Using behavioral insights to make firms more energy efficient:

A field experiment on the effects of improved communication[1]

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Abstract

The Dutch government provides annual, detailed, energy-efficiency feedback to individual companies that have signed a voluntary agreement to increase their energy efficiency. However, only about 14% of all companies actually download their dedicated report containing this feedback. To increase the assumed positive effect of the feedback, the Dutch government aims to increase this download rate. Drawing upon insights from behavioral economics, the present study investigates the effects of alternative emails, inviting to download the feedback report, on 505 companies´ download behavior, in a randomized controlled field experiment with two treatment groups and one control group. The download rates for our treatment groups are more than three times higher compared to the control group. Survey results indicate that the follow up behavior does not differ between the respondents who were nudged and those who were not. Moreover, we found indications that downloading the report induces the energy coordinators to consider energy-saving measures. More generally we have shown that policy targeting energy saving of firms can benefit from using behavioral insights. Relatively small changes in the implementation of specific interventions can have large influences on the effectiveness of the policy.

Keywords
Behavioral insights, Firms, Energy saving, Feedback

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1. Introduction

The Energy Efficiency Directive of the European Union gives clear targets to the member states to reduce CO_2 emission levels. In the Netherlands, for non-ETS[2] sectors, this CO_2 emission reduction goal is 16% for the period between 2005 and 2020 (Daniëls et al., 2014). To contribute to this goal, the Dutch government and 1,100 companies[3] signed a voluntary agreement.[4] These companies have a relatively high energy usage and differ largely with respect to their activities, production processes, energy usage, size, and energy efficiency. Companies who joined the agreement commit to making an Energy Efficiency Plan (EEP). Each plan contains energy-saving measures that should improve energy efficiency by 8% in 4 years—an average of 2% per year. In return, eligible companies can get a tax reduction. Monitoring of the energy-efficiency improvements occurs annually, and each company is obliged to provide data. Based on this data, an annual dedicated company report is made by RVO.nl, an agency of the Dutch government that provides detailed feedback to the individual company regarding its energy efficiency. The report also contains anonymous scores of companies in the same sector and a sector average as a benchmark to which energy-efficiency improvements can be compared.

The provision of individual feedback is based on the assumption that it helps the companies to improve their energy efficiency. The assumption is based on a broad literature that shows that individuals move toward more energy-efficiency behavior when provided with feedback (see e.g., Darby, 2006). Of course, the feedback can only be effective if company representatives responsible for energy efficiency actually read their dedicated reports. When reports are available, the companies receive an email that invites them to download the report from a password-protected website. However, only about 14% of all companies actually download their reports[5]. To increase the assumed feedback effect on energy-efficiency improvement, the Dutch government wants to increase the report download rate.[6]

Drawing upon insights from behavioral economics, the research described here aims to investigate how the invitation email can be improved to substantially increase the number of report downloads. We established the effect by a controlled natural field experiment (randomized controlled trial). Moreover, we also monitored the feedback effect with a survey, asking the companies if and how they have used the reports to improve their energy efficiency (follow-up behavior). To the best of our knowledge, this study is one of

[2] ETS = The EU CO_2 emissions trading system.
[3] In fact, these are 1,100 business units that individually function as a company. More business units can be a part of one larger company.
[4] This agreement concerned the MJA3 agreement (in Dutch: Meerjarenafspraak Energie-Efficiëntie 2001–2020)
[5] For safety reasons the report is not send by email.
[6] The low download rates can be caused by several factors, e.g. by the fact that the agreement is not very demanding, or because companies believe not to find much new information in the company report. However, the research described here aims to investigate how communication with the companies can be improved to substantially increase the request for feedback, which can lead to more energy saving.

the first natural field experiments specifically targeting the energy-efficiency behavior of company representatives.

We find that the download rates are more than three times higher for our treatment groups compared with the control group. The survey results indicate that we do not need to worry that the nudges did trigger respondents to download the report who subsequently do not do anything with it. We do indeed not find any significant differences regarding relevant follow-up behavior between the respondents who were nudged and those who were not nudged. Moreover, we find that downloading the report induces the energy coordinators to consider more energy-saving measures.

2. Theoretical Background and Hypotheses

Most of the research in behavioral economics on how to "nudge" individuals to adopt more energy-efficient behavior has focused on private consumers. Without doubt, consumers constitute a key target group for policymakers that aim for energy conservation. Abrahamse et al. (2005), for example, report that in the U.S., in 2003, private households were responsible for an estimated 1214.8 million metric tons (MMT) of U.S. energy-related CO2-emissions, equivalent to 21% of the total. OECD figures on household contributions to total energy usage generally range between 15% and 20% (Biesiot & Noorman, 1999). While these figures suggest that private households are an important target group, they also show that organizations, including private firms, are important as well. The industrial sector accounted for around 26% of total final energy consumption in the EU-28 in 2012 (Ademe, 2015). However, decision makers and representatives of firms, such as managers and energy coordinators, receive comparatively little attention in behavioral economics research, despite the fact that they represent an important target group when it comes to energy efficiency. This omission may be due to the fact that bounded rationality within organizations has been only incompletely absorbed in the economics of organization literature (see Bromiley, 2009), and thus also within the field of behavioral change and nudging.

Research in behavioral economics has shown that behavioral changes are positively associated with the provision of a limited amount of relevant and targeted information, as well as specific and timely feedback (see, e.g., Fischer, 2008; Darby, 2006). Regarding consumer responses to different forms of information and feedback about their energy use, the Energy Demand Research Project (EDRP), conducted by AECOM Building Engineering and Ofgem (AECOM Building Engineering and Ofgem; June, 2011) in the U.K., shows promising results. In the EDRP, four energy providers each conducted trials on the impact of various interventions, with the majority directed at stimulating energy conservation, and others aimed at shifting use from peak to off-peak periods. The effect of generic advice and historic feedback on energy consumption was not always seen, and when it was seen the reduction in [median] consumption was up to 5%**.** Information on energy conservation was most effective when provided in simple, short statements, and (repeatedly) over a period of time—minimal information but well-presented and easy to absorb. Therefore, the authors of the report concluded that, "advice should be provided but the details of delivery

(e.g., clarity, quantity of information, timing) and combination with other interventions, are critical" (p. 167). The same conclusions applied to the provision of historic usage feedback.

Ehrhardt-Martinez et al. (2010) present a meta-review of 57 primary studies into household electricity saving in response to various types of feedback performed over the course of the past 36 years in 9 countries including the U.S., Canada, Australia, Japan, and European countries. Overall, they find that significant savings can be achieved. The key message from their meta-analysis is that the type of feedback matters crucially. Some forms of feedback appear to be much more effective than others in generating more substantial energy savings. In particular, the frequency and richness of the feedback seem important. Fischer (2008) and Darby (2006) indicate that regular feedback has the greatest effect. We can conclude that in order to have the desired (positive) effect, information should not only be relevant and provided regularly, it should also be limited, as an overload may induce people to abstain from acting.

To investigate the effect of an improved invitation to gain feedback and the effect of this feedback on follow-up energy-saving behavior, we formulate hypotheses for our randomized controlled field experiment and the survey, both previously mentioned, from a behaviorally enriched, rational-choice framework. We consider downloading behavior as the outcome of a trade-off: if the perceived benefits from downloading the dedicated report are larger than the perceived costs, the respective decision maker should decide to adopt this behavior. We explicitly allow these benefits to include non-monetary benefits and the costs to include cognitive costs and other frictions. The behavioral economics literature provides evidence from various contexts (see, e.g., Haynes et al., 2013; Gleerup et al., 2010) that simplifying desired behavior can positively influence the likelihood that individuals display such behavior. We therefore hypothesize that if we reduce the perceived costs by making the message of the invitation email clearer and shorter and reducing the effort required to download, download rates should increase. Moreover, by emphasizing the additional informational value of downloading, we aim to increase the (perceived) benefits. This should additionally increase the download rate of the reports.

