy Economics, 4, 402-414.

Boonekamp, P.G.M., 2006. Actual interaction effects between policy measures for energy efficiency – a qualitative matrix method and quantitative simulation results for households. Energy, 31, 2848-2873.

Bortoni, E.C., Nogueira, L.A.H., Cardoso, R.B., Haddad, J., Souza, E.P., Dias, M.V.X., Yamachita, R.A., 2013. Assessment of the achieved savings from induction motors energy efficiency labeling in Brazil. Energy Conversion and Management, 75, 734-740.

Brännlund, R., 2013. The effects on energy saving from taxes on motor fuels: the Swedish case. CERE Working Paper, 2013:6.

Brounen, D., Kok, N., 2011. On the economics of energy labels in the housing market. Journal of Environmental Economics and Management, 62, 166-179.

Brown, D. (ed.), 2002. Effectiveness and impact of Corporate Average Fuel Economy (CAFE) standards. Board on Energy and Environmental Systems, Transportation Research Board, National Research Council.

Brown, M.A., White, D.L., 1992. Evaluation of Bonneville's 1988 and 1989 residential weatherization program: a northwest study of program dynamics. ORNL/CON-323, Oak Ridge National Laboratory.

Bruegge, C., Carrión-Flores, C., Pope, J.C., 2016. Does the housing market value energy efficient homes? Evidence from the energy star program. Regional Science and Urban Economics, 57, 63-76.

Cabrera, D., Seal, T., Bertholet, J.-L., Lachal, B., Jeanneret, C., 2012. Evaluation of energy efficiency program in Geneva. Energy Efficiency, 5, 87-96.

Carrico, A.R., Riemer, M., 2011. Motivating energy conservation in the workplace: an evaluation of the use of group-level feedback and peer education. Journal of Environmental Psychology, 31, 1-13.

Carroll, J., Lyons, S., Denny, E., 2014. Reducing household electricity demand through smart metering: The role of improved information about energy saving. Energy Economics, 45, 234-243.

Chang, A.T., Yeung, V.C.H., 2005. Implementing buidings energy codes in Hong Kong: energy savings, environmental impacts and cost. Energy and Buildings, 37, 631-642.

Chapman, R., Howden-Chapman, P., Viggers, H., O'Dea, D., Kennedy, M., 2009. Retrofitting houses with insulation: a cost-benefit analysis of a randomized community trial. Journal of Epidemiology and Community Health, 63, 271-277.

Chedwal, R., Mathur, J., Agarwal, G.D., Dhaka, S., 2015. Energy saving potential through Energy Conservation Building Code and advance energy efficiency measures in hotel buildins of Jaipur City, India. Energy and Buildings, 92, 282-295.

Chegut, A., Eichholtz, P., Kok, N., 2014. Supply, demand and the value of green buildings. Urban Studies, 51, 22-43.

Chen, H., Lee, W.L., Wang, X., 2015. Energy assessment of office buildings in China using China building energy codes and LEED 2.2. Energy and Buildings, 86, 514-524.

Chen, V.L., Delmas, M.A., Locke, S.L., Singh, A., 2017. Information strategies for energy conservation: a field experiment in India. Energy Economics, 68, 215-227.

Chirarattananon, S., Chaiwiwatworakul, P., Hien, V.D., Rakkwamsuk, P., Kubaha, K., 2010. Assessment of energy savings from the revised building energy code of Thailand. Energy, 35, 1741-1753.

Chirarattananon, S., Chaiwiwatworakul, P., Hien, V.D., Rakkwamsuk, P., Kubaha, K., 2007. Revised building energy code of Thailand: potential energy savins. Proceedings of sustainable building South-East Asia, Kuala Lumpur, Malaysia.

Chirarattananon, S., Limmeechokchai, B., 1994. A new building energy-efficiency law in Thailand: impact on new buidings. Energy, 19, 269-278.

Commission for Energy Regulation, 2011. Electricity smart metering customer behavior trials (CBT) findings report. Information paper, CERT11080a, Comission for Energy Regulation, Ireland.

Constantine, S., Denver, A., Hakim, S., McMahon, J.E., Rosenquist, G., 1999. Ghana residential energy use and appliance ownership survey: Final report on the potential impact of appliance performance standards in Ghana. LBLN-43069, Lawrence Berkeley National Laboratory, University of California Berkeley.

Cort, K.A., Belzer, D.B., 2004. Statewide savings projections from the adoption of a commercial building energy code in Illinois: updated to reflect current utility rates. PNNL-14611, Pacific Northwest National Laboratory.

Cort, K.A., Belzer, D.B., Winiarski, D.W., Richman, E.E., 2002. Analysis of potential benefits and costs of updating the commercial building energy code in Iowa. PNNL-14016, Pacific Northwest National Laboratory.

Costa, D.L., Kahn, M., 2013. Energy conservation "nudges" and environmentalist ideology: evidence from a randomized residential electricity field experiment. Journal of the European Economic Association, 11, 680-702.

Davis, L.W., Fuchs, A., Gertler, P., 2014. Cash for coolers: evaluating a large-scale appliance replacement program in Mexico. American Economic Journal: Economic Policy, 6, 207-238.

Davis, M., 2011. Behavior and energy savings. Evidence from a series of experimental interventions. Evironmental Defense Fund.

Davis, W.B., Levine, M.D., Train, K., 1995. Effects of feebates on vehicle fuel economy, carbon dioxide emissions, and consumer surplus. Energy Efficiency in the U.S. Economy, Technical Report Two, U,S. Department of Energy Office Policy.

De Ayala, A., Galarraga, I., Spadaro, J.V., 2016. The price of energy efficiency in the Spanish housing market. Energy Policy, 94, 16-24.

De Visser, E., Harmsen, R., Harmelink, M., 2006. Evaluation of the energy investment deduction scheme in the Netherlands. AID-EE Project, Ecofys.

Deason, J., Hobbs, A., 2011. Codes to cleaner buildings. Effectiveness of U.S. building energy codes. Climate Policy Initiative Report.

Degraeuwe, B., Beusen, B., 2013. Corrigendum on the paper "Using on-board data logging devices to study the longer-term impact of an eco-driving course". Transportation Research Part D, 19, 48-49.

Delmas, M.A., Lessem, N., 2014. Saving power to conserve your reputation? The effectiveness of private versus public information. Journal of Environmental Economics and Management, 67, 353-370.

Deng, Y., Li, Z., Quingley, J.M., 2012. Economic returns to energy-efficient investments in the housing market: evidence from Singapore. Regional Science and Urban Economics, 42, 506-515.

Deng, Y., Wu, J., 2014. Economic returns to residential green building investment: the developers' perspective. Regional Science and Urban Economics, 47, 35-44.

Dermisi, S., 2009. Effect of LEED ratings and levels on office property assessed and market values. Journal of Sustainable Real Estate, 1, 23-47.

Devine, A., Kok, N., 2015. Green certification and building performance: implications for tangibles and intangibles. The Journal of Portfolio Management, 41, 151-163.

Dhaka, S., Mathur, J., Garg, V., 2012. Combined effect of energy efficiency measures and thermal adaptation on air conditioner building in warm climatic conditions of India. Energy and Buildings, 55, 351-360.

Diamond, R., Opitz, M., Von Neida, B., Herrera, S., 2006. Evaluating the energy performance of the first generation of LEED-certified commercial buildings. ACEEE Summer Study on Energy Efficiency in Buildings, American Council for an Energy-Efficient Economy.

Dineen, D., Ó Gallachóir, B.P., 2011. Modelling the impacts of buiding regulations and a property bubble on residential space and water heating. Energy and Buildings, 43, 166178.

Dobson, J.K., Griffin, J.D.A., 1992. Conservation effect of immediate electricity cost feedback on residential consumption behaviour. American Council Energy-Efficient Economy Summer Study.

