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Christoph Bühren and Maria Daskalakis

Which Green Nudge Helps to Save Energy? Experimental Evidence

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Coordination: Bernd Hayo • Philipps-University Marburg
School of Business and Economics • Universitätsstraße 24, D-35032 Marburg
Tel: +49-6421-2823091, Fax: +49-6421-2823088, e-mail: hayo@wiwi.uni-marburg.de

Which green nudge helps to save energy? Experimental evidence[1]

Christoph Bühren[2], Maria Daskalakis[3]

Abstract

Which behavioral interventions are more appropriate to induce energy saving: energy saving goals with or without monetary incentives, environmentally related information, social comparison, or a competition to save energy? We try to answer this question in a comprehensive study. First, we designed energy bills with different behavioral interventions. Second, we evaluated their appropriateness in an empirical survey with 457 participants. Third, we tested behavioral consequences in a "real effort" lab experiment with 550 subjects in 11 treatments and one baseline. Finally, we tested two interventions in a small field experiment with 36 test-households. Our results indicate that monetary incentives to save energy foster the intention to invest effort in energy saving but may backfire if real effort is required. Instead, self-set goals – without monetary incentives – and providing social comparison induced substantial effort in our lab experiment. Extending the social comparison to a competition – without monetary incentives – provided the best results. In our field experiment, however, we find no support that goals and social comparison change every-day behavior in energy consumption. Our study concludes with implications for practical policy design and possible future research.

JEL: D03; D12; C91

Keywords: Energy-saving; Goals; Social Comparison; Competition; Real effort experiment

Research Highlights:

We designed and evaluated 11 different behavioral interventions in electricity bills

We conducted a survey, a real effort lab experiment, and a small field experiment

Monetary incentives score well in the survey but reduced "energy-saving" effort in the lab

Goals, social comparison, and competition induced the highest effort in the lab

Goals and social comparison did not change energy consumption in the field

[1] A previous version was circulated under the title "Do not incentivize eco-friendly behavior– Go for a competition to go green!".

[2] Clausthal University of Technology, Department of Economics, Julius-Albert Str. 2, 38678 Clausthal-Zellerfeld, Germany. christoph.buehren@tu-clausthal.de

[3] University of Kassel, Department of Economics, Nora-Platiel-Str. 4, 34127 Kassel, Germany. daskalak@.uni-kassel.de.

1. Introduction

Policy instruments aligned with the insights from behavioral economics – and with corresponding insights from psychology – might be more efficient than traditional policy instruments. The nudge approach of Thaler and Sunstein (2009), in particular, provides convincing examples including health policy, pension policy, and environmental policy. Schubert (2017) introduced the term "green nudges" for innovative policy tools (Beckenbach 2016) in Behavioral Environmental Economics (Shogren 2012) intending to encourage eco-friendly behavior by adjusting the consumers' decision environment. Schubert (2017) distinguishes between green nudges that (1) address the consumers' desire to attain or maintain an attractive "green" self-image, (2) utilize the customers' desire to follow the herd, and (3) exploit their status quo bias by setting defaults. See also Sunstein and Reich (2013) for an account of "green defaults", Steg and Vlek (2009) for an overview of green nudges, and Jager and Mosler (2007), who measure the effectiveness of environmental policies via agent-based models simulating "environmental behavior change" (Nielson 2017).

Our study aims to contribute to the development of instruments for environmental policy based on behavioral economics (see Beckenbach 2016 and Daskalakis 2016a for an overview). It focuses on the question of which behavioral instruments in energy bills may motivate private households to save energy. Related research typically addresses this question using field experiments. However, most of these studies consider a mix of different instruments without analyzing the effect of a particular instrument in isolation.

The advantages of our study are that we cooperated with a local energy provider and that we used different methods in our empirical strategy. We started by developing "behavioral energy bills" and conducted face-to-face interviews to evaluate them. The survey results were the basis for our incentivized laboratory experiment, in which we used the real effort task of Gill and Prowse (2012) to simulate the effort to save energy. Finally, we checked the findings of our lab experiment in a small field experiment with test households.

The remainder of the paper is structured as follows: After discussing related literature on energy-saving and real effort tasks in section 2, we explain the behavioral design of the electricity bills in section 3. Section 4 reports survey results evaluating these bills. Section 5 presents and discusses the results of a comprehensive lab experiment analyzing the behavioral consequences of the different interventions applied in the electricity bills. Furthermore, section

5 shows the results of a field experiment testing two of these interventions. Finally, we conclude our findings, give policy implications and options for future research in section 6.

2. Related Literature

2.1. Energy-saving behavior

The research on behavioral interventions to reduce energy consumption was initiated by field experiments of psychologists (see Winnett and Neale 1979, Shippee 1980, Abrahamse et al. 2005, and Osbaldiston and Schott 2012 for overviews). One key area of research was the question of whether feedback about their energy consumption leads households to save energy. A further research question was whether setting goals enhances the effort to save energy. Becker (1978), e.g., found that setting a higher goal in combination with feedback (20% more than the period before) leads to reductions in energy consumption up to 15.1%, but setting a lower goal (2%) not (see also e.g. Seligmann et al. 1977). Another topic was to what extent individual or group incentives in the form of monetary rewards lead to energy-saving behavior: Hayes and Cone (1977), e.g., found a positive correlation of the height of incentives and the level of energy-saving. An extension of individual feedback is the social comparison to the consumption of other (comparable) households: It addresses descriptive social norms and may foster the propensity to comply. Midden et al. (1983) find that social comparison is an effective instrument, which can be reinforced by monetary incentives.

Most studies applied several instruments at once (see Daskalakis 2016b and RAND Europe 2012). Hence, often the effects of the treatments cannot be assigned unambiguously and it is not possible to isolate the effect of a single instrument. Table 1 summarizes examples of field experiments on energy-saving behavior. It provides information on the medium used for displaying the intervention, the main types of interventions, the number of participants, the type of energy addressed, the duration of the study, and the effect on energy saving.

Table 1: Overview of the literature

Author	Medium for communicating the intervention	Core interventions	Number of participants (households/ rooms in case of dormitories)	Type of energy	Duration of the study	Achieved reduction
Allcott (2011)	Energy report (written), energy-saving tips	Feedback, energy-saving tips, social comparison (with emoticon)	60,000	Electricity	23 months	- 2.03% on average over all treatments - Upper 10 percent of the households with the highest overall consumption: 6.3% - least consuming 10 percent of the households: 0.3%
Allcott/ Rogers (2014)	Energy report (written), energy-saving tips	Feedback, energy-saving tips, social comparison (with emoticon)	234,000	Electricity	Interventions: 2 to 4 years Observations: further 2 to 3 years	- Second year: 3% on average - Increase of reduction 50-60% in the third year if continued - Effect decay after discontinuation of reports 10 to 20% per year
Ayres et al. (2013)	Energy report (written), energy-saving tips	Feedback, energy-saving tips, social comparison (with emoticon)	84,000 (SMUD), 84,000 (PSE)	Electricity	12 months (SMUD), 7 months (PSE)	Sacramento Municipal Utility District Experiment (SMUD): - 2% on average Puget Sound Energy Experiment (PSE): - 1.2% (energy) and 1.2 to 1.3% (central heating) on average
Abrahamse et al. (2007)	Online tool on Web-Page (with energy report)	Individual and group feedback, individual and group goal-setting (default goal of 5%), tailored energy-saving tips	189	Gas, electricity, fuel	5 months	- 5.1% average treatment effect on direct energy use (gas, electricity, and fuel) - Tailored energy saving tips and goal setting: 5.0% - Tailored energy saving tips on energy saving, goal setting, and group feedback: 5.3%
Delmas/ Lessem (2014)	Energy report (online)	Individual feedback, public feedback (reputational) competition	66	Electricity	8 months	- Only individual feedback: no significant effect - Individual feedback and reputational competition: 25% reduction of heating energy, 5% reduction of energy for lights in case previous energy consumption was above the median
Loock et al. (2013)	Online tool on Web-Page (with energy report)	Feedback, goal setting	1,791	Electricity	4 months	- 2.3% on average over all treatments - No default goal): 4.02% - Default 0%; individually adjustable: 0.76% (not significant) - Default 15%: 4.18% - Default 30%: 0.001% (not significant)