Hypothesis 1a: *Reducing the perceived costs of downloading by simplifying the message and the process leads to more downloading.*

Hypothesis 1b: *Reducing the perceived costs and increasing the (perceived) benefits from downloading by emphasizing the additional informational value leads to even more downloading.*

Regarding households, a series of U.S. trials have demonstrated that personalized behavioral feedback can help households reduce their energy consumption (Houde et al., 2013; Allcott, 2011). In the same way, we expect that companies that download the dedicated report will stimulate energy-saving behavior. We therefore hypothesize the effects of downloading the dedicated report on energy-saving behavior.

Hypothesis 2a: *Downloading the dedicated report stimulates energy-saving behavior.*

At the same time we would like to ensure that our nudges did not stimulate firms to merely download the report to thereafter ignore it. In this sense, we hypothesize that, for the companies that have downloaded their dedicated report, our nudges (simplifying the message and the downloading process) will not reduce (or increase) follow-up behavior that is relevant for or related to energy saving.

Hypothesis 2b: *Reducing the perceived costs and increasing the (perceived) benefits from downloading does not affect follow-up behavior or the motives for downloading.*

Additionally, we expect companies that request feedback (i.e., downloaded the report in 2015) to show more energy-saving behavior, which would become visible in higher energy savings in 2015. Unfortunately, due to the short time lapse between providing feedback and measured realized energy savings, it is not possible to establish a causal relation between download behavior and realized energy savings. Any realized energy savings could also be the result of feedback requests of earlier years. This implies that possible differences in actual energy savings can be only an indication of the effectiveness of the requested feedback. For this reason, we do not explicitly pose a hypothesis, but still put the relation between download behavior and realized energy savings subject to closer examination.

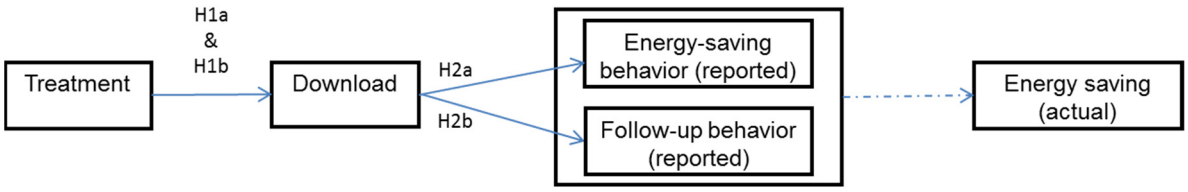

Figure 1: The hypothesized effects of the interventions.

The magnitude of the effects associated with the nudges is an open empirical question, motivating the experiment presented next.

3. Experimental Method

To test our hypotheses, we conducted a field experiment (randomized controlled trial). This allowed us to observe a subject in a controlled setting while the subject does not perceive any of the controls as being unnatural and no deception is being practiced (Harrison and List, 2004). We expect that the results of this experiment can be used directly to improve the energy-efficiency policy in the setting of voluntary agreements and possibly other programs, using information to stimulate energy-saving behavior.

We next describe the design of the experiment, the sample, the treatments, and the collection of the data.

3.1 Sample

The experiment participants are the energy coordinators of the companies that signed the voluntary agreement. From all 1100 companies that participated in the voluntary agreement, we selected 639 companies for our experiment, represented by 505 energy coordinators. We limited the experiment to this group because these companies received a standardized dedicated report and an email in which they were invited to download their report. The companies that were not selected received a non-standardized dedicated report as an appendix to an email. The coordinators were not told that they were participants of an experiment.

3.2 Treatments

Our treatment variable is the email content that announces the availability of the dedicated report and invites companies to download this report. This independent variable has three conditions: an extended message, a simplified message, and a simplified message plus emphasized additional informational benefits. We randomly assigned the participants to one of the three conditions. The sampling procedure was based on firm sector, size, and energy usage. See Appendix A1 for an extended description of the random assignment. The conditions led to three treatment groups:

- The control group (T0) received an extended email, similar to that of the email of the previous year, in which the companies were invited to download their report. The email started with an announcement that the company had fulfilled its obligations and included a general link to the website, from which the dedicated report could be downloaded.
- Treatment group 1 (T1) received an invitation email that was significantly shorter than the email sent to the control group (T0). In a short email, the main purpose was expressed in the first paragraph, directly followed by an embedded link to the report on the website. By using the deep link, one less click was required to download the report.
- Treatment group 2 (T2) received the same shortened email of T1. To increase the (perceived) benefits from downloading, we added one sentence to emphasize the additional informational value: "Your company report shows how your company

performs, compared to other companies in your sector."[7] While a large part of the dedicated report reflects the energy coordinator's own information, the achievements of comparable companies is new information.

See Appendix A2 for the translated texts of all three emails.

3.3 Data and measures

Our data comes from three data sources: (1) monitoring of actual download behavior, (2) a survey to measure follow-up energy-saving behavior, and (3) general company data from a database.

3.3.1 Actual download behavior: monitoring

For this experiment we ensured that each treatment group received a different email invitation. The emails were sent in July 2015. Subsequently, the actual download of the reports was monitored. The actual download behavior is our first main dependent variable. The dedicated reports can be downloaded from a password protected website. Companies receive their username and an annually changing password usually by the second week of January. When all monitoring data of the participating companies are available, the companies are invited by email to download their dedicated report.

For each report download, we registered the date and time. Thus, the download behavior was unambiguously associated with one energy coordinator. If one coordinator was responsible for more than one company, the download of one report was enough to register as "downloaded." The coordinators were not told that their actual download behavior was monitored.

3.3.2 Reported follow-up behavior and reported energy-saving behavior: survey

The follow-up behavior and energy-saving behavior are our other main dependent variables, which we retrieved from the energy coordinators' responses to an online survey. Two months after the treatment, an email was sent to each participating coordinator with a request to complete a survey.[8] On the survey, first the (treatment dependent) "inviting to download" email was shown, which the respective respondent had received two months ago. We next asked the respondents to answer seven closed questions in regards to the concerning email, as well as follow-up behavior such as whether they had downloaded their dedicated report, and subsequent actions and motivation. Further, the respondents were asked about their reported energy-saving behavior and their intentions regarding new energy-saving measures. Finally, we requested some additional information about the perceived relative importance of the company energy bill, the size of the company, the sector of the company, and how much time in fulltime equivalent (FTE) the company has

[7] Translated from Dutch: "Uw bedrijfsrapport vertelt u hoe uw bedrijf op het gebied van energie-efficiëntie presteert ten opzichte van bedrijven uit uw sector."
[8] For the exact time line of our data collection see Appendix A3.

allocated to saving energy—all of which we considered relevant control variables for our analysis. The (translated) survey questions are replicated in Appendix A4.

3.3.3 General company data: database

We included general company data as additional control variables. Each year the companies must provide data to comply with the obligations of the voluntary agreement. For a full description of this process, see Abeelen et al. (2013). For the present study, a relevant selection of this data from the years 2015 and 2016 was used, as well as the data on download behavior, and the survey data on follow-up energy-saving behavior. Appendix A5 gives an extended description of the data section.

3.3.4 Measures

To test our hypotheses, we used the collected data from the three different sources for the three treatment groups:

- To test Hypothesis 1a (*Reducing the perceived costs of downloading by simplifying the message and the process leads to increased downloading*), we compared the actual download behavior of T0 and T1.
- To test Hypothesis 1b (*Reducing the perceived costs and increasing the (perceived) benefits from downloading by emphasizing the additional informational value leads to even more downloading*.), we compared the actual download behavior of T1 and T2.
- To test Hypothesis 2a (*Downloading the dedicated report stimulates follow-up energy-saving behavior*), we compared the self-reported follow-up behavior of respondents who downloaded and those who did not.
- To test Hypothesis 2b (R*educing the perceived costs and increasing the (perceived) benefits from downloading does not affect follow-up energy-saving behavior*), we compared the self-reported follow-up behavior between T0, T1, and T2 to those respondents who downloaded the report.