Dolan, P., Metcalfe, R., 2015. Neighbors, knowledge, and nuggets: two natural field experiments on the role of incentives on energy conservation. Becker Friedman Institute for Research in Economics Working Paper nº 2589269.

Dulleck, U., Kaufmann, S., 2004. Do customer information programs reduce household electricity demand? – The Irish program. Energy Policy, 32, 1025-1032.

Dutt, G.S., Lutz, W.F., McNeil, M.A., Tanides, C.G., 2008. Proyecto de eficiencia energética en la República Argentina. Diseño de un programa de etiquetado y normalización de eficiencia energética. Secretaría de Energía de la Nación República Argentina. Dirección Nacional de Promoción.

Dutt, G.S., Tanides, C.G., Gonzále, E.D., Evans, J.M., de Schiller, S., Iglesias Furfaro, H., 2006. Análisis del potencial de reducción de emisiones de gases de efecto invernadero en el sector eléctrico de la República Argentina. (Parte I: la eficiencia energética). Informe preparado por Esenerg S.A. para la Fundación Vida Silvestre Argentina y para el WWF.

Economics for Energy, 2011. Potencial económico de reducción de la demanda de energía en España. Informe 2011, Economics for Energy.

Eichholtz, P., Kok, N., Quigley, J.M., 2013. The economics of green building. The Review of Economics and Statistics, 95, 50-63.

Eichholtz, P., Kok, N., Quigley, J.M., 2010a. Doing well by doing good? Green office buildings. The American Economic Review, 100, 2492-2509.

Eichholtz, P., Kok, N., Quigley, J.M., 2010b. Sustainability and the dynamics of green buildings: new evidence on the financial performance of green office buildings in the USA. RICS Research, London.

Elliot, R.N., Eldridge, M., Shipley, A.M., Laitner, J., Nadel, S., Fairey, P., Vieira, R., Sonne, J., Silverstein, A., Hedman, B., Darrow, K., 2007. Potential for energy efficiency and renewable energy to meet Florida's growing energy demands. Report number E072, American Council for an Energy-Efficient Economy.

Elliot, R.N., Shipley, A.M., Nadel, S., Brown, E., 2003. Natural gas price effects of energy efficiency and renewable practices and policies. Report number E032, American Council for an Energy-Efficient Economy.

Elsland, R., Divrak, C., Fleiter, T., Wietschel, M., 2014. Turkey's strategic energy efficiency plan – an ex ante impact assessment of the residential sector. Energy Policy, 70, 14-29.

Elsland, R., Schlomann, B., Eichhammer, W., 2013. Is enough electricity being saved? Impact of energy efficiency policies addressing electrical household appliances in Germany until 2030. ECEEE Summer Study on Energy Efficiency, Hyères.

EPRI, 2009. Assessment of achievable potential from energy efficiency and demand response programs in the U.S. (2010-2030). Electric Power Research Institute, California.

Ericsson, K., 2006. Evaluation of the Danish voluntary agreements on energy efficiency in trade and industry. AID-EE Project, Ecofys.

European Commission, 2014. Commission staff working document. Impact assessment. COM (2014) 15 final.

Feng, W., Huang, K., Levine, M., Zhou, N., Zhang, S., 2014. Evaluation of energy savings of new Chinese commercial building energy standard. 2014 ACEEE Summer Study on Energy Efficiency in Buildings. The American Council for an Energy-Efficient Economy.

FIAT, 2010. Eco-driving uncovered. The benefits and challenges of eco-driving, based on the first study using real journey data. Available at: http://www.futuremobilitynow.com/assets/ECO-DRIVING_UNCOVERED_full_report_2010_EN.pdf

Filippini, M., Hunt, L.C., Zoric, J., 2014. Impact of energy policy instruments on the estimated level of underlying energy efficiency in the EU residential sector. Energy Policy, 69, 73-81.

Filippini, M., Zhang, L., 2018. Impacts of heat metering and efficiency retrofit policy on residential energy consumption in China. Environmental Economics and Policy Studies, 1-14.

Fischer, C., Harrington, W., Parry, I.W.H., 2007. Should automobile fuel economy standards be tightened? Energy Journal, 28, 1-29.

Fleiter, T., Gruber, E., Eichhammer, W., Worrell, E., 2012. The German energy audit program for firms – a cost-effective way to improve energy efficiency? Energy Efficiency, 5, 447-469.

Forfori, F., 2006. Evaluation of the British energy efficiency commitment. AID-EE Project, Ecofys.

Fowlie, M., Greenstone, M., Wolfram, C.D., 2015. Do energy efficiency investments deliver? Evidence from the weatherization assistance program. NBER Working paper nº 21331.

Fridley, D., Aden, N., Zhou, N., Lin, J., 2007. Impacts of China's current appliance standards and labeling program to 2020. LBNL-62802, Lawrence Berkeley National Laboratory.

Fuerst, F., Gabrieli, T., McAllister, P., 2017. A green winner's curse? Investor behavior in the market for eco-certified office buildings. Economic Modelling, 61, 137-146.

Fuerst, F., McAllister, P., 2011a. Eco-labeling in commercial office markets: do LEED and Energy Star offices obtain multiple premiums? Ecological Economics, 70, 1220-1230.

Fuerst, F., McAllister, P., 2011b. Green noise or green value? Measuring the effects of environmental certification on office values. Real Estate Economics, 39, 45-69.

Fuerst, F., McAllister, P., Nanda, A., Wyatt, P., 2016. Energy performance ratings and house prices in Wales: An empirical study. Energy Policy, 92, 20-33.

Fuerst, F., Shimizu, C., 2016. Green luxury goods? The economics of eco-labels in the Japanese housing market. Journal of the Japanese and International Economies, 39, 108-112.

Fyfe, J., Milne, G., Mohr, S., Rickwood, P., Jackson, M., 2014. Savings analysis of the home power savings program – Phase 2, prepared for the NSW Office of Environment and Heritage by the Institute for Sustainable Futures, UTS.

Fyfe, J., Mohr, S., Milne, G., Rickwood, P., 2013. Quantitative analysis of electricity savings from the home saver rebates program. Final Report. prepared for the NSW Office of Environment and Heritage by the Institute for Sustainable Futures, UTS.

Galarraga, I., Abadie, L.M., Kallbekken, S., 2016. Designing incentive schemes for promoting energy-efficient appliances: a new methodology and a case study for Spain. Energy Policy, 90, 24-36.

Galarraga, I., González-Eguino, M., Markandya, A., 2011a. Willingness to pay and price elasticities of demand for energy-efficiente appliances: combining the hedonic approach and demand systems. Energy Economics, 33, S66-S74.

Galarraga, I., Heres, D.R., Gonzalez-Eguino, M., 2011b. Price Premium for high-efficiency refrigerators and calculation of price-elasticities for close-substitutes: a methodology using hedonic pricing and demand systems. Journal of Cleaner Production, 19, 2075-2081.

Galarraga, I., Ramos, A., Lucas, J., Labandeira, X., 2014. The price of energy efficiency in the Spanish car market. Transport Policy, 36, 272-282.

Gans, W., Alberini, A., Longo, A., 2013. Smart meter devices and the effect of feedback on residential electricity consumption: evidence from a natural experiment in Northern Ireland. Energy Economics, 36, 729-743.

Garcia, A.G.P., Szklo, A.S., Schaeffer, R.,McNeil, M. A., 2007. Energy-efficiency standards for electric motors in Brazilian industry. Energy Policy, 135, 3424-3439.

Garrido-Soriano, N., Rosas-Casals, M., Ivancic, A., Álvarez-del Castillo, M.D., 2012. Potential energy savings and economic impact of residential buildings under national and regional efficiency scenarios. A Catalan case study. Energy and Buildings, 49, 119-125.