Petersen et al. (2007)	Monitoring system with real-time feedback; Energy report (online)	Competition, feedback, social comparison	1,612	Electricity, water	7 weeks	Electricity: - Total reduction of 32% - High-resolution feedback: 55% - Low-resolution feedback: 31% (Students in earlier semesters (46%); students of higher semesters (2%) Water: - 3% (both treatments)
Schultz et al. (2007)	Energy report (written)	Feedback, energy-saving tips social comparison (a) with and b) without emoticon)	287	Electricity	5 weeks	Without emoticon: - Households with above-average energy consumption: 1.22 kWh per day - Households of group 1 with below-average energy consumption: **increase** of 0.89 kWh per day With emoticon: - Households with above-average energy consumption: 1.72 kWh per day - Households with below-average energy consumption: no significant effect
Tiefenbeck et al. (2013)	Individualized flyers (written)	Appeal for the relevance of saving the environment feedback, energy-saving tips, social comparison	200	Electricity, water	11 weeks	- 4.1% less water use - 5.6% **more** electricity use

2.2. Real effort tasks in experimental economics

Carlsson et al. (2013) emphasize that real effort tasks enhance the external validity of laboratory experiments. Quite a few real effort tasks have already been implemented in experimental economics: e.g., counting 1s in matrices consisting of 1s and zeros (Abeler et al. 2011, Bühren and Kundt 2013), summing up numbers (Corgnet et al. 2014), or filling envelopes (Hennig-Schmidt et al. 2010). Yet, there are only a few lab experiments in which consumption is addressed by behavioral economics. Newell and Silkamäki (2013), e.g., analyze the behavioral effects of different energy labels for electronic devices, and Barth and Graf (2011) examine if subjects choose alternative tariffs for mobile telephony in a rationale way.

In the lab experiment of McCalley et al. (2011), subjects are asked to set energy-saving goals (between 0 and 20 percent) before selecting programs of a simulated washing machine. Goal-setting induced energy saving, and the levels of goals were higher if subjects previously committed themselves to save energy (foot-in-the-door treatment). However, the levels of the goals did not affect the amount of energy saved.

The most acknowledged real effort task is the slider task of Gill and Prowse (2012), in which subjects have to put sliders (maximum 48 per round) that are scaled from 0 to 100 to the middle position (50). Heap et al. (2015) introduced reference points via social comparison in the slider task. They find that social comparison increases the effort invested in the task, especially for subjects who performed poorly before the reference point is given. In our lab experiment, we use the slider task because it reminds of calibrating energy-consuming products: The effort invested in our slider task symbolizes the effort of reducing the brightness of screens, switching off lights or stand-by functions, etc.

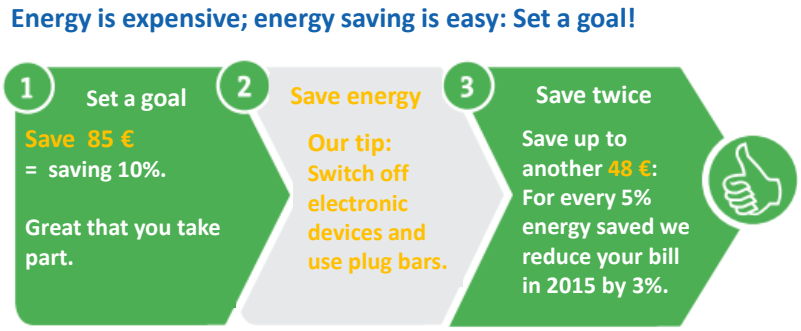
3. The design of our behavioral energy bill

In Europe, like in many states in the US, most of the content of the energy bill is mandatory (Directive 2006/32/EC, European Commission 2006; see for the US Mahone/Haley 2011). The energy supplier has "to enable final consumers to make better-informed decisions concerning their individual energy consumption…" (Directive 2006/32/EC (29), European Commission 2006). Most of the rules require the provision of information related to increasing the customers' understanding of the bill. One rule, however, already applies behavioral economics: The energy

provider has to compare the household's energy consumption to other households (social comparison, Directive (2006/3/2; §5(a)).

We focus on designing the first page of the bill because customers typically overlook further pages (see Ipsos MORI 2011 and Roberts 2004). On the first page, we removed all contents not directly relevant for payment. We translated the relevant information in Euro instead of kilowatt-hours: Our pre-test as well as Roberts (2004) and Ipos MORI (2011) showed that energy costumers often do not sufficiently understand technical parameters. Additionally, we provided an energy-saving tip and the respective behavioral intervention – the green nudge. Furthermore, we applied a new, green design for the elements on the bill (see appendix). Figure 1 shows the intervention of bill no. 2 (translated from German), which comprised goal-setting including a monetary incentive as behavioral interventions.

Figure 1: Behavioral and monetary incentives of Bill no. 2[4]



4. Empirical survey

4.1. Procedure

First, we redesigned the energy bills in cooperation with the local energy supplier Städtische Werke Kassel, Germany. We created different versions of the first page of the bill, each comprising different interventions but the same layout and text otherwise. We tested and adapted those bills concerning comprehensibility and layout iteratively in 46 pretest interviews that lasted 10 to 15 minutes and took place at the customer center of the supplier.

Second, we analyzed the potential effects of three green nudges in electricity bills in an empirical survey, which was embedded in the annual market survey of the energy supplier:

[4] All the original bills are in the online appendix.

goals, with or without monetary incentives and social comparison (see Table 2). The three bills included the same energy-saving tip. The representative survey was conducted in all city districts of Kassel (Germany) by a market research institute via face to face interviews in May and June 2014. On average, the age of our respondents was 35 years and 50% of them were female.

The 457 respondents were first requested to imagine that they were at home, had just received their energy bill, and were in the process of opening it. Subsequently, the three bills were successively presented, and the respondents evaluated for each of the bills to what extent it would motivate them to reduce their energy consumption.

Table 2: Green nudges in the bills presented in the market survey

Bills	
Bill 1	Default saving goal of 15%
Bill 2	Default saving goal of 10% and a monetary incentive in the form of a 3% reduction of the annual billing amount per 5% saving
Bill 3	Social comparison

4.2. Results

For the evaluation in how far each of the three bills would motivate energy-saving we used a 5-point Likert scale (from 1 = “not at all” to 5 = “very much”). The bill with the combination of goal and monetary incentives was rated the highest (mean: 3.4, median: 4), followed by the bill including a social comparison (mean: 3, median: 3) and the bill including a goal without monetary incentives (mean: 2.7, median: 3). According to a Friedman test, the evaluation of the three bills is highly significantly different ($p<0.01$).