To investigate whether obtaining feedback about energy-saving behavior (i.e., download of the report in 2015) leads to a higher number of realized energy-saving measures in 2015, we compared the actual energy savings of companies that downloaded the report with those that did not.

4. Results

4.1 Validity of the random assignment and response

Before we present the treatment effects of our experiment, we verify the validity of the treatment groups and the responses to the survey. Table 1 presents descriptive statistics for all treatment groups regarding our control variables of firm characteristics from the database and the survey responses.

For the available control variables, the three treatment groups do not differ from each other, neither when considering all companies nor when considering only the survey respondents. One-third of the companies responded to the survey. As shown by the p-

values in the fifth column of Table 1, all variables are balanced between the treatment groups and the control group.

	T0	T1	T2	Total	P
All companies					
N	170	169	166	505	
Average energy usage (in TJ in 2014	188	177	153	173	0,67 [a]
Average number of employees	126	113	122	120	0,47 [a]
Number of different sectors	21	22	22	22	
Average savings in TJ in 2014	13	11	8	11	0,50 [a]
Survey response					
N	53	54	60	167	
Average energy usage (in TJ 2014)	127	255	157	167	0,15 [a]
Average savings (in TJ 2014)	9	38	3	16	0,66 [a]
Self-reported importance energy bill (H/M/L) (in %)	38/43/19	50/43/7	40/50/10		0,31[b]
Self-reported no of employees	139	129	130		0,43 [a]
Self-reported existence of shareholders (% yes)	70	72	78		0,57 [a]
Family business (% yes)	40	33	40		0,72 [a]
Self-reported time spend on energy-related activities (hour/wk)	3,0	3,2	3,3		0,96 [a]

Superscripts indicate p-values for a) Kruskal-Wallis and b) Pearson tests.

Table 1. Descriptive Statistics for the Treatment groups and Control Group

4.2 Impact of the nudges on actual download behavior

Our first hypothesis (H1a) postulates that the reduction of perceived costs of downloading by simplifying the message and the process will lead to an increase in downloading. We therefore expect to see a higher actual download percentage in Treatment T1 compared with T0. The first estimate of interest is the average treatment effect in the download behavior of the experimental contact persons if they received the treatment email of T1 and if they were not treated, respectively (Gerber and Green; 2012). Hypothesis 1b postulates that the download rate will be higher by additionally emphasizing the informational value of the report. We therefore expect to see a higher actual download

percentage in Treatment T2 compared with T1. The actual download behavior for all companies is based on download registration and shown in Table 2.

Treatment	N	Actual download	Cohen's d
T0	170	24 (14%)	
T1	169	77 (46%)	1.9
T2	166	85 (51%)	2.2
Total	505	186	

Table 2. Actual Download Behavior

The download rate for T1 is more than 3 times compared with T0 ($p<0.00$, Pearson). Hypothesis 1a, stating that a reduction of perceived costs of downloading is associated with increased downloading, cannot be rejected.

Following our next hypothesis (H1b), we expect to find that if, additionally, to reduced costs, the perceived benefits from downloading are increased, downloading increases even more. This hypothesis can be rejected, as we find no significant difference in download behavior between T1 and T2 ($p = 0.3$, Pearson). A possible reason for this insignificant result could be that the potential extra positive effect is not homogeneous among all firms and the overall size of the effect therefore is too small to be detectable with our sample size.

Note that a few respondents downloaded the report only after receiving the survey invitation. Their download behavior, however, does not affect these results.

4.3 Impact of nudges on reported follow-up behavior

Before we test Hypothesis 2a, we first test Hypothesis 2b. To do this we analyze the reported follow-up behavior (what did the respondents do with the dedicated report?) and their motives (why?). This analysis is based on the survey data.

To evaluate the survey results, we first compare the actual download frequency of the respondents with their self-reported download behavior and the download frequency of all the companies. We find that for all treatments, the actual download frequency of the respondents is much higher than for the total sample of all companies (see Table 3). It is reasonable to assume that the energy coordinators who are more focused on energy topics than the average coordinator are also more likely to respond to our survey. This means that the survey response is not representative regarding this point. In addition to the actual download behavior, Table 3 shows also the self-reported download behavior. It is remarkable that a large part of the responding energy coordinators incorrectly report whether they have downloaded their report.

Treatment	Total population	Response		Downloaded (actual) survey respondents		Downloaded (actual)		Not downloaded (actual)	
						Correctly self-reported	Incorrectly self-reported	Correctly self-reported	Incorrectly self-reported
	N	N	%	N	%	N	N	N	N
T0	170	53	31	15	28	10	4	24	13
T1	169	54	32	37	69	29	7	8	7
T2	166	60	36	43	72	30	13	12	4
Total	**505**	**167**		**95**		**69**	**24**	**44**	**24**

Table 3. Response, Actual Download Behavior and Self-reported Download Behavior[9]

Because the incorrect reporting is as high for the actual downloaders as for the non-downloaders, it is unlikely that the respondents reported incorrectly on purpose. It is more likely that they simply did not accurately remember their actions. Two months after the invitation email, the energy coordinators were invited to complete a survey (See Appendix A3).

4.3.1 Impact of nudges on perception of the invitation mail

To gain a better view on the direct effects of the nudges, at the beginning of the survey the previously sent email was presented. We asked the respondents whether, at the time, they had read and how they had judged the invitation in terms of its clarity, incentive to read further, taking additional action, length, and information.

About 87% of the respondents reported that they did remember the invitation email, of which 94% reported that they had read the email. About 10% of the respondents did not remember receiving an email, and 4% reported they never received such an email. More respondents in T1 and T2 remembered that they had received the invitation email.[10]

Treatment	Did read the email	Did not read the email	Does not remember anymore	Never received such an email	Total
T0	39	1	11	2	53
T1	46	3	2	3	54
T2	52	4	3	1	60
All	137	8	16	6	167

Table 4. Answers of the Question: Have you Read the Invitation Email?

[9] Six respondents did not give a response on the self-report question because they indicated that they did not receive any mail from RVO.nl (please spell out). It is moreover possible that in some cases, other employees downloaded the report. However, as the survey was sent to the same email address as the invitation email, we attribute all inconsistencies mainly to memory failure and therefore neglect issues of (two-sided) non-compliance.

[10] Pearson Chi^2 for only the categories "did read the email" and "does not remember anymore": $p=0.016$.