Geller, H.S., 1987. Energy and economic savings from national appliance efficiency standards. American Council for an Energy-Efficient Economy, Washington, DC.

Geller, H.S., Miller, P.M., 1988. 1988 lighting ballast efficiency standards: analysis of electricity and economic savings. ACEEE-A883, American Council for an Energy-Efficient Economy.

Gerard, F., 2013. The impact and persistence of ambitious energy conservation programs: evidence from the 2001 Brazilian electricity crisis. Available at SSRN: http://dx.doi.org/10.2139/ssrn.2097195.

Gleerup, M., Larsen, A., Leth-Petersen, S., Togeby, M., 2010. The effect of feedback by text message (sms) and email on household electricity consumption: experimental evidence. Energy Journal, 31, 111-130.

Goldberg, P.K., 1998. The effects of the corporate average fuel efficiency standards in the US. The Journal of Industrial Economics, XLVI, 1-33.

Gölz, S., 2017. Does feedback usage lead to electricity savings? Analysis of goals for usage, feedback seeking, and consumption behavior. Energy Efficiency, 10, 1453-1473.

Goulder, L.H., Jacobsen, M.R., van Benthem, A.A., 2012. Unintended consequences from nested state and federal regulations: the case of the Pavley greenhouse-gas-per-mile limits. Journal of Environmental Economcis and Management, 63, 187-207.

Gowri, K., Halverson, M.A., Richman, E.E., 2007. Analysis of energy saving impacts of ASHRAE 90.1-2004 for the state of New York. PNNL-16770, Pacific Northwest National Laboratory.

Greene, D.L., Patterson, P.D., Singh, M., Li, J., 2005. Feebates, rebates and gas-guzzler taxes: a study of incentives for increasing fuel economy. Energy Policy, 33, 757-775.

Griffin, P.W., Hammond, G.P., Ng, K.R., Norman, J.B., 2012. Impact review of past UK public industrial energy efficiency RD&D programmes. Energy Conversion and Management, 60, 243-250.

Grimes, A., Young, C., Arnold, R., Denne, T., Howden-Chapman, P., Preval, N., Telfar-Barnard, L., 2011. Warming up New Zealand: impacts of the New Zealand insulation fund on metered household energy use. Paper prepared for Ministry of Economic Development, New Zealand.

Grønhøj, A., Thøgersen, J., 2011. Feedback on household electricity consumption: learning and social influence processes. International Journal of Consumer Studies, 35, 138-145.

Gruber, E., Fleiter, T., Mai, M., Frahm, B.J., 2011. Efficiency of an energy audit program for SMEs in Germany – results o fan evaluation study. ECEEE 2011 Summer Study, Energy Efficiency First: The Foundation of a Low-Carbon Society.

Guo, F., Kurdgelashvili, L., Bengtsson, M., Akenji, L., 2016. Analysis of achievable residential energy-saving potential and its implications for effective policy interventions: a study of Xiamen city in southern China. Renewable and Sustainable Energy Reviews, 62, 507-520.

Haakana, M., Sillanpää, L., Talsi, M., 1997. The effect of feedback and focused advice on household energy consumption. European Council for an Energy Efficient Economy Summer Study.

Hadley, D.L., Halverson, M.A., 1993. Energy conservation potential of the U.S. department of energy interim commercial building standards. PNL-7967, Pacific Northwest Laboratory.

Haeri, H., Stewart, J., Osman, A., 2013. The view from the top: application of macro-economic models to measure energy-efficiency program savings in California. Paper presented at the 2013 International Energy Program Evaluation Conference, Chicago.

Halverson, M.A., Gowri, K., Richman, E.E., 2006. Analysis of energy saving impacts of new commercial energy codes for the Gulf Coast. PNNL-16282, Pacific Northwest National Laboratory.

Halverson, M., Liu, B., Richman, E., Winiarski, D., 2011a. ANSI/ASHRAE/IESNA standard 90.1-2007 final determination quantitative analysis. PNNL-20456, Pacific Northwest National Laboratory.

Halverson, M., Liu, B., Rosenberg, M., Wang, W., Zhang, J., Mendon, V., Athalye, R., Xie, Y., Hart, R., Goel, S., 2014. ANSI/ASHRAE/IES standard 90.1-2013 determination of energy savings: quantitative analysis. PNNL-23479, Pacific Northwest National Laboratory.

Halverson, M., Rosenberg, M., 2011b. ANSI/ASHRAE/IES standard 90.1-2010 final determination quantitative analysis. PNNL-20882, Pacific Northwest National Laboratory.

Handgraaf, M. J., van Lidth de Jeude, M. A., Appelt, K. C., 2013. Public praise vs. private pay: Effects of rewards on energy conservation in the workplace. Ecological Economics, 86, 86-92.

Harmsen, R., van den Hoed, R., Harmelink, M., 2007. Improving the energy efficiency of road transport: the case of eco-driving in the Netherlands. ECEEE 2007 Summer Study – Saving Energy – Just Do It!

Harris, J., Shearer, E., 2006. Evaluation of the market-transforming effects of the US federal energy management program. AID-EE Project, Ecofys.

Harrison, D., Seiler, M., 2011. The political economy of green office buildings. Journal of Property Investment and Finance, 29, 551-565.

Harsman, B., Daghbashyan, Z., Chaudhary, P., 2016. On the quality and impact of residential energy performance certificates. Energy and Buildings, 133, 711-723.

Hartman, R.S., 1988. Self-selection bias in the evolution of voluntary energy conservation programs. The Review of Economics and Statistics, 70, 448-458.

Hartwig, J., Kockat, J., Schade, W., Braungardt, S., 2017. The macroeconomic effects of ambitious energy efficiency policy in Germany – Combining bottom-up energy modelling with a non-equilibrium macroeconomic model. Energy, 124, 510-520.

Hirst, E., 1987. Energy and economic effects of utility financial incentive programs: the BPA residential weatherization program. Energy Journal, 8, 97-110.

Hirst, E., 1986. Electricity savings one, two, and three years after participation in the BPA residential weatherization pilot program. Energy and Buildings, 9, 45-53.

Hornung, D., Röthlisberger, T., 2003. Evaluation der wirkung des eco-trainings. Quality Alliance Eco-Drive and Swiss Fedetral Office of Energy, Bern.

Hornung, D., Stiefel, A., Stampfli, M., 2003. Evaluation der wikung von simulator-demonstrationsfahrten. Quality Alliance Eco-Drive and Swiss Fedetral Office of Energy, Bern.

Hornung, D., Stiefel, A., Stampfli, M., 2001. Evaluation der eco-drive simulator-kurse. Quatily Alliance Eco-Drive and Swiss Federal Office of Energy, Bern.

Hornung, D., Stiefel, A., Stampfli, M., von Hebenstreit, B., 2000. Evaluation der eco-drive-kurse. Swiss Federal Office of Energy, Bern.

Horowitz, M.J., 2011. Measuring the savings from energy efficiency policies: a step beyond program evaluation. Energy Efficiency, 4, 43-56.

Horowitz, M.J., 2007. Changes in electricity demand in the United States from the 1970s to 2003. Energy Journal, 28, 93-120.

Horowitz, M.J., 2004. Electricity intensity in the commercial sector: market and public program effects. Energy Journal, 25, 115-137.

Horowitz, M.J., Bertoldi, P., 2015. A harmonized calculation model for transforming EU bottom-up energy efficiency indicators into empirical estimates of policy impacts. Energy Economics, 51, 135-148.

Horowitz, M.J., Haeri, H., 1990. Economic efficiency v energy efficiency. Do model conservation standards make good sense? Energy Economics, 12, 122-131.

Hou, J., Liu, Y., Wu, T., Zhou, N., Feng, W., 2016. Comparative study of commercial building energy-efficiency retrofit policies in four pilot cities in China. Energy Policy, 88, 204-215.