Table 3: Results of the market survey

Item	Median	Average	N	Std. dev.
Bill no. 1 (Goal)	3.00	2.66	457	1.18
Bill no. 2 (Goal + Incentive	4.00	3.41	457	1.24
Bill no. 3 (Social Comparison)	3.00	3.05	457	1.37

4.3. Discussion

Bill no. 2 (Goal + Incentive) can be seen as an extension of Bill no. 1 (Goal) and might be perceived to dominate it because of the monetary incentives. At least, we cannot exclude a possible attraction effect (Huber 1982 and Huber 2014; Ariely 2008, Chapter 1 calls it "decoy effect"): Products that dominate other products are evaluated better than products which cannot easily be compared to other products and for which evaluation consumers have to take tradeoff decision.

Furthermore, the respondents gave their opinion about the possible impact of the bills on their energy-saving behavior. From the survey results, it is not possible to measure the actual effect of the bills and there might be a gap between evaluation and behavior. In the literature, such kinds of discrepancies are referred to as hypothetical bias (Carlsson 2010 and Robinson/Hammitt 2011) or intention-behavior-gap (Sheeran 2002 and Ajzen/Brown 2004). Study results addressing the height of these biases are mixed (Fishbein/Ajzen 2010 and Schläpfer/Fischhoff 2011). Moreover, the market survey was restricted to three interventions. Hence, we could neither evaluate the effects of different versions of the given interventions, nor the effects of additional interventions.

To overcome these limitations, we set up a comprehensive lab experiment presented in the next section.

5. Experiments

5.1. Procedure and treatments

We designed the incentivized lab experiment in a way that enabled us to compare the results to our survey results reported in section 4. We used identical behavioral bill designs to make both empirical analyses as comparable as possible. In the market survey, the results concerning the goal-setting interventions were ambiguous. Thus, we analyze different goal-setting nudges in the lab. Based on the literature discussed in section 2.1., we further focus on social comparison, competition, environmental framing, and the purchase of energy-saving products. As indicated in section 2.2., to simulate the effort of saving energy, we used a real effort task (the slider task of Gill and Prowse 2012).

The instructions started with a cover story, in which we tried to introduce an energy-saving framing: We asked subjects to imagine putting effort into energy-saving activities like adjusting the temperature of fridges or the brightness of screens and switching off standby functions and lights. In two treatment variants, we wasted real energy with terrace heaters outside the laboratory and combined the slider task with timers which switched the heaters off the earlier the more sliders subjects put into the correct position. Thus, we can test if our results change if the real effort task is coupled with real – and visible – energy usage. To make sure that subjects understood the instructions, they were asked to fill out a printed sample electricity bill. These bills were designed according to the corresponding treatment and the findings of the pretests reported in section 4.1.

In Table 4, we describe the procedure of the baseline in detail and explain the deviations from the baseline in our treatments. We programmed the experiment with z-tree (Fischbacher, 2007) and conducted it in three PC pools of the University of Kassel (KLab) with 40, 25, and 16 cubicles respectively. Participants were recruited from a big introductory lecture on economics (around 600 students). In addition to the money earned in the experiment (see Table 4), the students received 2 bonus points for their exam (90 points) if they participated in the experiment. We randomly allocated our subjects to treatments. The randomization was successful: Socio-demographics and environmental attitudes were homogeneous across treatments. 50.55% of the students were male, the age of the subjects was 22.17 on average. We made sure that no student participated twice in our experiment.

Table 4: Description of Treatments[5]

Main Treatments	
Baseline	Subjects received a show-up fee of 15 €, from which they had to pay electricity bills of 2.40 € in each of the six rounds. They could reduce the bill with the effort invested in the slider task of Gill and Prowse (2012): In every round, they had two minutes to put up to 48 sliders into the middle position. Every correct slider saved 5 Cent of the bill. With the slider task we try to simulate the effort of saving energy. Subjects earn at least 60 Cent (15 € - 6*2.40 €) if they do not invest any effort and a maximum of 15 € if they put every slider into the right position in all six rounds. The experiment lasted around 45 minutes.
Goal	Before every round of the Goal treatment (except for round 1), subjects had to set the goal of how much more energy they want to save compared to the previous period, i.e. they had to announce how much more sliders they want to put into the correct position compared to the previous round.
Goal + Incentive	In the Goal + Incentive treatment, the achievement of the goal was incentivized with 2 Cent for every slider (in addition to the 5 Cent, see Baseline) that the achieved goal was higher than the number of correct sliders in the previous round. Hence, subjects faced a tradeoff between setting low vs. high goals which were easy vs. hard to achieve but have a small vs. considerable impact on payoffs.
Products	In the Products treatment, subjects could buy up to four "energy-saving products" for 20 Cent each in every round. In Addition to the 5 Cent per slider (see Baseline), they could save further $2*\sqrt{x}$ Cent (with x=number of products) for every correct slider: e.g., additionally 2 Cent (4 Cent) if they bought one (four) products. Thus, buying one product makes sense if subjects think that they will achieve at least 10 correct sliders and buying four products (which cost 4*20 Cent) is profitable if more than 20 sliders are put into the correct position in that round (which saves 20*4 Cent of the energy bill).
Social Comparison	After every round in the Social Comparison treatment, subjects received feedback on the average number of correct sliders in the session. Thus, they can compare their performance with the average performance of all subjects in a session: The typical number of subjects in a session was 20.
Competition	In the Competition treatment, subjects were divided into two groups. After every round, we made public which group saved the most energy and announced to every subject the average number of correct sliders per group. The typical number of subjects in a group was 10. Competition extends Social Comparison by a competitive element: The procedure of the two treatments is identical, except for the division into two groups in Competition. Thus, subjects could compare their effort to their own group's average and the other group's average.

[5] The corresponding "electricity bills", instructions, z-tree codes, and data can be found here: http://dx.doi.org/10.17632/9v3mf2kz88.2.

Treatment variants	
Baseline + Environment	In Baseline + Environment, we extended our baseline by an environment framing, in which we made subjects aware of how much CO_2 is saved by saving energy.
Default **Goal + Incentive**	In Default Goal + Incentive, subjects were asked to put two sliders more into the correct position than in the previous round. The monetary incentive for achieving the goal was as high as in Goal + Incentive (2*2 Cent = 4 Cent) in addition to the 5 Cent per slider (see Baseline).
Default **Goal** + High **Incentive**	The procedure of Default Goal + High Incentive was the same as in Default Goal + Incentive. The only difference was that the incentive amounted to 15 Cent instead of 4 Cent.
Social Comparison + Heater	To evaluate the external validity of our energy-saving simulation, we combined the results of the slider task with the time in which terrace heaters outside the PC pool (visible through the window) were switched off. The heaters burned for a maximum of one hour and were switched off earlier the higher the average number of correct sliders in each round of the session was: For each slider, we subtracted 10 seconds from the time switch.
Competition + Heater	In Competition + Heater, every group had its own terrace heater, which was switched off 10 seconds earlier for every slider that was, on average, put into the correct position in the respective group.
Competition + Bonus	In each round of Competition + Bonus, every participant of the winning group (the group which saved the most) got a 15 Cent bonus payment.