Figure 2 shows that the respondents in T1 and T2 viewed the short invitation email more favorably than the respondents in T0 viewed the long one. Although the differences in the scores on the judged items between T0 and T1/T2 are not always significant,[11] if the ratings for the separate items are combined into one score, the appreciation for the invitation email in T1 and T2 is higher than the email in T0.[12]

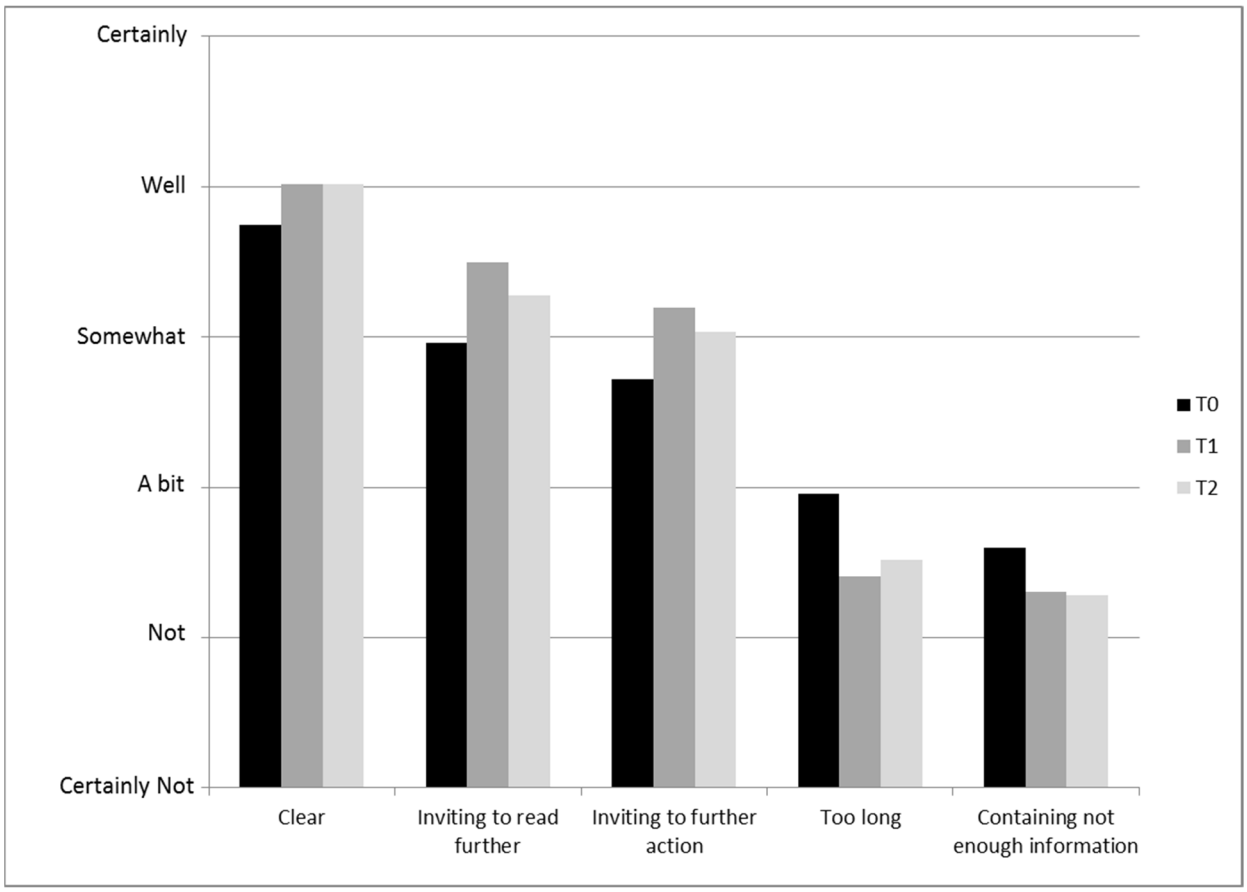

Figure 2. Opinions of the energy coordinators regarding the invitation email.

[11] The scores of T1 and T2 do not differ significantly for any of the items, while T0 and T1 (and T0 and T2 respectively) differ for "too long" with p=0.012 (p=0.027), and for "inviting to read further" with p=0.009 (p=0.099). For "inviting to further action" only T0 and T1 differ significantly, with p=0.049.

[12] To combine the ratings for the separate items, we added up the scores for the positive items (clarity, inviting to read further, inviting to further action) and we subtracted the score for the negative items (too long, not containing enough information). With respect to the average score for this new variable, t-tests reveal that T0 and T1 (and T2, respectively) differ significantly: p=0.004 (p=0.016, respectively), while the scores of T1 and T2 do not differ significantly, p=0.51.

4.3.2 Relation nudges and follow-up behavior or motives to download

To verify that our nudges did not stimulate firms to merely download the report and thereafter ignore it, we asked those respondents who downloaded the report what they subsequently did with it. The answer options ranged from "nothing (yet)" to "forwarded it" to colleagues or management, respectively, to "discussed it" with colleagues or management. We interpret these answers as an indication of increasing commitment to follow-up behavior. Figure 3 shows that respondents in T1 and T2 answered that they more frequently forwarded the report to or to have discussed it with management.[13] A Kruskal-Wallis test reveals that this difference is not statistically significant for either of the two answers (p=0.78).

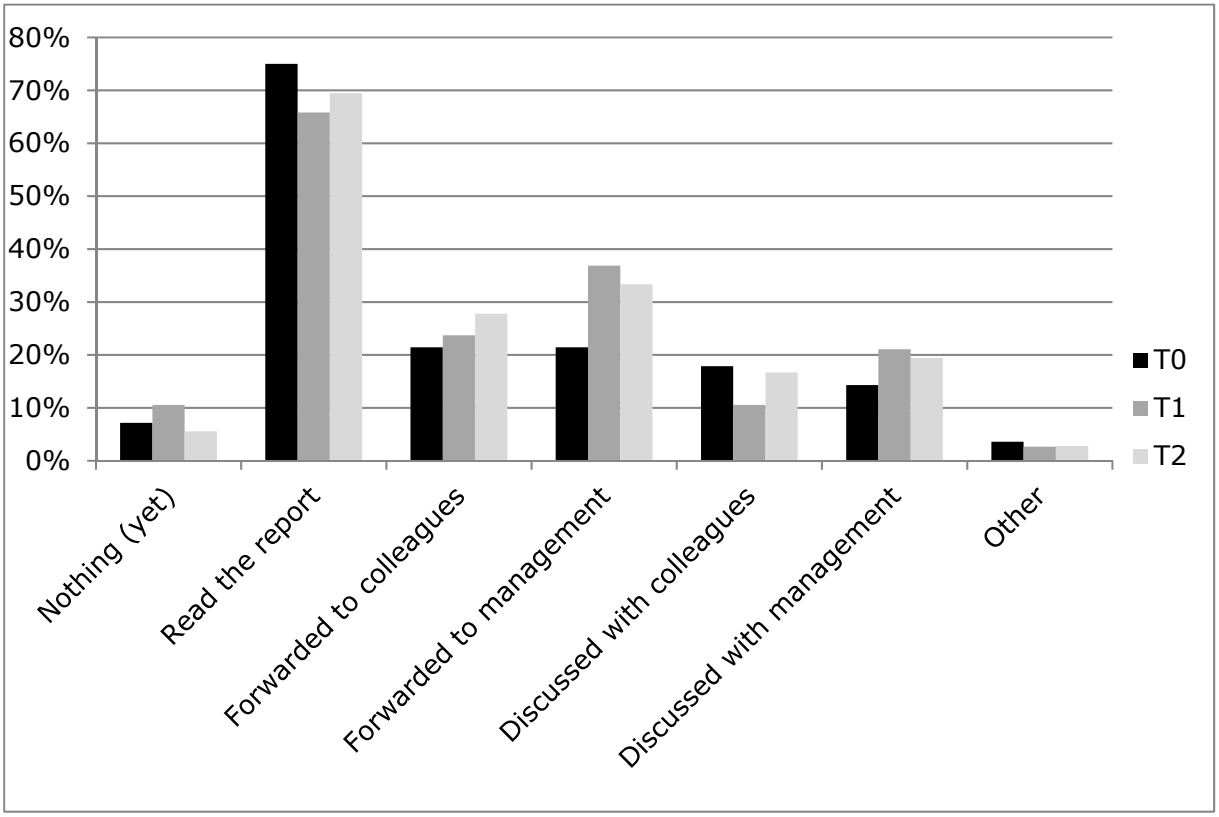

Figure 3. The energy coordinators' answers on follow-up behavior regarding the report.

As multiple answers were possible, we created three new variables: (1) one indicating the sum of positive answers to the question, labeled as "positive," excluding only option "nothing (yet);" (2) one indicating the sum of positive answers to "forwarded it to management" and "discussed it with management" labeled as "reported to management;" and (3) one indicating the sum of positive answers to "forwarded it" to colleagues or management and "discussed it" with colleagues or management, labeled as "reported action."