Houde, S., 2014a. Bunching with the stars: how firms respond to environmental certification. Working paper, University of Maryland.

Houde, S., 2014b. How consumers respond to environmental certification and the value of energy information. NBER Working paper 20019.

Houde, S., Aldy, J.E., 2017. Consumers' response to state energy efficient appliance rebate programs. American Economic Journal: Economic Policy, 9, 227-255.

Houde, S., Todd, A., Sudarshan, A., Flora, J.A., Armel, K.C., 2013. Real-time feedback and electricity consumption: a field experiment assessing the potential for savings and persistence. Energy Journal, 34, 87-102.

Hu, Y., 2007. Implementation of voluntary agreements for energy efficiency in China. Energy Policy, 35, 5541-5548.

Hutton, R.B., Mauser, G.A., Filiatrault, P., Ahtola, O.T., 1996. Effects of cost-related feedback on consumer knowledge and consumption behavior: a field experimental approach. Journal of Consumer Research, 13, 327-336.

Hydro One, 2006. The impact of real time feedback on residential electricity consumption: the hydro one pilot.

Hyland, M., Lyons, R.C., Lyons, S., 2013. The value of domestic building energy efficiency – evidence from Ireland. Energy Economics, 40, 943-952.

IEA, 2015. Energy and climate change. World Energy Outlook Special Report. International Energy Agency, Paris.

Isaacs, N., Camilleri, M., French, L., Pollard, A., Saville-Smith, K., Fraser, R., Rossouw, P., Jowett, 2006. Energy use in New Zealand households. Report on the year 10 analysis for the Household Energy End-use Project (HEEP). Study report SR 155, Building Research Association of New Zealand.

Ito, K., 2015. Asymmetric incentives in subsidies: evidence from a large-scale electricity rebate program. American Economic Journal: Economic Policy, 7, 209-237.

Ito, K., 2012. Does conservation targeting work? Evidence from a statewide electricity rebate program in California. Working paper, available at: https://pdfs.semanticscholar.org/981f/5f60804e963a0cc1e1e53c83a9a2478bb130.pdf

Ito, K., Ida, T., Tanaka, M., 2018. Moral suasion and economic incentives: field experimental evidence from energy demand. American Economic Journal: Economic Policy, 10, 240-267.

Ivanov, C., Getachew, L., Fenrick, S.A., Vittetoe, B., 2013. Enabling technologies and energy savings: the case of EnergyWise Smart Meter Pilot of Connexus Energy. Utilities Policy, 26, 76-84.

Jacobsen, G.D., Kotchen, M.J., 2013. Are building codes effective at saving energy? Evidence from residential billing data in Florida. The Review of Economics and Statistics, 95, 34-49.

Jacobsen, G.D., Kotchen, M.J., Vandenbergh, M.P., 2012. The behavioral response to voluntary provision of an environmental public good: evidence from residential electricity demand. European Economic Review, 56, 946-960.

Jacobsen, M.R., 2013. Evaluating US fuel economy standards in a model with producer and household heterogeneity. American Economic Journal: Economic Policy, 5, 148-187.

Jaffee, D., Stanton, R., Wallace, N., 2012. Energy factors, leasing structure and the market price of office buildings in the U.S. Fisher Center Working Papers, UC Berkeley.

Jeffreys, I., Graves, G., Roth, M., 2018. Evaluating of eco-driving training for vehicle fuel use and emissions reduction: a case study in Australia. Transportation Research Part D: Transport and Environment, 60, 85-91.

Jensen, O.M., 2003. Visualisation turns down energy demand. ECEEE 2003 Summer Study – Time to Turn Down Energy Demand.

Jessoe, K., Rapson, D., 2014. Knowledge is (less) power: experimental evidence from residential energy use. American Economic Review, 104, 1417-1438.

Johansson, H., Färnlund, J., Engström, C., 1999. Impacto f ecodriving on emissions and fuel consumption, a pre-study. Swedish National Road Administration.

Joosen, S., 2007. Evaluation of the Dutch energy performance standard in the residential and services sector. AID-EE Project, Ecofys.

Kahn J., 2006. Evaluation of the energy audit programme in Finland. AID-EE Project, Ecofys.

Kahn, M.E., Kok, N., 2014. The capitalization of green labels in the California housing market. Regional Science and Urban Economics, 47, 25-34.

Kalavase, P., McNeil, M., Letschert, V., Ke, J., Carreño A.M., 2012. Projected impacts of global energy efficiency standards for appliances implemented in SEAD countries since 2010. ACEEE Summer Study on Energy Efficiency in Buildings.

Karlsson, M., Thollander, P., Rohdin, P., 2012. Impact and process evaluation of the Swedish national energy audit program for small and medium-size industries. ECEE Industrial Summer Study.

Ke, J., Price, L., Ohshita, S., Fridley, D., Khanna, N.Z., Zhou, N., Levine, M., 2012. China's industrial energy consumption trends and impacts of the top-1000 enterprises energy-saving program and the ten key energy-saving projects. Energy Policy, 50, 562-569.

Kemna, R., Wierda, L., 2015. Ecodesign impact accounting. Final – Status May 2015, VHK.

Kjaerbye, V.H., 2009. Does energy labelling on residential housing cause energy savings? ECEEE Summer Study.

Kleit, A.N., 2004. Impacts of long-range increases in the fuel economy (CAFE) standard. Economic Inquiry, 42, 279-294.

Kleit, A.N., 2002. Short- and long-range impacts of increase in the corporate average fuel economy (CAFE) standard. Report prepared for General Motors.

Kneifel, J., 2013. Benefits and costs of energy standard adoption in new commercial buildings. NIST Special Publication 1147, National Institute of Standards and Technology.

Kneifel, J., Butry, D., 2014. Impact of more precise construction data on estimated savings from energy standard adoption for commercial buildings. NIST Special Publication 1178, National Institute of Standards and Technology.

Kneifel, J., O´Rear, E., 2015. Benefits and costs of energy standard adoption for new residential buildings: national summary. NIST Special Publication 1194, National Institute of Standards and Technology.

Koirala, B.S., Bohara, A.K., Berrens, R.P., 2014. Estimating the net implicit price of energy efficient building codes on U.S. households. Energy Policy, 73, 667-675.

Koirala, B.S., Bohara, A.K., Li, H., 2013. Effects of energy-efficiency building codes in the energy savings and emissions of carbon dioxide. Environmental Economics and Policy Studies, 15, 271-290.

Kok, N., Jennen, M., 2012. The impact of energy labels and accessibility on office rents. Energy Policy, 46, 489-497.

Koomey, J. G., Dunham, C., Lutz, J.D., 1995. The effect of efficiency standards on water use and water-heating energy use in the U.S.: a detailed end-use treatment. Energy, 20, 627-635.

Koomey, J.G., Mahler, S.A., Webber, C.A., McMahon, J.E., 1999. Projected regional impacts of appliance efficiency standards for the US residential sector. Energy, 24, 69-84.

Korytarova, K., 2006. Evaluation of kfw soft loans for building modernisation. AID-EE Project, Ecofys.

Kotchen, M.J., 2015. Do building energy codes have a lasting effect on energy consumption? New evidence from residential billing data in Florida. NBER Working Paper nº 21398.

Krarti, M., Dubey, K., 2017. Energy productivity evaluation of large scale building energy efficiency programs for Oman. Sustainable Cities and Society, 29, 12-22.

Kua, H.W., Wong, S.E., 2012. Lessons for integrated household energy conservation policies from an intervention study in Singapore. Energy Policy, 47, 49-56.

Kubo, T., Sachs, H., Nadel, S., 2001. Opportunities for new appliance and equipment efficiency standards: energy and economic savings beyond current standards programs. Report number A016, American Council for an Energy-Efficient Economy.