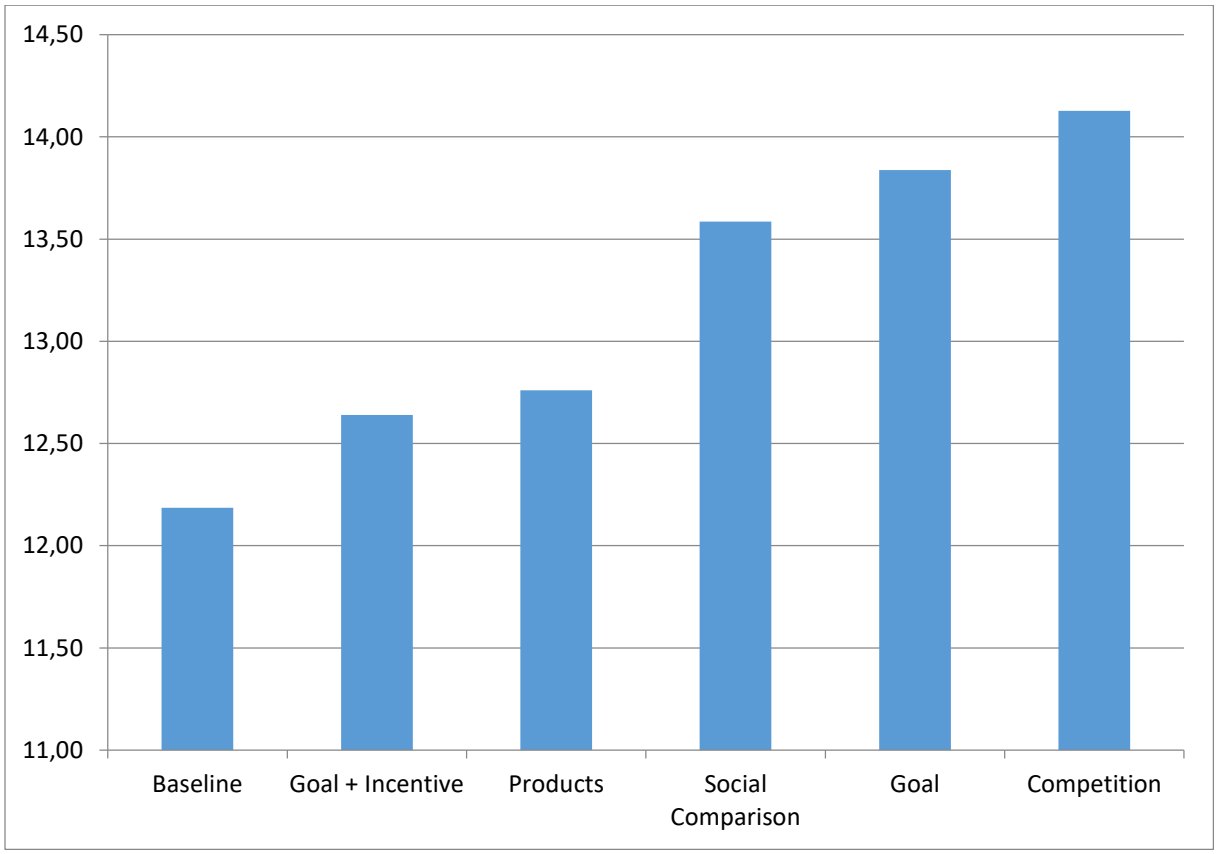
5.2. Results

5.2.1. Descriptive statistics and nonparametric tests

Figure 2 displays the average amount of energy saved (in terms of correct sliders) by our main treatments (green nudges). It was highest in Competition, Goal, and Social Comparison. In Competition, subjects on average put about 2 sliders per round more into the right position than in Baseline. That means their electricity bills were on average 60 Cent lower than in the Baseline treatment (6 rounds*2 sliders*5 Cent). In Baseline, subjects saved 3.66 € (6*12.19*5 Cent) and in Competition 4.24 € (6*14.13* 5 Cent) (two-sided Mann Whitney U test[6]: Z=-3.231, p=0.001). In Goal, subjects saved on average approximately 50 Cent more (Z=-2.247, p=0.025) and in Social Comparison 42 Cent more (Z=-2.223, p=0.026) than in Baseline.

[6] If not explicitly mentioned, we use two-sided Mann Whitney U tests in this section.

Figure 2: Average amount of energy saved (in terms of correct sliders) by main treatment



Monetary incentives reduced the effort to save energy from 4.15 € saved in Goal (6*13.84*5 Cent) to 3.79 € in Goal + Incentive (6*12.64*5 Cent) (Z=-1.919, p=0.055). A possible explanation for this finding is crowding out of intrinsic motivation (Frey and Oberholzer-Gee 1997, Gneezy et al. 2011). Similar to Goal + Incentive, the energy saved in the Products treatment was not significantly different from Baseline either (3.83 € vs. 3.66 €).

Table 5: Average amount of energy saved (in terms of correct sliders) by all treatment variants

Treatment	Rank	Average	N	Std. dev.
Competition	1	14.43***	29	2.50
Competition + Heater	2	14.10**	40	3.17
Competition + Bonus	3	13.93*	40	4.68
Goal	4	13.84**	81	5.03
Social Comparison + Heater	5	13.71*	37	3.60
Default Goal + Incentive	6	13.69	24	3.44
Social Comparison	7	13.49*	50	3.83
Products	8	12.76	59	4.16
Goal + Incentive	9	12.49	56	3.21
Baseline + Environment	10	12.31	39	4.16
Baseline	11	12.12	76	3.68
Default Goal + High Incentive	12	11.77	19	3.69
Total		13.18	550	3.99

Notes: *: p<0.1, **p<0.05, ***: p<0.01, two-sided Mann Whitney U tests treatment vs. baseline; Kruskal Wallis test: Chi^2=19.722, p=0.049

Table 5 ranks the energy saved across all treatment variants. The treatment variants did not differ significantly from the specific main treatments: The environment framing did not change the effort compared to Baseline (similar to the results of McCalley et al. 2011). Default goals with (high) incentives did not change the bad performance of Goal + Incentive. The bonus did not significantly affect Competition. And the effort did not change after including real energy saving in Social Comparison and Competition via terrace heaters.

The pure Competition treatment (without heater or bonus) performed best on average: Competition encouraged subjects the most to put effort into our "energy-saving task". This green nudge can be interpreted as a form of gamification (see Morganti et al. 2007 for an overview). Ro et al. (2017), e.g., show that playing their "Cool Choices" sustainability game motivated households to reduce their energy consumption even half a year after playing the game. In contrast, in our treatments with monetary incentives the effort was low - in Default

Goal + High Incentive even slightly (not significantly) lower than in Baseline. In the next section, we analyze our lab data deeper with regression analyses, followed by a discussion on external validity and a small field experiment.

5.2.2. Regression results

Table 6: OLS regressions of effort in each round of the main treatments

	Sliders in each round OLS	
	Coef.	Robust std. err.
Social Comparison	1.398***	0.523
Goal	1.497**	0.658
Goal + Incentive	0.395	0.486
Products	0.440	0.662
Competition	1.950***	0.345
Male	1.504***	0.345
Round	0.982***	0.044
Cons	8.123***	0.427
N	3132	
R^2	0.143	
Adjusted R^2	0.141	
F, Prob>F	75.03, <0.01	

Notes: reference category: Baseline; *****: p<0.1, ******: p<0.05, *******: p<0.01; standard errors are clustered at the individual level; calculating the treatment effects with the nearest neighbor matching estimation (Abadie et al. 2004) yields very similar results.