[13] Keep in mind that in about 20% of the (mostly smaller) companies, the function of the energy coordinator is assigned to a member of the management. In such cases, the option to forward or discuss the report with management is not a valid option, as we do not know if forwarding and discussing with management is necessary or desirable. This depends on the management organization of the company.

Table 5 shows the results of an OLS regression for each of the three variables, controlling for size, total energy costs and sector. We find only a weak effect of T1, and no effect of T2.

	Positive	Reported to management	Reported action
T1	0.513	0.304	0.420
	(2.23)*	(2.42)*	(2.40)*
T2	0.286	0.185	0.262
	(1.33)	(1.85)$^{+}$	(1.62)
Size	0.001	-0.000	0.001
	(1.05)	(0.27)	(1.37)
Costs electricity	0.000	-0.000	0.000
	(0.46)	(0.25)	(0.60)
Costs natural gas	-0.000	-0.000	0.000
	(1.04)	(1.69)+	(0.10)
Sector dummies	Yes	Yes	Yes
Constant	0.582	0.208	-0.045
	(0.76)	(0.52)	(0.09)
R^2	0.13	0.16	0.17
N	167	167	167

Heteroskedasticity-consistent estimator of variance; session dummies incl. + p<0.1; * p<0.05

Table 5. OLS Regression Results for Follow-up Behavior

We also asked the respondents who indicated to have downloaded the report about their motives. Figure 4 shows the answers. The first two answers, as well as the sixth, capture a company's rather defensive motive to check the report for its correctness and to ensure that the company meets the minimum criteria (DEFENCE). The fourth and fifth answers capture the company's motive in comparing its performance to an internal or external benchmark (COMPARING). The third and seventh answers capture a company's motive to understand and discuss its energy-saving policy (UNDERSTANDING), the eighth and ninth answers capture a curiosity motive (CURIOSITY).

In Figure 4, it is shown that respondents in T1 and T2 more frequently indicate to have downloaded for internal and external comparative reasons, but also out of curiosity. In the figure, respondents in T1 also indicated a defensive motive (Option 6) but a Wilcoxon rank sum test reveals that this difference in the control treatment is not statistically significant (Prob > |z| = 0.12).

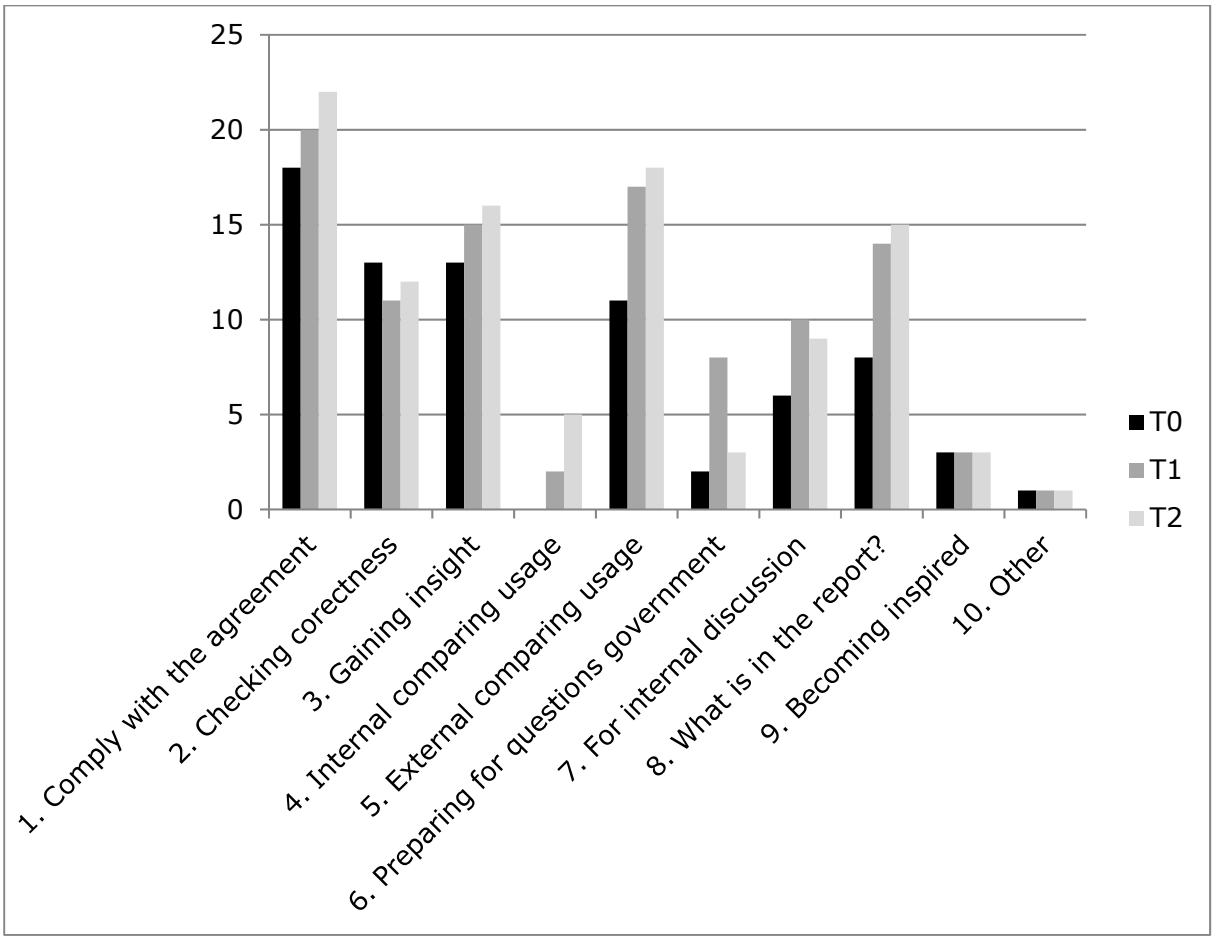

Figure 4. Reasons for downloading the report according to the energy coordinators.

The regression presented in Table 6 confirms the finding that companies in Treatment 1 and 2 show some tendency to use the report more for internal and external comparison than the control group even if we control for size, total energy costs, and sector, while no significant difference exists with respect to the other motives. While the email in T2 explicitly emphasized the possibility of using the report for comparing company results to other companies in the same sector, T1 did not include such a statement. However, different from T0, both emails explicitly emphasized the sector report in bold letters. Without any further experimentation, inferences about causal effects unfortunately remain speculative.

	DEFENCE	COMPARING	UNDERSTANDING	CURISOSITY
T1	0.141	0.224	0.193	0.141
	(0.78)	(2.41)*	(1.53)	(1.44)
T2	0.013	0.200	0.110	0.062
	(0.08)	(2.01)*	(0.95)	(0.65)
Size	0.000	0.001	0.000	-0.000
	(0.26)	(2.65)**	(0.15)	(0.54)
Costs electricity	-0.000	0.000	0.000	-0.000
	(0.49)	(1.06)	(0.83)	(0.12)
Costs natural gas	-0.000	-0.000	-0.000	-0.000
	(0.67)	(2.30)*	(1.71)+	(2.33)*
Sector dummies	yes	yes	yes	yes
Constant	0.321	0.342	-0.176	0.295
	(0.86)	(0.82)	(1.20)	(0.84)
R^2	0.11	0.28	0.20	0.16
N	167	167	167	167

Heteroskedasticity-consistent estimator of variance; session dummies incl.; + P<0.1; * p<0.05; ** p<0.01

Table 6. OLS Regression Results for Motives to Download the Report

Summarizing the results from this section, in the case of respondents who have downloaded the report, we do not find large differences in follow-up behavior between the three treatments. We found neither significant differences between the treatments regarding the immediate action triggered by the report, nor regarding the motives to download the report, with the exception of the companies in Treatment 1 and 2 that use the report more for internal and external comparative purposes than the control group. We conclude that not enough strong evidence exists to fully reject Hypothesis 2b: Reducing the perceived costs and increasing the (perceived) benefits from downloading does not affect follow-up behavior or the motives for downloading.