Kurani, K.S., Stillwater, T., Jones, M., 2013. Ecodrive I-80: a large sample fuel economy feedback field test . Final Report, Institute of Transportation Studies, University of California, Davis.

Kushler, M., York, D., Witte, P., 2005. Examining the potential for energy efficiency to help address the natural gas crisis in the Midwest. Report number U051, American Council for an Energy-Efficient Economy.

Kushler, M., York, D., Witte, P., 2004. Five years in: an examination of the first half-decade of public benefits energy efficiency policies. Report number U041, American Council for an Energy-Efficient Economy.

Labanca, N., 2006. Evaluation of rue obligations of electricity distribution grid managers in Flanders. AID-EE Project, Ecofys.

Lane, K., Harrington, L., 2010. Evaluation of energy efficiency policy measures for household refrigeration in Australia. An assessment of energy savings since 1986. E3 report nº 2010/10, Equipment Energy Efficiency Committee.

Larsson, H., Ericsson, E., 2009. The effects o fan acceleration advisory tool in vehicles for reduced fuel consumption and emissions. Transportation Research Part D, 14, 141-146.

Lee, W.L., Yik, F.W.H., 2002. Regulatory and voluntary approaches for enhancing energy efficiencies of buildings in Hong Kong. Applied Energy, 71, 251-274.

Leite, A.A.F., Bajay, S.V., 2007. Impactos de possíveis novos programas de eficiência energética nas projeçoes da demanda energética nacional. Revista Brasileira de Energia, 13, 21-34.

Letschert, V.E., Bojda, N., Ke, J., McNeil, M.A., 2012. Estimate of cost-effective potential for minimum efficiency performance standards in 13 major world economies. LBNL-5723E, Lawrence Berkeley National Laboratory.

Levine, M.D., Hirst, E., Koomey, J.G., McMahon, J.E., Sanstad, A.H., 1994. Energy efficiency, market failures, and government policy. LBL-35376, Energy Analysis Program, Energy and Environment Division, Lawrence Berkeley National Laboratory.

Levinson, A., 2016. How much energy do building energy codes save? Evidence from California houses. American Economic Review, 106, 2867-2894.

Li, H., Carrión-Flores, C.E., 2017. An analysis of the energy star® program in Alachua County, Florida. Ecological Economics, 131, 98-108.

Li, S., Linn, J., Spiller, E., 2013. Evaluating "cash-for-clunkers": program effects on auto sales and the environment. Journal of Environmental Economics and Management, 65, 175-193.

Liang, J., Qiu, Y., Ruddell, B.L., Dalrymple, M., Earl, S., Castelazo, A., James, T., 2018. Do energy retrofits work? Evidence from commercial and residential buildings in Phoenix. Journal of Environmental Economics and Management, 92, 726-743..

Lin, B., Liu, H., 2015. A study on the energy rebound effect of China's residential building energy efficiency. Energy and Buildings, 86, 608-618.

Lin, J., 2006. Mitigating carbon emissions: the potential of improving efficiency of household appliances in China. LBLN-60973, Ernest Orlando Lawrence Berkeley National Laboratory.

Lin, J., 2002. Appliance efficiency standards and labeling programs in China. Annual Review of Energy and the Environment, 27, 349-367.

List, J.A., Metcalfe, R.D., Price, M.K., Rundhammer, R., 2017. Harnessing policy complementarities to conserve energy: evidence from a natural field experiment. NBER Working Paper nº 23355.

Liu, X., Hewings, G.J.D., Wang, S., 2009. Evaluation on the impacts of the implementation of civil building energy efficiency standards on Chinese economic system and environment. Energy and Buildings, 41, 1084-1090.

Loi, T.S.A., Loo, S.L., 2016. The impacto f Singapore's residential electricity conservation efforts and the way forward. Insights from the bounds testing approach. Energy Policy, 98, 735-743.

Loughran, D.S., Kulick, J., 2004. Demand-side management and energy efficiency in the United States. Energy Journal, 25, 19-43.

Lowenberger, A., Mauer, J., deLaski, A., DiMascio, M., Amann, J., Nadel, S., 2012. The efficiency boom: cashing in on the savings from appliance standards. Report number ASAP-8/ACEEE-A123, American Council for an Energy-Efficient Economy.

Lu, W., 2007. Potential energy savings and environmental impacts of energy efficiency standards for vapor compression central air conditioning units in China. Energy Policy, 35, 1709-1717.

Lu, W., 2006. Potential energy savings and environmental impact by implementing energy efficiency standard for household refrigerators in China. Energy Policy, 34, 1583-1589.

Lucas, R.G., 2009. Determination for the 2006 international energy conservation code, residential buildings – technical support document. PNNL-18806, Pacific Northwest National Laboratory.

Lucas, R.G., 2007. Analysis fo energy saving impacts of new residential energy codes for the Gulf Coast. PNNL-16265, Pacific Northwest National Laboratory.

Luttmer, M., 2006. Evaluation of labelling of appliances in the Netherland. AID-EE Project, Ecofys.

Mahlia, T.M.I., Masjuki, H.H., Choudhury, I.A., Ghazali, N.N.N., 2002. Economical and environmental impact of room air conditioners energy labels in Malaysia. Energy Conversion and Management, 43, 2509-2520.

Mahlia, T.M.I., Masjuki, H.H., Choudhury, I.A., Saidur, R., 2001. Potential CO_2 reduction by implementing energy efficiency standard for room air conditioner in Malaysia. Energy Conversion and Management, 42, 1673-1685.

Mahlia, T.M.I., Masjuki, H.H., Saidur, R., Amalina, M.A., 2004. Cost-benefit analysis of implementing minimum energy efficiency standards for household refrigerator-freezers in Malaysia. Energy Policy, 32, 1819-1824.

Mahlia, T.M.I., Yanti, P.A.A., 2010. Cost efficiency analysis and emission reduction by implementation of energy efficiency standards for electric motors. Journal of Cleaner Production, 18, 365-374.

Malik, L., Tiwari, G., 2017. Assessment of interstate freight vehicle characteristics and impact of future emission and fuel economy standards on their emissions in India. Energy Policy, 108, 121-133.

Mansouri, I., Newborough, M., 1999. Dynamics of energy use in UK households: end-use monitoring of electric cookers. Summer Study of the European Council for an Energy-Efficient Economy.

Martínez-Montejo, S.A., Sheinbaum-Pardo, C., 2016. The impact of energy efficiency standards on residential electricity consumption in Mexico. Energy for Sustainable Development, 32, 50-61.

Masjuki, H.H., Mahlia, T.M.I., Choudhury, I.A., 2001. Potential electricity savings by implementing minimum energy efficiency standards for room air conditioners in Malaysia. Energy Conversion and Management, 42, 439-450.

Matsukawa, I., 2004. The effects of information on residential demand for electricity. Energy Journal, 25, 1-17.

Matthies, E., Kastner, I., Klesse, A., Wagner, H.-J., 2011. High reduction potentials for energy user behavior in public buildings: how much can psychology-based interventions achieve? Journal of Environmental Studies and Sciences, 1, 241-255.

McCalley, L.T., Midden, C.J.H., 2002. Energy conservation through product-integrated feedback: the roles of goal-setting and social orientation. Journal of Economic Psychology, 23, 589-603.

McMahon, J.E., Chan, P., Chaitkin, S., 2000. Impacts of U.S. appliance standards to date. LBNL-45825, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory.

McNeil, M.A., Fenrg, W., de la Rue du Can, S., Khanna, N.Z., Ke, J., Zhou, N., 2016. Energy efficiency outlook in China’s urban buildings sector through 2030. Energy Policy, 97, 532-539.

McNeil, M.A., Letschert, V.E., Wiel, S., 2007. Reducing the price of development: the global potential of efficiency standards in the residential electricity sector. EEDAL, London.