Table 6 shows the OLS regression results of the energy saved in each round. Ceteris paribus, subjects in Social Comparison put on average 1.40 more sliders per round into the correct position than in Baseline. In Goal, it was 1.50 more sliders and in Competition 1.95 more than in Baseline. Furthermore, male subjects performed on average 1.50 sliders better and earned about 45 Cent (6*1.50*5 Cent) more than females. On average, subjects managed to put nearly 1 slider more per round into the correct position.

Table 7: OLS regressions of effort in each round of the Goal treatments

	Sliders in each round OLS	
	Coef.	Robust std. err.
Incentive	0.382	0.557
Male	1.403**	0.689
Round	0.419***	0.103
Height of the goal	0.331***	0.105
Cons	6.198***	1.289
N	685	
R^2	0.256	
Adjusted R^2	0.252	
F, Prob>F	19.90, <0.01	

Notes: reference category: Goal; *****: p<0.1, ******: p<0.05, *******: p<0.01; standard errors are clustered at the individual level; calculating the treatment effects with the nearest neighbor matching estimation (Abadie et al. 2004) yields very similar results.

Table 7 analyses the data of green nudges that include a goal. The Goal treatment without monetary incentives serves as a baseline in this analysis. Furthermore, we include the Goal + Incentive treatment pooled with its two variants (Default Goal + Incentive and Default Goal + High Incentive).

The height of the goal positively influences effort (but not 1:1): A goal that is one slider higher enhances effort by 0.33 sliders. According to a two-sided Wilcoxon signed-rank test, subjects set optimistically high goals compared to their effort (Z=-6.910, p<0.01) in the Goal treatment. This effect is not observed when achieved goals are financially incentivized because subjects only obtained the bonus payment (in Goal + Incentive) if they reached their goal. Moreover, subjects seem to strategically underperform in the first rounds of all Goal + Incentive treatment variants to reach goals in the following rounds easier. On average, they moved only 8 sliders into the correct position in the first round, whereas subjects of the Goal treatment managed to achieve about 12 sliders in the first round (two-sided Mann Whitney U test, Z=4.659, p<0.01).

Table 8: OLS regressions of effort in each round of the Social Comparison and Competition treatments

	Sliders in each round OLS	
	Coef.	Robust std. err.
Social Comparison + Heater	0.129	0.833
Competition	1.772**	1.011
Competition + Heater	0.440	0.727
Competition + Bonus	0.215	0.931
Male	2.003***	0.574
Round	1.129***	0.074
Cons	8.710***	0.548
N	1128	
R^2	0.180	
Adjusted R^2	0.175	
F, Prob>F	43.47, p<0.01	

Notes: reference category: Social Comparison; *****: p<0.1, ******: p<0.05, *******: p<0.01; standard errors are clustered at the individual level; calculating the treatment effects with the nearest neighbor matching estimation (Abadie et al. 2004) yields very similar results.

Table 8 shows the regression results for treatments (plus variants) in which there is a social comparison: Social Comparison (reference category), Social Comparison + Heater, Competition, Competition + Heater, and Competition + Bonus. The heater and the bonus payment did not increase the effort to save energy significantly in comparison to the reference category. Competition without bonus payment and terrace heaters affected effort positively compared to Social Comparison. On average, male subjects managed to put two sliders per round more into the correct position than female subjects in treatments including a social comparison (and competition, see Niederle/Vesterlundt 2011 for gender differences in competitions).

In the Social Comparison treatments (with and without heater), subjects who performed below average in the previous round increased their effort to a significantly larger extent than subjects who performed above average (on average 2.75 sliders vs. 1.06 sliders, $Z=-3.73$, $p<0.01$). This large discrepancy can partly be explained by the fact that below-average subjects had a better chance to improve their bad results. Interestingly, we find the opposite effect in the pooled Competition treatments (with and without heater or bonus): On average, subjects who performed worse than average slightly reduced their effort in the next round (-0.13 sliders), whereas subjects who performed better than average increased their effort by 2.80 sliders ($Z=-8.66$, $p<0.01$). A possible explanation is a free-rider effect in the groups of the Competition treatments. Another explanation could be that badly performing subjects may believe that they cannot help their team. We cannot replicate this finding if we compare the effort of subjects whose team previously won the energy-saving contest with those whose team previously lost (on average 1.39 sliders vs. 1.00 slider more after winning vs. losing, $Z=-1.10$, $p=0.271$).

5.3. Discussion

Competition induced the highest energy saving in our lab experiment. Similarly, the trophy winner effect of Bühren and Pleßner (2014) demonstrates the positive influence of winning an effortful competition on the valuation of the won item. Our results show that competition can enhance the effort invested in energy saving. This is consistent with the findings from the field experiments referred to in section 2.1. Paying a bonus to the winner of the competition, however, impairs the effect of the treatment and the difference to the baseline was only significant at the 10% level for Competition + Bonus. The high standard deviation in this treatment variant (see Table 5) can be considered as an indicator that subjects reacted heterogeneously to the inclusion of monetary incentives in our competition to save energy.

In second place after the Competition treatments, the Goal treatment had the highest effect on our subjects' effort (to save energy), which is in line with the findings of Shippee (1980) and Loock et al. (2013). Again, the negative consequence of monetary incentives becomes evident: The Goal treatment variants with monetary incentives do not differ significantly from Baseline. In our experiment, it was obvious for the participants when they reached their goal. The incentive to proceed with the slider task, after reaching the goal, is not very high and subjects could strategically underperform after reaching the goal to achieve future goals easier. In households, however, people do not check their energy consumption regularly. Thus, the

motivation to save energy may be higher than our experiment suggests because households might be unsure if they already reached their goal.

In the market survey, the social comparison was evaluated worse than the incentivized goal and better than the goal intervention. In the lab experiment, Social Comparison performed slightly worse than Goal but better than Goal + Incentive. The effort in Social Comparison only differed from the effort Baseline on the 10% level. Allcott and Rogers (2014) and Delmas and Lessem (2014) find the distinction between people with a previously low vs. high energy consumption to be an important determinant of the effectiveness of social comparison. Our results indicate that social comparison works better for subjects who previously performed below average. However, this does not hold if we introduce competition between teams: Then, the encouraging effect of subjects who performed below average seems to be counteracted by a free-rider effect (see section 5.2.2.).

The Products treatment was not significantly different from the baseline. We do not know how far subjects perceived our Product treatment similar to purchasing real energy-saving products. Subjects have to decide under uncertainty in the treatment: They have to evaluate if their investment in "energy-efficient products" will pay off. Yet we did not control for subjects' risk aversion. Qui et al. (2014) find in an online survey that more risk-averse consumers are less likely to buy energy-efficient products. The authors use lotteries similar to those of Holt and Laury (2002) but did not incentivize them.

Additional environmental references (Baseline + Environment) did not affect our subjects, which is in line with the findings of Petersen et al. (2007) and contrast to Asensio and Delmas (2015).

In the market survey, we observe no relevant gender differences concerning the evaluation of the three energy bills. However, the lab results show that our treatments affected female and male participants differently (The gender difference is highest for treatments including social comparison and competition). Previous results on gender differences in the effectiveness of green nudges are similarly mixed: Karlin et al. (2014) report that men respond more strongly than women to different interventions in field studies on energy-saving. In contrast, surveys typically conclude that women show stronger environmental attitudes than men (see Stern et al. 1993; Yue et al. 2013, and Botetzagias et al. 2014). Finally, the results of Urban and Ščasný (2012) indicate that gender differences highly depend on specific energy-saving activities.