4.4 Impact download on reported energy-saving behavior

To test our Hypothesis 2a, we analyzed the reported energy-saving behavior of the respondents. To gain a perspective on changes in energy-saving behavior from the downloaded report, we asked all respondents what kind of activities they initiated in new energy-saving measures. Figure 5 shows the answers, which ranged from "Yes, discussed with management," on the furthest left to, "No, and not planning to do," on the furthest right, with several decreasingly committing options in between. As multiple answers were possible for this question, we made a new variable, "New measures," that had value 1 if Option 0 ("No, and not planning to do") or Option 1 ("No, but I think I will") was chosen, a value of 2 if Option 2 was chosen, 3 if Options 3 and 2 or 1 were chosen, and so on, up to 8 if Option 8 and any lower option was chosen. This variable thus considers only respondents' highest commitment. The respective scores for these variables for both—the

companies who actually downloaded the report as well as the companies that did not—are presented in Figure 5.

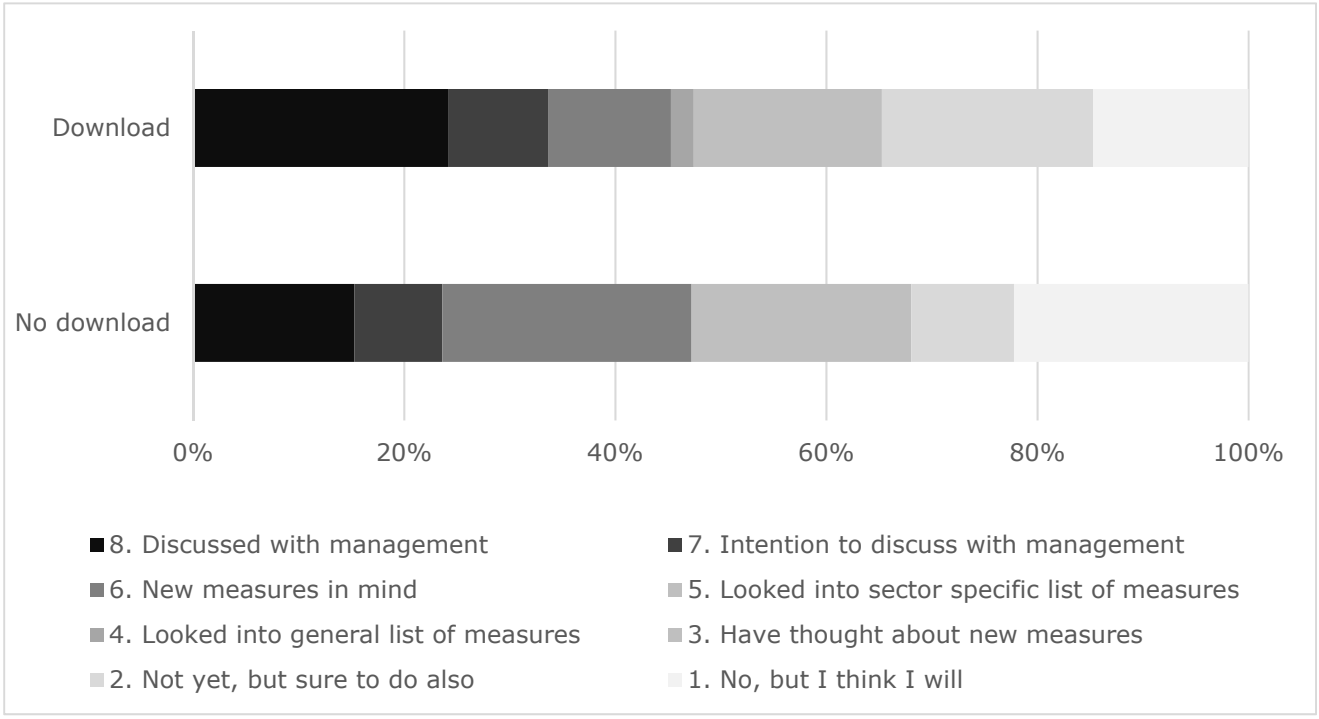

Figure 5. The energy coordinators' answers on energy-saving behavior.

A logit regression is presented in Table 7, with the highest commitment—i.e., given by the value of the variable "New measures," as a dependent variable and the download as an independent, controlling for size, total energy use and sectors—confirms that respondents who downloaded the report are significantly more likely to report that they discussed new measures with the management ($p= 0.098$) and are significantly less likely to answer that they are not planning any new measures ($p= 0.079$). This means that, taking into account the higher actual download behavior for T1 and T2, we have no reason to reject Hypothesis 2a: that is, downloading the dedicated report indeed stimulates energy-saving behavior. There is an indication that downloading the report induces the energy coordinators to consider more energy-saving measures.

	New measures 1	New measures 2	New measures 3	New measures 6	New measures 7	New measures 8
Download	[illegible]	1.000	-0.209	-1.164	-0.061	0.918
	[illegible]	(1.51)	(0.41)	(1.62)	(0.10)	(1.68)+
Treat1	[illegible]	-0.048	0.704	0.111	0.340	-0.927
	[illegible]	(0.08)	(1.44)	(0.21)	(0.37)	(1.08)
Treat2	[illegible]	-0.449	1.526	-0.492	1.057	-0.731
	[illegible]	(0.80)	(2.39)*	(0.70)	(1.31)	(0.84)
Energy usage	[illegible]	-0.003	0.001	-0.000	-0.001	0.004
	[illegible]	(2.02)*	(0.43)	(0.69)	(0.46)	(1.64)
Result 2015	[illegible]	0.016	0.132	-0.322	-0.020	0.000
	[illegible]	(0.07)	(0.68)	(0.47)	(0.10)	(0.00)
Size	[illegible]	0.001	-0.005	0.000	0.005	0.001
	[illegible]	(0.42)	(1.38)	(0.06)	(1.89)+	(0.39)
Sector Dummies	[illegible]	Yes	Yes	yes	yes	yes
Constant	[illegible]	-0.183	-1.564	0.414	-3.520	-3.841
	[illegible]	(0.18)	(1.21)	(0.33)	(5.76)**	(2.64)**
N	[illegible]	128	145	136	113	147

Heteroskedasticity-consistent estimator of variance; session dummies incl. + p<0.1; * p<0.05; ** p<0.01

Table 7. Logistic Regression Results for Positive Answers on New Measures

4.4.1 Download behavior and measured energy efficiency

As previously mentioned, we cannot establish a causal relation between requesting feedback (downloading the report) and energy savings, but we will give a closer look to the relation between download behavior and realizing energy savings. We compared the realized energy savings of companies that downloaded the report to those that did not.

Table 8 shows the realized energy savings in terajoules in 2015 in Model 1, and the change in realized energy savings from 2014 to 2015, as a ration between the two (DIFF1514), all estimated robust for all firms in Model 2. Model 3 and Model 4 show the same two estimations controlled for size and energy use for all firms for which all variables are non-missing and well defined. Downloading is weakly positively associated with higher energy-efficiency improvements in 2015, but not with an increase in the ratio. This effect is robust when controlling for other firm specific variables. The treatments did not have an additional significant effect.