Mendon, V.V., Taylor, Z.T., Rao, S.U., Xie, Y.L., 2014. 2015 IECC determination of energy savings: preliminary technical analysis. PNNL-23438, Pacific Northwest National Laboratory.

Meng, T., Hsu, D., Han, A., 2017. Estimating energy savings from benchmarking policies in New York City. Energy, 133, 415-423.

Meyers, S., McMahon, J., Atkinson, B., 2008. Realized and projected impacts of U.S. energy efficiency standards for residential and commercial appliances. LBNL-63017, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory.

Meyers, S., McMahon, J., McNeil, M., 2005. Realized and prospective impacts of U.S. energy efficiency standards for residential appliances: 2004 update. LBNL-56417, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory.

Meyers, S., McMahon, J., McNeil, M., Liu, X., 2003. Impact of US federal energy efficiency standards for residential appliances. Energy, 28, 755-767.

Meyers, S., Williams, A., Chan, P., 2011. Energy and economic impacts of U.S. federal energy and water conservation standards adopted from 1987 through 2010. LBNL – 5291E, Lawrence Berkeley National Laboratory.

Meyers, S., Williams, A., Chan, P., Price, S., 2016. Energy and economic impacts of U.S. federal energy and water conservation standards adopted from 1987 through 2015. LBNL – 1004328, Lawrence Berkeley National Laboratory.

Miller, N., Spivey, J., Florance, A., 2008. Does green pay off? Journal of Real Estate Portfolio Management, 14, 385-400.

Mizobuchi, K., Takeuchi, K., 2013. The influences of financial and non-financial factor son energy-saving behaviour: a field experiment in Japan. Energy Policy, 63, 775-787.

Modig, G., 2006. Evaluation of the industrial energy efficiency network in Norway. AID-EE Project, Ecofys.

Molenbroek, E., Smith, M., Surmeli, N., Schimschar, S., Waide, P., Tait, J., McAllister, C., 2015. Savings and benefits of global regulations for energy efficient products. A 'cost of non-world' study. Final Report, European Commission.

Mountain, D.C., 2012. Real-time feedback and residential electricity consumption: the Newfondland and Labrador pilot. QSEP Research Report nº449, McMaster University.

Mudgal, S., Lyons, L., Cohen, F., Lyons, R., Fedrigo-Fazio, D., 2013. Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries. Final report prepared for European Commission (DG Energy). Disponible en: https://ec.europa.eu/energy/sites/ener/files/documents/20130619-energy_performance_certificates_in_buildings.pdf

Murphy, L., 2014. The influence of energy audits on the energy efficiency investments of private owner-occupied households in the Netherlands. Energy Policy, 65, 98-407.

Nadel, S., 2004. Supplementary information on energy efficiency for the national commission on energy policy. American Council for an Energy-Efficient Economy.

Nadel, S., Kubo, T., Geller, H., 2000. State scorecard on utility energy efficiency programs, Report number U004, American Council for an Energy-Efficient Economy.

Nadel, S., Pye, M., 1996. Appliance and equipment efficiency standards: impacts by state. American Council for an Energy-Efficient Economy.

Neubauer, M., deLaski, A., DiMascio, M., Nadel, S., 2009. Ka-BOOM! The power of appliance standards. Opportunities for new federal appliance and equipment standards. Report number ASAP-7/ACEEE-A091, Amercian Council for an Energy-Efficient Economy.

Newell, G., MacFarlane, J., Walker, R., 2014. Assessing energy rating premiums in the performance of green office buildings in Australia. Journal of Property Investment and Finance, 32, 352-370.

Ni, C.C., 2013. Potential energy savings and reduction of CO_2 emissions through higher efficiency standards for polyphase electric motors in Japan. Energy Policy, 52, 737-747.

Nikaido, S., Saeki, O., Tsuji, K., Momen, T., 2006. Statistical analysis on the effect of energy saving by energy consumption information system in residential houses. The 2nd Joint International Conference on "Sustainable Energy and Environment (SEE 2006)", Bangkok, Thailand.

Nilsson, A., Andersson, K., Jakobsson Bergstad, C., 2015. Energy behaviors at the office: an intervention study on the use of equipment. Applied Energy, 146, 434-441.

Nilsson, A., Jakobsson Bergstad, C., Thuvander, L., Andersson, D., Andersson, K., Meiling, P., 2014. Effects of continuous feedback on households' electricity consumption: potentials and barriers. Applied Energy, 122, 17-23.

Nogueira, L.A.H., Cardoso, R.B, Cavalcanti, C.Z.B., Leonelli, P.A., 2015. Evaluation of the energy impacts of the Energy Efficiency Law in Brazil. Energy for Sustainable Development, 24, 58-69.

NSW Office of Environment and Heritage, 2014. Measurement and verification of energy savings within the energy efficiency for small business program – phase 2, prepared by Energetics.

Ó Broin, E., Mata, É., Göransson, A., Johnsson, F., 2013 The effect of improved efficiency on energy savings in EU-27 buildings. Energy, 57, 134-148.

Ó Broin, E., Nässén, J., Johnson, F., 2015. Energy efficiency policies for space heating in EU countries: a panel data analysis for the period 1990-2010. Applied Energy, 150, 211-223.

O'Rear, E.G., Sarica, K., Tyner, W.E., 2015. Analysis of impacts of alternative policies aimed at increasing US energy independence and reducing GHG emissions. Transport Policy, 37, 121-133.

OFGEM, 2005. A review of the energy efficiency commitment 2002-2005. A report for the Secretary of State for Environment, Food and Rural Affairs, Office of Gas and Electricity Markets.

OFGEM, 2004. A review of the energy efficiency commitment to the end of the second year. Office of Gas and Electricity Markets report 178/04.

Oikonomou, V., Rietbergen, M., Patel, M., 2007. An ex-ante evaluation of a white certificates scheme in the Netherlands: a case study for the household sector. Energy Policy, 35, 1147-1163.

Olaussen, J.O., Oust, A., Solstad, J.T., 2017. Energy performance certificates – Informing the informed or the indifferent? Energy Policy, 111, 246-254.

Ouyang, J., Hokao, K., 2009. Energy-saving potential by improving occupants' behavior in urban residential sector in Hangzhou City, China. Energy and Buildings, 41, 711-720.

Pacific Northwest National Laboratory (PNNL), 2009. Impacts of Standard ASHRAE 90.1-2007 for commercial buildings at state level. US Department of Energy, Building Energy Codes Program.

Pantong, K., Chirarattananon, S., Chaiwiwatworakul, P., 2011. Development of energy conservation programs for commercia buildings based on assessed energy saving potentials. Energy Procedia, 9, 70-83.

Papineau, M., 2017. Setting the standard? A framework for evaluating the cost-effectiveness of building energy standards. Energy Economics, 64, 63-76.

Paramonova, S., Thollander, P., 2016. Ex-post impact and process evaluation of the Swedish energy audit policy programme for small and medium-sized enterprises. Journal of Cleaner Production, 135, 932-949.

Parker, D., Hoak, D., Cummings, J., 2010. Pilot evaluation of energy savings and persistence from residential energy demand feedback devices in a hot climate. ACEEE Summer Study on Energy Efficiency in Buildings.

Parker, P., Rowlands, I.H., Scott, D., 2005. Who changes consumption following residential energy evaluations? Local programs need all income groups to achieve Kyoto targets. Local Environment, 10, 173-187.

Petersen, J.E., Shunturov, V., Janda, K., Platt, G., Weinberger, K., 2007. Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives. International Journal of Sustainability in Higher Education, 8, 16-33.

Pigg, S., 2002. Energy savings from the Wisconsin Energy Star Homes program. Report 211-1, Energy Center of Wisconsin.

Pivo, G., Fisher, J., 2010. Income, value, and returns in socially responsible office properties. Journal of Real Estate Research, 32, 243-270.