The combination of the slider task with real energy usage via terrace heaters did not change the results of the corresponding treatments (Social Comparison and Competition), although it was salient to the participants that energy was wasted in the heater conditions: We installed the heaters in front of the windows of the lab, and we made sure that every participant saw the heaters. This serves as a first indication that our results can be externally valid. However, we do not know in how far our real effort task can be compared with the effort to save energy in households (for a discussion on the external validity of lab experiments see Levitt/List 2007 and Camerer 2011). Thus, we conducted a small field experiment with two treatments of our survey and lab experiment.

5.4. Field experiment

We tested the green nudges Goal and Social Comparison with three monthly electricity bills for 36 test households of the same energy supplier as in section 4. The average age of our respondents was 47.42, and 44.44% of them were female. On average, they lived together with 1.47 other persons in a household.

We randomly split the sample into a control group (with no interventions) and a treatment group. Their average energy consumption per month in the last year was not significantly different (on average, 209 vs. 271 kilowatt-hours). On the first of November, in the first electricity bill, the treated group received the (default) goal to try to reduce 10% of their October energy consumption in November 2019 (without further monetary incentives). On the first of December, in the second bill, the treated group received a social comparison to the development of the energy consumption (from October to November) of the other treated households.

Figure 3: Energy consumption by treatment in our field experiment

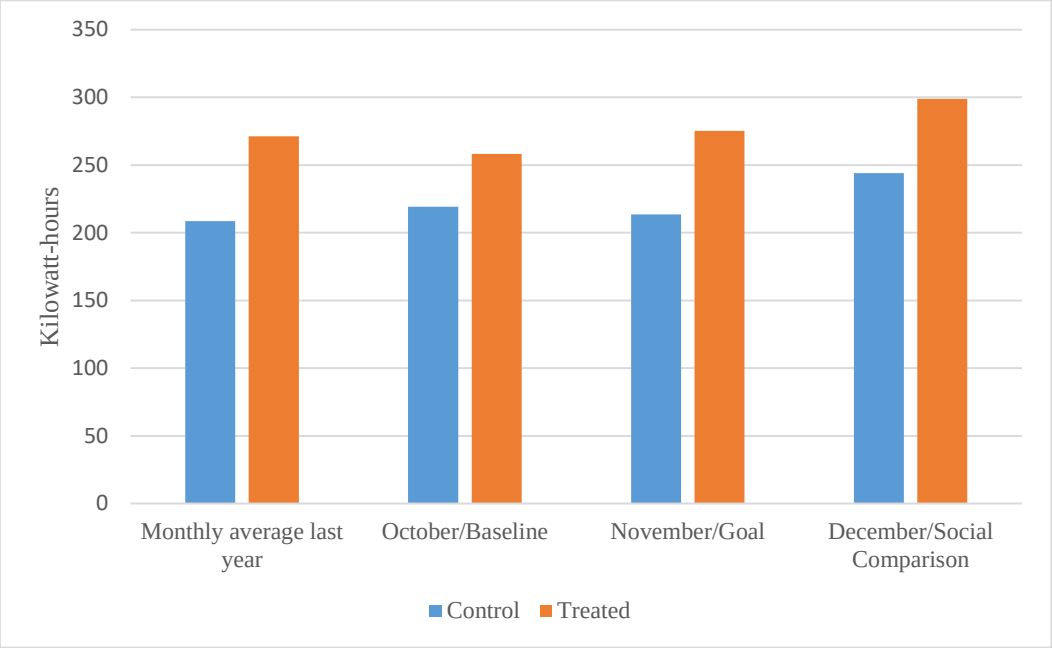


Figure 3 shows the main results of our field experiment.[7] As we conducted the experiment from October 2019 to January 2020 (the households read their meters on the first of each month and we calculated their consumption of October, November, and December), the control and the treatment group increased their energy consumption during this time. In an interview with the households after the experiment, most of them ascribed this increase to Christmas lighting. In October, the average consumption in our whole sample was 239 kilowatt-hours, whereas it was 272 kilowatt-hours in December. Compared to the monthly average consumption last year, the December consumption in our field experiment was significantly higher (Wilcoxon signed rank tests: p=0.035 for the control group and p=0.094 for the treated group).

According to a Friedman test, the increase in energy consumption during our experiment in the control group was significant (p=0.001). In contrast, the increase in the treatment group was not significant (p=0.135). This may be seen as an indication that our behavioral interventions also worked in the field. However, the energy consumption in the treatment group is slightly higher than in the control group also in November and December after our behavioral interventions – but not significantly different according to two-sided Mann-Whitney U tests (p=0.255 and p=0.311, respectively).

[7] The electricity bills and the data can be found here: http://dx.doi.org/10.17632/9v3mf2kz88.2.

6. Conclusion, policy implications, and future research

6.1. Conclusion

We evaluated the effect of green nudges included in energy bills on the effort to reduce energy consumption with a comprehensive empirical approach. In the first step, the behavioral bills were designed in cooperation with an energy provider in an iterative process based on customer feedback. In a second step, selected versions of the bill were presented to 457 respondents in a market survey. The respondents were asked to specify to what extent the bills would motivate them to save energy. The results were the basis for the third step, in which we aimed to evaluate the effectiveness of different bill versions in incentivized lab experiments with a real effort task. In the lab experiment, we compared 11 treatments and one baseline with 550 subjects. The results show that the provision of incentives has a potentially negative influence. The option to buy "energy-saving products" as well as the encouragement to save energy by providing environmentally related information did not influence our subjects differently than in the baseline. In contrast, social comparison and the request to set goals resulted in a considerable effort (to save energy) in our lab experiment, and the highest effect was induced by energy-saving competitions. In our small field experiment, however, we observed no effect of goals and social comparison on the energy consumption of test households.

6.2. Policy implications

Our results show that behavioral interventions on the first page of an energy bill have the potential to induce energy-saving behavior. We recommend extending the present regulations concerning the energy bill accordingly. Our results illustrate that the variance of the effectiveness of these green nudges is considerably high. In the context of political practice, the question arises which of the interventions will work efficiently in terms of costs and benefits. Regarding the benefits, our findings indicate that the initiation of competition is promising. However, initiating a competition to save energy through an energy bill may be relatively complex and expensive, and there could be legal restrictions especially concerning data protection. Applying a goal-setting intervention seems to be promising in terms of the simplicity and costs of the implementation.

6.3. Future research

In our lab experiment, monetary incentive schemes backfired: They seemed to crowd out the intrinsic motivation to save energy (Oberholzer-Gee/Frey 1997). Goals that were not financially incentivized, social comparison, and especially competition (without bonus payment) are more effective according to our results. This is in line with Handgraaf et al. (2013), who report that social rewards outperform monetary rewards in decreasing the electricity use in a Dutch firm. Future field experiments could analyze under which conditions monetary incentives decrease the motivation to save energy.