	Realized measures [TJ] 2015 Model (1)	DIFF1514 [TJ] Model (2)	Realized measures [TJ] 2015 Model (3)	DIFF1514 [TJ] Model (4)
Download	27.494	-4.962	30.620	-4.748
	(1.70)+	(1.00)	(1.88)+	(0.93)
Treatments 1&2	4.937	2.954	6.493	2.552
	(0.51)	(0.83)	(0.73)	(0.60)
Sector Dummies	yes	yes	yes	yes
Size			0.077	0.013
			(1.20)	(0.77)
Energy usage			0.127	-0.022
			(2.08)*	(1.02)
Result 2015			53.551	-1.097
			(2.29)*	(1.44)
Constant	-4.870	7.141	-98.750	9.114
	(0.36)	(1.00)	(2.70)**	(1.05)
R^2	0.08	0.03	0.22	0.05
N	505	396	449	350

Heteroskedasticity-consistent estimator of variance; sector dummies incl.; + $p<0.1$; * $p<0.05$; ** $p<0.01$

Table 8. (OLS) Regression Results for Realized Energy Savings in 2015 Measured in TeraJoules.

5 Discussion

Several comments should be made with respect to the results.

First, regarding the relevant control variables, the three treatment groups do not differ from each other in terms of all companies as well as the survey respondents. However, we found that the actual download frequency of the responding companies is much higher than the download frequency of all the companies.[14] As previously mentioned, it is reasonable to assume that the energy coordinators who are more focused on energy topics are also more likely to respond to our survey. This means that the survey response is not representative regarding this point and implies that the survey results could be distorted when it comes to motive, follow-up behavior, or energy-saving behavior. Nonetheless, to draw our conclusions, we only compare groups of respondents, which is why we do not expect these possible distortions to affect our conclusions.

Second, it was remarkable that a large part of the respondents from the survey did not remember correctly whether they downloaded their reports. This means that here, observed behavior provides more reliable results than just a survey to detect behavior. We do not think that the incorrect reporting affects our conclusions, as the incorrect reporting is as high for the actual downloaders as for the non-downloaders.

Third, about 20% of the energy coordinators are directly responsible for the energy savings of the company and could be members of the management. In the survey, we asked respondents about their follow-up behavior and energy-saving behavior. For energy coordinators who are part of the management the option to forward or discuss the report

[14] This is also valid for each treatment group and the control group separately.

with the management are possibly not valid, as we do not know if these actions are necessary or desirable. This means that the follow-up behavior and energy-saving behavior could be underestimated.

Fourth, in the introduction we stated that, in order for information to have the desired (positive) effect, it should not only be relevant and targeted, but it should also be limited to prevent an overload. Both treatment groups received a shorter invitation email with limited information that was more targeted than the invitation email of the control group. We cannot disentangle which aspect—targeting or the limitation of information—caused the higher download rate.

Fifth, besides the motives addressed in our survey, the energy coordinators' incentive also play a role. However, our conclusions are based on the comparison between two randomly assigned groups. We therefore do not expect that this mechanism will affect our results and conclusions. To confirm this conjecture, we ran a robustness check on our analysis in which we performed a logistic regression, where we regressed the probability to download on all relevant variables that characterize the firm's context (firm size, energy usage, energy efficiency, sector), see Appendix B3. In this robustness check we assume that an individual energy coordinator's incentives (credit for efficiency gains, role in firm) are to a large extent a function of the firm's context.

Finally, The Behavioral Insights Team in the UK (2010) has conducted dozens of RCTs with Government departments that examine ways of making desired behavior easier, e.g. by reducing the 'hassle factor' or simplifying the message. Making a letter easy to understand often results in a 5% or 10% increase in response rates. Compared to this, our result of tripling the download rate from is very high. However, comparative feedback interventions on households lead to a reduction in gas usage of up to 20% (Abrahamse et al., 2005).

6 Conclusions and policy implications

Based on our findings, we draw three main conclusions: First, a reduction of the (perceived) costs of requesting feedback about energy savings leads to a higher request of feedback from companies. The companies that received a shorter adjusted email, taking into account behavioral insights, in which they were invited to receive the feedback, downloaded their reports three times more often than the companies who received the original longer, less-targeted email containing more information. We did not find any effect of emphasizing that the report contains additional information. The companies judged the short invitation email more favorable than the extended email on aspects such as clarity, length, and informational content.

Second, reducing the perceived costs and increasing the (perceived) benefits from downloading does slightly affect the follow-up behavior or the motives for downloading. The companies that were triggered by the shorter email, report the same follow-up behavior (such as reading the report and forwarding or discussing the report with others) and approximately the same motivation to download compared to the companies who received the long email.

Third, downloading the report induces companies to consider more energy-saving measures. We found that the group that downloaded the report is more likely to consider new energy-saving measures and discusses such measures more often with the management. Based on the available data, we cannot establish a causal relation between

requesting feedback (downloading the report) and energy savings, but we found a weak indication that a positive relation exists between downloading the report and higher energy savings.
More generally we have shown that policy targeting energy saving of firms can benefit from using behavioral insights. Relatively small changes in the implementation of specific interventions can have large influences on the effectiveness of the policy. Specifically, improved communication with companies about their energy saving performance, by simplifying the message and removing 'frictions', leads to more follow-up behavior to save energy.

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Appendix

Appendix A (Data collection)

A1 Sampling

To ensure good comparability of the three the treatment groups, company units have been randomly assigned to one of the three groups. For this firms were first assigned to categories using the variables sector, energy usage and number of employees. A list of included sectors is available upon request. Energy usage in the total sample varies between 1 and 11392, with an average of 242, the number of employees varies between 1 and 1395, with an average of 120. Categories were constructed using: 1) a three digit sector code, 2) a code from 1 to 4 reflecting their total energy usage (EG), and 3) a code from 1 to 3 reflecting the number of employees (WG).[15] The firms for which data on the number of employees was not available were added as a separate category (0). For example, the code 102.11 would indicate a company that belongs to sector 102 (foundries), has a total primary energy usage between 1-100 TJ, and number of employees between 1-150.

Then firms were grouped according to these codes and random numbers between 1-3 were allocated. Based on these number firms were distributed in one of the three treatment groups. Lastly, a check on 'concerns' (companies with the same contact person), has been made, to ensure that one contact person does not receive different mails. To check comparability of the treatment groups, a Pearson test has been performed to ensure insignificant differences w.r.t. all three selection criteria (p=0.172 for TJ, p=0.985 number of employees, p=0.522 sector).

Table A1: sample description

Treatment Group	Number of company units	Number of contact persons	Energy usage			Number of employees		
			Average	Min	Max	Average	Min	Max
1	211	170	188	1	2161	126	3	1221
2	217	169	177	2	2888	113	1	657
3	211	166	153	3	1386	122	1	1395
Total	**639**	505	**173**	**1**	**2888**	**120**	**1**	**1395**

[15] See Table 10 in Appendix A5 for the categories.

A2 The email texts used in the different treatments

In this experiment three different emails were used to announce the availability of the company report to the energy coordinator of each company. The control group (T0) got nearly the same email used the year before. Treatment group 1 (T1) got an email of which the whole text has been changed, using behavioural insights. Letter number three is a copy of letter number two, with one additional sentence.

T0	Standard RVO download email
T1	Easier and prominent email, focus on action
T2	Easier and prominent email, focus on action + stating the comparison with other company's

The behavioural insights used in T1 and T2 compared to T0:

- The subject of the email is more inviting, more personal (mentioning 'your energy efficiency results');
- Saluation with the name of the receiving person
- Much shorter and more easy to read by skipping all unnecessary text and using more direct language;
- The first sentence starts with the required action (download the link);
- Stating the advantage for the reader to download the company report, referring to earlier commitment;

Compared to T1, T2 contains one more sentence: "Your company report shows your companies energy efficiency results compared to other companies" (In Dutch: 'Uw bedrijfsrapport vertelt u hoe uw bedrijf op het gebied van energie-efficiëntie presteert ten opzichte van bedrijven uit uw sector'). The assumption is that it might be interesting for the receiver to know how energy efficient his company is compared to others.