Popescu, D., Bienert, S., Schützenhofer, C., Boazu, R., 2012. Impact of energy efficiency measures on the economic value of buildings. Applied Energy, 89, 454-463.

Radhi, H., 2009. Can envelope codes reduce electricity and CO_2 emissions in different types of buildings in the hot climate of Bahrain? Energy, 34, 205-215.

Ramos, A., Pérez-Alonso, A., Silva, S., 2015. Valuing energy performance certificates in the Portuguese residential sector. WP 02/2015, Economics for Energy.

Reichardt, A., 2014. Operating expenses and the rent premium of energy star and LEED certified buildings in the central and eastern U.S. Journal of Real Estate Finance and Economics, 49, 413-433.

Reichardt, A., Fuerst, F., Rottke, N., Zietz, J., 2012. Sustainable building certification and the rent premium: a panel data approach. Journal of Real Estate Research, 34, 99-126z

Reiss, P.C., White, M.W., 2008. What changes energy consumption? Prices and public pressures. The RAND Journal of Economics, 39, 636-663.

Rickwood, P., Mohr, S., Nguyen, M., Milne, G., 2012. Evaluation of the home power savings program – Phase 1, prepared by the Institute for Sustainable Futures, UTS for the NSW Office of Environment and Heritage.

Rivers, N., Jaccard, M., 2011. Electric utility demand side management in Canada. Energy Journal, 32, 93-116.

Rohmund, I., Duer, A., Yoshida, S., Borstein, J., Wood, L., Cooper, A., 2011. Assessment of electricity savings in the U.S. achievable through new appliance/equipment efficiency standards and building efficiency codes (2010-2025). IEE White Paper.

Román, R., Sanz, M.T., 2017. Analysis of energy end-use efficiency policy in Spain. Energy Policy, 101, 436-446.

Rosenquist, G., McNeil, M., Iyer, M., Meyers, S., McMahon, J., 2006. Energy efficiency standards for equipment: additional opportunities in the residential and commercial sectors. Energy Policy, 34, 3257-3267.

Sabapathy, A., Ragavan, S.K.V., Vijendra, M., Nataraja, A.G., 2010. Energy efficiency benchmarks and the performance of LEED rated buildings for Information Technology facilities in Bangalore, India. Energy and Buildings, 42, 2206-2212.

Sanchez, I., Pulido, H., McNeil, M.A., Turiel, I., della Cava, M., 2007. Assessment of the impacts of standards and labeling programs in Mexico (four products). Report No. 12933ITF FN LBNL 001, Lawrence Berkeley National Laboratory.

Schall, D.L., Mohnen, A., 2017. Incentiving energy-efficient behavior at work: an empirical investigation using a natural field experiment on eco-driving. Applied Energy, 185, 1757-1768.

Scheer, J., Clancy, M., Hógáin, S.N., 2013. Quantification of energy savings from Ireland's home energy savin scheme: an ex post billing analysis. Energy Efficiency, 6, 35-48.

Schleich, J., Faure, C., Klobasa, M., 2017. Persistence of the effects of providing feedback alongside smart metering devices on household electricity demand. Energy Policy, 107, 225-233.

Schleich, J., Klobasa, M., Brunner, M., Gölz, S., Götz, K., Sunderer, G., 2011a. Smart metering in Germany – results of providing feedback information in a field trial. ECEEE Summer Study, Energy Efficiency First: The Foundation of a Low-Carbon Society.

Schleich, J., Klobasa, M., Brunner, M., Gölz, S., Götz, K., Sunderer, G., 2011b. Smart metering in Germany and Austria: results of providing feedback information in a field trial. Working paper sustaninability and innovation nº S6/2011, Fraunhofer ISI.

Schleich, J., Klobasa, M., Gölz, S., Brunner, M., 2013. Effects of feedback on residential electricity demand – Findings from a field trial in Austria. Energy Policy, 61, 1097-1106.

Schultz, P.W., Nolan, J.M., Cialdini, R.B., Goldstein, N.J., Griskevicius, V., 2007. The constructive, destructive, and reconstructive power of social norms. Psychological Science, 18, 429-434.

Scofield, J.H., 2013. Efficacy of LEED-certification in reducing energy consumption and greenhouse gas emission for large New York City office buildings. Energy and Buildings, 67, 517-524.

Scott, M.J., Daly, D.S., Hathaway, J.E., Lansing, C.S., Liu, Y., McJeon, H.C., Moss, R.H., Patel, P.L., Peterson, M.J., Rice, J.S., Zhou, Y., 2015. Calculating impacts of energy standards on energy demand in U.S. buildings with uncertainty in an integrated assessment model. Energy, 90 1682-1694.

Sexton, R.J., Johnson, N.B., Konakayama, A., 1987. Consumer response to continuous-display electricity-use monitors in a time-of-use pricing experiment. Journal of Consumer Research, 14, 55-62.

Shewmake, S.,Viscusi, W.K., 2015. Producer and consumer responses to green housing labels. Economic Inquiry, 53, 681-699.

Shi, X., 2015. Application of best practice for setting minimum energy efficiency standards in technically disadvantaged countries: case study of air conditioners in Brunei Darussalam. Applied Energy, 157, 1-12.

Shingler, J., 2009. Long term study of Pennsylvania's low income usage reduction program: results of analyses and discussion. Consumer Services Information System Project, Penn State University.

Siderius, P.J.S., Nakagami, H., 2013. A MEPS is a MEPS is a MEPS: comparing ecodesign and top runner schemes for setting product efficiency standards. Energy Efficiency, 6, 1-19.

Sipe, B., Castor, S., 2008. The net impact of home energy feedback devices. 2009 Energy Program Evaluation Conference, Portland, 341-351.

Siskos, P., Capros, P., De Vita, A., 2015. CO_2 and energy efficiency car standards in the EU in the context of a decarbonisation strategy: a model-based policy assessment. Energy Policy, 84, 22-34.

Staats, H., Harland, P., Wilke, H.A.M., 2004. Effecting durable change. A team approach to improve environmental behavior in the household. Environment and Behavior, 36, 341-367.

Staats, H., van Leeuwen, E., Wit, A., 2000. A longitudinal study of informational interventions to save energy in an office building. Journal of Applied Behavior Analysis, 33, 101-104.

Statewide Evaluation Team, 2015. Energy efficiency potential study for Pennsylvania. Final Report, Pennsylvania Public Utility Commission.

Stenqvist, C., Nilsson, L.J., 2012. Energy efficiency in energy-intensive industries – an evaluation of the Swedish voluntary agreement PFE. Energy Efficiency, 5, 225-241.

Stillwater, T., Kurani, K.S., 2012. Preliminary results from a field experiment of three fuel economy feedback designs. Working Paper UCD-ITS-WP-12-01, Institute of Transportation Studies, University of California, Davis.

Sudarshan, A., 2017. Nudges in the marketplace: The response of household electricity consumption to information and monetary incentives. Journal of Behavioral Economics and Organization, 134, 320-335.

Sulyma, I., Tiedemann, K., Pedersen, M., Rebman, M., Yu, M., 2008. Experimental evidence: a residential time of use pilot. ACEE Summer Study on Energy Efficiency in Buildings.

Suter, J.F., Shammin, M.R., 2013. Returns to residential energy efficiency and conservation measures: a field experiment. Energy Policy, 59, 551-561.

Tanides, C.G., Dutt, G.S., Brugnoni, M.S., 2000. Characterisation and energy savings potential of video appliances in the Argentine residential sector. Energy for Sustainable Development, 4, 43-51.

Taylor, N.W., Jones, P.H., Searcy, J.K., Miller, C.R., 2014. Evaluating ten years of energy performance of HERS-rated homes in Alachua County, Florida. Energy Efficiency, 7, 729-741.