The discrepancy between the rating of the bills given by participants of our survey and the behavior of the subjects in our experiments suggests three possible extensions of our study: First, it might be worthwhile to extend the survey with additional green nudges, especially "green competition". Furthermore, to avoid possible attraction effects (see section 4.3.), interventions with and without incentives should be evaluated separately. Second, to enable a consistent comparison of the survey results and the lab experiments, it could be fruitful to conduct the lab experiments with the surveyed participants or a representative subject pool of electricity customers, respectively. Third, in future lab experiments more realistic simulations of energy consumption or energy saving could be used instead of the slider task of Gill and Prowse (2012). The simulation of McCalley et al. (2011), in which washing machines have to be programmed, may serve as a starting point.

Moreover, future research could try to find out which green nudges are the most appropriate for different subject pools, such as customers with different ideological priors (e.g. liberals vs. conservatives, see Costa/Kahn 2013). Furthermore, future studies could look deeper into the effects of green competition by gender (Niederle/Vesterlundt 2011). Finally, our field experiment can be extended to further analyze what motivates customers to change their everyday energy consumption.

References

Abadie, A., Drukker, D., Herr, J. L., & Imbens, G. W. (2004). Implementing matching estimators for average treatment effects in Stata. Stata Journal, 4(3), 290–311.

Abeler, J., A. Falk, L. Goette, & D. Huffmann (2011). Reference Points and Effort Provision, American Economic Review, 101(2), 470-492.

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology, 25(3), 273-291.

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(4), 265-276.

Ajzen, I., T. C. Brown, et al. (2004). "Explaining the Discrepancy Between Intentions and Actions: The Case of Hypothetical Bias in Contingent Valuation." Personality and Social Psychology Bulletin 30(9), 1108-1121.

Allcott, H. (2011). Social norms and energy conservation. Journal of Public Economics, 95(9-10), 1082-1095.

Allcott, H., & Rogers, T. (2014). The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation. American Economic Review, 104(10), 3003-3037.

Ayres, I., Raseman, S., & Shih, A. (2013). Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage. Journal of Law, Economics, and Organization, 29(5), 992-1022.

Ariely, D. (2008). Predictably Irrational: The Hidden Forces That Shape Our Decisions. Pymble, NSW, HarperCollins e-books.

Asensio, O. I., & Delmas, M. A. (2015). Nonprice incentives and energy conservation. Proceedings of the National Academy of Sciences, 112(6), E510-E515.

Barth, A. & Graf, J. (2011). Irrationality rings! Experimental Evidence on Mobile Tarif Choices. mimeo.

Beckenbach, F. (2015). Innovative behavioral approaches to analyze the incentives of environmental instruments – a survey. In F. Beckenbach & W. Kahlenborn (Eds.), New Perspectives for Environmental Policies through Behavioral Economics. Berlin: Springer, pp. 15-68.

Becker, J. (1978). Joint Effect of Feedback and Goal Setting on Performance: A Field Study of Residential Energy Conservation. Journal of Applied Psychology
63, 4, 428-433.

Botetzagias, I., Malesios, C., & Poulou, D. (2014). Electricity curtailment behaviors in Greek households: Different behaviors, different predictors. Energy Policy, 69, 415-424.

Bühren, C., & Kundt, T. C. (2014). Does the level of work effort influence tax evasion? Experimental evidence. Review of Economics, 65(2), 209.

Bühren, C. & Pleßner, M. (2014). The Trophy Effect, Journal of Behavioral Decision Making, 27(4), 363-377.

Camerer, C. (2011). "The promise and success of lab-field generalizability in experimental economics: A critical reply to Levitt and List." Available at SSRN 1977749.

Carlsson, F. (2010). "Design of Stated Preference Surveys: Is There More to Learn from Behavioral Economics?" Environmental and Resource Economics 46: 167-177. Carlsson, F., H. Haoran & Martinsson, P. (2013). Easy come, easy go – The role of windfall money in lab and field experiments, Experimental Economics, 16(2), 190-207.

Coates, A. (2012). Queensland's ClimateSmart Home Service. Interventions of Change Highlights Series.

Corgnet, B., Hernán-González, R., & Schniter, E. (2014). Why real leisure really matters: Incentive effects on real effort in the laboratory. Experimental Economics, 18(2), 1-18.

Costa, D. L., & Kahn, M. E. (2013). Energy conservation "nudges" and environmentalist ideology: Evidence from a randomized residential electricity field experiment. Journal of the European Economic Association, 11(3), 680-702.

Daskalakis, M. (2016a). Specification required? A survey of scientists' views about the role of behavioral economics for assessing environmental policy instruments. In F. Beckenbach & W. Kahlenborn (Eds.), New Perspectives for Environmental Policies through Behavioral Economics. Berlin: Springer, pp. 69-106.

Daskalakis, M. (2016b). Citizen orientated regulation. A guideline for the design of behavioral based instruments for environmental policy. Policy Brief, Federal Environmental Agency, Germany (to be obtained from the author).

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(3), 353-370.

European Commission (2006). " Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC " Official Journal of the European Union 27, 136-148.

Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. Experimental Economics, 10(2), 171-178.

Fishbein, M. and I. Ajzen (2010). Predicting and changing behavior: The reasoned action approach. New York, Psychology Press, Taylor & Francis

Frey, B. S., & Oberholzer-Gee, F. (1997). The cost of price incentives: An empirical analysis of motivation crowding-out. The American economic review, 87(4), 746-755.

Gill, D., & Prowse, V. (2012). A structural analysis of disappointment aversion in a real effort competition. The American Economic Review, 102(1), 469-503.

Gneezy, U., S. Meier, et al. (2011). When and why incentives (don't) work to modify behavior. The Journal of Economic Perspectives, 25(4) 191-209.

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

Hayes, S. C., & Cone, J. D. (1977). Reducing Residential Electrical Energy Use: Payments, Information, and Feedback. Journal of Applied Behavior Analysis, 10(3), 425–435.

Heap, S. H., Ramalingam, A., & Arjona, D. R. (2015). Social information 'nudges': An experiment with multiple group references (No. 15-02). School of Economics, University of East Anglia, Norwich, UK.

Hennig-Schmidt, H., Sadrieh, A., & Rockenbach, B. (2010). In search of workers' real effort reciprocity—a field and a laboratory experiment. Journal of the European Economic Association, 8(4), 817-837.

Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. American economic review, 92(5), 1644-1655.

Huber, J. and C. Puto (1983). "Market Boundaries and Product Choice: Illustrating Attraction and Substitution Effects." Journal of Consumer Research 10(1): 31-44. Huber, J., J. W. Payne, et al. (2014). "Let's Be Honest About the Attraction Effect." Journal of Marketing Research 51(4): 520-525.

Ipsos MORI (2011). Empowering Households - Research on presenting energy consumption benchmarks on energy bills. London Department of Energy & Climate Change.

Jager, W., & Mosler, H. J. (2007). Simulating human behavior for understanding and managing environmental resource use. Journal of Social Issues, 63(1), 97-116.

Karlin, B., Davis, N., Sanguinetti, A., Gamble, K., Kirkby, D., & Stokols, D. (2014). Dimensions of Conservation: Exploring Differences Among Energy Behaviors. Environment and Behavior, 46(4), 423 –452.

Levitt, S. D. and J. A. List (2007). "What Do Laboratory Experiments Measuring Social Preferences Reveal about the Real World?" The Journal of Economic Perspectives 21(2): 153-174.

Lockwood, M. (2009). Green Streets – Final Report to British Gas.

Loock, C.-M., Staake, T., & Thiesse, F. (2013). Motivating Energy-Efficient Behavior with Green is: An Investigation of Goal and Setting and the Role of Defaults MIS Quarterly, 37(4), 1313-A1315.

Mahone, A., Haley, B. (2011). Overview of Tesidentaial Energy Feedback and behavioral energy efficiency. Prepared for the Customer Information and Behavior Working Group of the State and Local Energy Efficiency Action Network. Energy and Environmental Economics inc (2011).

McCalley, L. T., de Vries, P. W., & Midden, C. J. (2011). Consumer response to product-integrated energy feedback: Behavior, goal level shifts, and energy conservation. Environment and Behavior, 43(4), 525-545.

Midden, C. J. H., Meter, J. F., Weenig, M. W. H., & Zieverink, H. J. A. (1983). Using Feedback, Reinforcement and Information to Reduce Energy Consumption in Households: a Field Experiment. Journal of Economic Psychology, 3(1), 65-86.

Morganti, L., Pallavicini, F., Cadel, E., Candelieri, A., Archetti, F., & Mantovani, F. (2017). Gaming for Earth: Serious games and gamification to engage consumers in pro-environmental behaviours for energy efficiency. Energy Research & Social Science, 29, 95-102.

Newell, R. G. & Siikamäki, J. (2013). Nudging energy efficiency behavior: The role of information labels. NBER Working Paper No. 19224.

Niederle, M., Vesterlund, L., 2011. Gender and competition. Annual Review of Economics 3(1), 601-630.

Nielsen, K. S. (2017). From prediction to process: A self-regulation account of environmental behavior change. Journal of Environmental Psychology, 51, 189-198.

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative Social Influence is Underdetected. Personality and Social Psychology Bulletin, 34(7), 913-923.

Osbaldiston, R., & Schott, J. P. (2012). Environmental Sustainability and Behavioral Science: Meta-Analysis of Proenvironmental Behavior Experiments. Environment and Behavior, 44(2), 257-299.

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(1), 16-33.

Qiu, Y., Colson, G., & Grebitus, C. (2014). Risk preferences and purchase of energy-efficient technologies in the residential sector. Ecological Economics, 107, 216-229.

RAND Europe (2012). What works in changing Energy - Using Behaviours in the Home? A Rapid Evidence Assessment. London Department of Energy and Climate Change.

Ro, M., Brauer, M., Kuntz, K., Shukla, R., & Bensch, I. (2017). Making Cool Choices for sustainability: Testing the effectiveness of a game-based approach to promoting pro-environmental behaviors. Journal of Environmental Psychology, 53, 20-30.

Roberts, S. (2004). Consumer preferences for improving energy consumption feedback. Bristol: Center for Sustainable Energy.

Schläpfer, F. & B. Fischhoff (2012). Task familiarity and contextual cues predict hypothetical bias in a meta-analysis of stated preference studies. Ecological Economics, 81, 44-47.

Schubert (2017). Green nudges: Do they work? Are they ethical? Ecological Economics, 132, 329-342.

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 (Wiley-Blackwell) 18(5), 429-434.

Seligman, C. and J. M. Darley (1977). "Feedback as a means of decreasing residential energy consumption." Journal of Applied Psychology 62(4): 363. Sheeran, P. (2002). "Intention - behavior relations: A conceptual and empirical review." European Review of Social Psychology 12(1): 1-36.

Shippee, G. (1980). Energy Consumption and Conservation Psychology: A Review and Conceptual Analysis. Environmental Management, 4(4), 297-314.

Shogren, J. F. (2012). WAEA Keynote Address Behavioral Environmental Economics: Money Pumps & Nudges. Journal of Agricultural and Resource Economics, 349-360.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. Journal of Environmental Psychology, 29(3), 309-317.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value Orientations, Gender, and Environmental Concern. Environment and Behavior, 25(5), 322-348.

Sunstein, C. R., & Reisch, L. A. (2013). Green by default. Kyklos, 66(3), 398-402.

Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving Decisions About Health, Wealth, and Happiness. London [et al.]: Penguin.

Tiefenbeck, V., T. Staake, et al. (2013). "For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign." Energy Policy 57: 160–171.

Urban, J., & Scasny, M. (2012). Exploring domestic energy-saving: The role of environmental concern and background variables. Energy Policy, 47, 69-80.

Winett, R. A., & Neale, M. S. (1979). Psychological framework for energy conservation in buildings: Strategies, outcomes, directions. Energy and Buildings, 2(2), 101–116.

Yue, T., R. Long, et al. (2013). "Factors influencing energy-saving behavior of urban households in Jiangsu Province." Energy Policy 62: 665-675.

Appendix

Sample electricity bill: Bill no. 2

Städtische Werke
Aktiengesellschaft

Städtische Werke
Aktiengesellschaft
Königstor 3–13
34117 Kassel
Telefon 0561 782-0
Telefax 0561 782-2121
www.sw-kassel.de
/swkassel

Städtische Werke Aktiengesellschaft | Postfach 10 36 09 | 34112 Kassel

Stefan Schmidt
Strombergstraße 23
34117 Kassel

Ihre Kundennummer	Rechnungdatum	Rechnungsnummer	Ihre Lieferadresse
STWKA-10010000070-9	15.6.2014	STWKA-ARV-2014-26486	(Siehe links oben)

Ihre Stromrechnung

Guten Tag Herr Schmidt,

für die vom 06.06.2013 bis zum 31.05.2014 gelieferte Energie erhalten Sie heute Ihre Rechnung. Zusätzlich geben wir Ihnen Informationen zum Verbrauchsvergleich und wollen Ihnen Stromspartipps vorstellen, mit welchen Sie Strom und Geld sparen können.

Überblick Ihrer Verbräuche und Kosten vom 06.06.2013 bis 31.05.2014

	Abrechnungsmenge	Bruttobetrag
Energiekosten Strom	2.865,85 kWh	847,72 €
Abzüglich geleisteter Abschläge		-805,27 €
Noch zu zahlender Betrag		42,23 €

Abschlagsinfo: **Ihr neuer Abschlag: 70,64 €**
Ihren ausführlichen Abschlagsplan finden Sie auf Seite 2

Die Nachzahlung in Höhe von 42,23Euro werden wir zum 14.07.2014 von Ihrem Konto mit der IBAN DE12 44345 4656 6767 88 bei der Kasseler Sparkasse abbuchen.

Strom ist teuer, Stromsparen ist nicht schwer: Setzen Sie sich ein Ziel!

1 **Ziel setzen**
85 € sparen
=10% sparen. Toll, dass Sie dabei sind.

2 **Strom sparen**
Unser Tipp:
Ihre Elektrogeräte ausstecken und Steckerleisten anbringen.

3 **Doppelt sparen**
Nochmal bis zu 48 € sparen: Pro eingesparte 5 % senken wir Ihre Stromrechnung in 2015 um 3%.

ACHTUNG TIPP!

Standby ist immer noch ein unterschätzter Stromfresser - Stromsparen ist nicht schwer:

Bis zu 115 € Ersparnis
durch konsequentes Ausstecken von Kaffeemaschine, Trockner, Fernseher und DvD-Spieler usw.

Bis 80 € Ersparnis
durch konsequentes Abschalten von Computer, Monitor, Router etc.

Schaltbare Steckdosen reduzieren den Aufwand und rechnen sich schnell.

Mehr Energiespartipps:
www.die-stromsparinitiative.de