Thollander, P., Danestig, M., Rohdin, P., 2007. Energy policies for increased industrial energy efficiency: evaluation of a local energy programme for manufacturing SMEs. Energy Policy, 35, 5774-5783.

Thorne, J., Kubo, T., Nadel, S., 2000. Opportunity knocks: capturing pollution reductions and consumer savings from updated appliance efficiency standards. ACEEE-A001, American Council for an Energy-Efficient Economy.

Thornton, B.A., Rosenberg, M.I., Richman, E.E., Wang, W., Xie, Y., Zhang, J., Cho, H., Mendon, V.V., Athalye, R.A., Liu, B., 2011. Achieving the 30% goal: energy and cost savings analysis of ASHRAE standard 9.1-2010. PNNL-20405, Pacific Northwest National Laboratory.

Trikam, A., Hughes, A., Howells, M., 2005. Greenhouse gas reduction impacts of energy efficiency policies, in Rubin, E.S., Keith, D.W., Gilboy, C.F., Wilson, M., Morris, T., Gale, J., Thambimuthu, K. (eds.), Greenhouse Gas Control Technologies 7. Proceedings of the 7th International Conference on Greenhouse Gas Control Technologies.

Tulsyan, A., Dhaka, S., Mathur, J., Yadav, J.V., 2013. Potential of energy savings through implementation of energy conservation building code in Jaipur city, India. Energy and Buildings, 58, 123-130.

Turner, C., Frankel, M., 2008. Energy performance of LEED for new construction buildings. Final Report, New Buildings Institute.

Ueno, T., Sano, F., Saeki, O., Tsuji, K., 2006a. Effectiveness of an energy-consumption information system on energy savings in residential houses base don monitored data. Applied Energy, 83, 166-183.

Ueno, T., Tsuji, K., Nakano, Y., 2006b. Effectiveness of displaying energy consumption data in residential buildings: to know is to change. American Council Energy-Efficient Economy Summer Study.

UNDP, 2004. Standards and labels for promoting Energy Efficiency in Russia. UNDP Project Document. Government of Russian Federation, United Nations Development Programme.

US Department of Energy, 2013. Technical support document: energy efficiency program for consumer products and commercial and industrial equipment: residential microwave ovens – stand-by power.

Van Dam, S.S., Bakker, C.A., van Hal, D.M., 2010. Home energy monitors: impact over the medium-term. Buildings Research and Information, 38, 458-469.

Van den Hoed, R., Harmelink, M., Joosen, S., 2006. Evaluation of the Dutch ecodrive programme. AID-EE Project, Ecofys.

Van Houwelinger, J.H., van Raaij, W.F., 1989. The effect of goal-setting and daily electronic feedback on in-home energy use. Journal of Consumer Research, 16, 98-105.

Varman, M., Masjuki, H.H., Mahlia, T.M.I., 2005. Electricity savings from implementation of minimum energy efficiency standard for TVs in Malaysia. Energy and Buildings, 37, 685-689.

Vassileva, I., Dahlquist, E., Wallin, F., Campillo, J., 2013. Energy consumption feedback devices' impact evaluation on domestic energy use. Applied Energy, 106, 314-320.

Vassileva, I., Odlare, M., Wallin, F., Dahlquist, E., 2012. The impact of consumers' feedback preferences on domestic electricity consumption. Applied Energy, 93, 575-582.

Waide, P., 2011. Opportunities for success and CO_2 savings from appliance energy efficiency harmonisation. Navigant Consulting, London.

Waldman, D.M., Ozog, M.T., 1996. Natural and incentive-induced conservation in voluntary energy management programs. Southern Economic Journal, 62, 1054-1071.

Wallander, S., 2008. Price impacts of the energy star label. The power of redundant information. Yale Environmental Economics Seminar Paper.

Walls, M., Gerarden, T., Palmer, K., Bak, X.F., 2017. Is energy efficiency capitalized into home prices? Evidence from three U.S. cities. Journal of Environmental Economics and Management, 82, 104-124.

Webber, P., Gouldson, A., Kerr, N., 2015. The impacts of household retrofit and domestic energy efficiency schemes: a large scale, ex post evaluation. Energy Policy, 84, 35-43.

Wiley, J.A., Benefield, J.D., Johnson, K.H., 2010. Green design and the market for commercial office space. Journal of Real Estate Finance and Economics, 41, 228-243.

Wilhite, H., Ling, R., 1995. Measured energy savings from a more informative energy bill. Energy and Buildings, 22, 145-155.

Wilhite, H., Ling, R., Uutela, A., Anttila, U., Arvola, A., 1993. A nordic test of the energy saving potential of new residential billing techniques. Nordiske Seminar- og Arbejdsrapporter 1993:627,The Nordic Council of Ministers.

Wills, W., Lèbre La Rovere, E., 2010. Light vehicle energy efficiency programs and their impact on Brazilian CO_2 emissions. Energy Policy, 38, 6453-6462.

Wirtshafter Associates, Inc., 2006. Evaluation of the California Statewide 20/20 demand reduction programs. Prepared for San Diego Gas and Electric, Pacific Gas and Electric, and Southern California Edison.

Wood, G., Newborough, M., 2003. Dynamic energy-consumption indicators for domestic appliances: environment, behaviour and design. Energy and Buildings, 35, 821-841.

Wu, Y., Zhao, X., Rong, J., 2015. The long-term effectiveness of eco-driving training: a pilot study. Proceedings of the Eighth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, University of Iowa.

Xu, L., Liu, J., Pei, J., Han, X., 2013. Building energy savings potential in hot summer and cold winter (HSCW) zone, China – Influence of building energy efficiency standards and implications. Energy Policy, 57, 253-262.

Yee, J., 1991. Effect of consumption standards on U.S. gasoline consumption. Journal of Policy Modeling, 13, 205-227

York, D., Kushler, M., 2002. State scorecard on utility and public benefits energy efficiency programs: an update. Report number U023, American Council for an Energy-Efficient Economy.

Yu, H., Tang, B.-J., Yuan, X.-C., Wang, S., Wei, Y.-M., 2015. How do the appliance energy standards work in China? Evidence from room air conditioners. Energy and Buildings, 6, 833-840.

Yu, M., Sparolin, A., Pedersen, M., Tiedemann, K., 2010. Power samrt residential behavioural program. Concept and impact evaluation: F2010. BC Hydro Power Smart.

Yu, S., Eom, J., Evans, M., Clarke, L., 2014. A long-term, integrated impact assessment of alternative building energy code scenarios in China. Energy Policy, 67, 626-639.

Yu, S., Evans, M., Kyle, P., Vu, L., Tan, Q., Gupta, A., Patel, P., 2018. Implementing nationally determined contributions: building energy policies in India's mitigation strategy. Envrionmental Research Letters, 13, 034034.

Yu, S., Tan, Q., Evans, M., Kyle, P., Vu, L., Patel, P.L., 2017. Improving building energy efficiency in India: state-level analysis of building energy efficiency policies. Energy Policy, 110, 331-341.

Yu, Y., Wang, X., Li, H., Qi, Y., Tamura, K., 2015b. Ex-post assessment of China's industrial energy efficiency policies during the 11th Five-Year Plan. Energy Policy, 76, 132-145.

Zhang, L., Li, Y., Stephenson, R., Ashuri, B., 2018. Valuation of energy efficient certificates in buildings. Energy and Buildings, 158, 1226-1240.

Zhou, N., Fridley, D., McNeil, M., Zheng, N., Letschert, V., Ke, J., Saheb, Y., 2011. Analysis of potential energy saving and CO_2 emission reduction of home appliances and commercial equipments in China. Energy Policy, 39, 4541-4550.

Zivin, J.G., Novan, K., 2016. Upgrading efficiency and behavior: electricity savings from residential weatherization programs. Energy Journal, 37, 1-23.