Control group (T0) Extended email similar to the one used the year before, with a general link to the e-mjv site.

Dear Sir, Madame,

We thank you for delivering your monitoring data for 2014.

We received the data in good order.

Company reports

As participant of MJA you can download your company report directly from the known eMJV-website: www.e-mjv.nl by using the "menu mja-rapportages".

What happens with your monitoring data?

The monitoring data of all MJA3/MEE-companies from your sector are processed to generate a sector report. This report is available after the OGE- meeting[1)] in May 2015, in which the data are final established.

Downloading the sector report

After establishing all sector reports by the OGE-meeting, these reports can be downloaded from our RVO-website; http://www.rvo.nl/subsidies-regelingen/sectorrapportages-mja/mee.

Result-brochure 2014

The monitoring data of all sectors form the input of the "Result-brochure 2014". This brochure is used to account the parliament about the energy saving of the Dutch industry. And sectors show their total effort and achieved energy savings. The result-brochure 2014 will be published around Prinsjesdag 2015. You can download the brochure via our website.

More information required?

Do you have any questions in response to this letter or do you want more information about the company report or other things about the covenant? Look at our website of contact our helpdesk via info.mja@rvo.nl. You can also call us. On working days between 8:30 and 17:00 hour via (088) 042 42 42.

Again thank you for your efforts,

Your sincerely,

The National Programs

drs. M.A. Verzandvoort

Teammanager Toetsing en Monitoring

1) OGE: Overleggroep Energiebesparing; in this meeting representatives of companies and government discuss the developments around the covenant in your sector

Colofon

Contact details

Rijksdienst voor
Ondernemend Nederland
Slachthuisstraat 71
6041 CB Roermond

Disclaimer

Your company report is generated automaticly, based on the by RVO.nl known data. Despite careful control of historical data we cannot exclude data-errors for earlier years. If you do discover in your company report an error, please get in contact with your RVO.nl contact person and you will get within 5 work days a corrected report.

Treatment group 1 (T1) Shortened email with a deep-link to the e-mjv site.

Rijksdienst voor Ondernemend Nederland

Dear <Name>,

Your MJA3-company report is ready and can be downloaded (per location) here.

Your company code to download the report has been sent to you by the project leader e-MJV per mail at the 13th of January. In the company report you can read to which extent your company has realized the agreed targets from you Energy Efficiency Plan (EEP).

The sector report

Based on the monitoring data from all the companies from your sector also a sector report is generated. You can download the sector report here.

More information required?

Do you have any questions in response to this letter or do you want more information about the company resort or other things about the covenant? Look at our website of contact our helpdesk via info.mja@rvo.nl or call us at 088 042 42 42.

Your sincerely,

drs. M.A. Verzandvoort

Teammanager Toetsing en Monitoring

Colofon

Contact details

Rijksdienst voor
Ondernemend Nederland
Slachthuisstraat 71
6041 CB Roermond

Disclaimer

Your company report is generated, based on the by RVO.nl known data. Despite careful control of historical data we cannot exclude data-errors for earlier years. If you do discover in your company report an error, please get in contact with your RVO.nl contact person and you will get within 5 work days a corrected report.

Treatment group 2 (T2) Shortened email with a deep-link to the e-mjv site and emphasizing the additional informational value.

Dear <Name>,

Your MJA3-company report is ready and can be downloaded (per location) here.

Your company code to download the report has been sent to you by the project leader e-MJV per mail at the 13th of January. In the company report you can read to which extent your company has realized the agreed targets from you Energy Efficiency Plan (EEP).

Your company report shows how your company performs, compared to other companies in your sector.

The sector report

Based on the monitoring data from all the companies from your sector also a sector report is generated. You can download the sector report here.

More information required?

Do you have any questions in response to this letter or do you want more information about the company resort or other things about the covenant? Look at our website of contact our helpdesk via info.mja@rvo.nl or call us at 088 042 42 42.

Your sincerely,

drs. M.A. Verzandvoort

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Disclaimer

Your company report is generated, based on the by RVO.nl known data. Despite careful control of historical data we cannot exclude data-errors for earlier years. If you do discover in your company report an error, please get in contact with your RVO.nl contact person and you will get within 5 work days a corrected report.

A3 Time line

Mail	Datum
Treatment	8 July 2015
Survey	9 September 2015
Reminder survey	22 September 2015
Closing survey	10 October 2015

A4 The survey questions

This questionnaire takes about 5 minutes to complete. Your answers will be processed anonymously.
If you have not completed the questionnaire yet, you can proceed to click on the link in the invitation mail again.

==========

At the 8th of July you received an email of RVO.nl with an invitation to download your dedicated company report. Below you will find an example of this email

<here a copy of the E-mail is presented, depending to the treatment group>

==========

Q1: Did you read this email from RVO?

1 Yes
2 No
3 I do not know anymore
4 I did never receive such an email

==========

Q2: What do you think about this mail from RVO.nl?

1 The goal of the email was clear to me
2 The email invited me to read
3 The email invited me to act
4 The email was too long
5 The email contained too little information

Answer possibilities: (sure not / no / somewhat no / somewhat yes / yes / yes sure)
If you want to see the email again, please go back to the former question with the arrow below. ATTENTION: Maybe you have to fill in the answers to this question again.

==========

Q3: What did you do in response to the email of RVO.nl?

(multiple answers are possible)

1 Nothing (yet) [no other answers possible]
2 I did send the email to other colleagues
3 I did send the email to the management / managing board
4 I did download my MJA company report for 2014
5 I did download the sector report for 2014
6 Other [Specify]

==========

Q4: Did you download and read one or more <u>company reports</u> before?

1 Yes, the one of 2013
2 Yes, of several years
3 Yes, all years
4 No, I have never downloaded / read a company report before (2013 or older).
5 No, our company joined only last year

==========

<Q5-Q9 only for not downloaders company report>

The next questions are about your MJA company report

Q5: From your answers it appears that you have not downloaded your company report of 2014 (yet).

What is/are the most important reason(s)? (maximal 3)

1 I did not know that I could download the report
2 The report does not contain any new information about our company
3 The management is nog interested
4 The presentation of the figures does not connect well with our company
5 I did not take any time for it yet
6 Downloading is too complicated
7 I have forgotten my codes
8 I am not responsible for that
9 The moment to download the report is not suitable
10 Other reasons: [Specify]
11 This is not correct, I have downloaded the report [No other answers are possible]

==========

You have indicated that the moment that you could download the company report was not suitable for you.

Q6: A more suitable moment for us is:

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

Q6A: Can you explain your preference?

[….]

==========

Q7: Are you planning to download the company report of 2014?

1 Yes, sure
2 Maybe
3 No, I am sure I do not

==========

Q8: What could be a reason to finally read the company report of 2014 ?

1 To see whether my company complies with the MJA agreements
2 To check whether the supplied data are correct
3 To be prepared for questions from RVO or authorized supervision
4 To gain understanding of the energy efficiency performance of my company for the last years
5 To compare the energy efficiency performance of more locations of my company

6 To compare the performance of my company with other companies in my sector
7 To use as an internal discussion paper
8 To discuss with the management / the managing board
9 Other reason(s)

Q8A: Can you explain your answer(s)?
[…]
==========
Q9: Can you indicate which relevant topics should be added to your company report?
[…]
==========
<The questions **Q10 to Q12** are similar to Q5 to Q7, but here the questions are about the sector report instead of the company report and only for not downloaders>
==========
Q13 Do you think about new energy-saving measures this summer?
1 Yes, I have spoken with the management / management board about new measures
2 Yes I intent to speak with the management / management board about new measures
3 Yes I have new measures in mind
4 Yes, I did look at the list of measures for my sector
5 Yes, I did look at the general list of measures
6 Yes, I have thought about new measures
7 Not yet, but I am sure I will [Exclusive]
8 No, but I think I will [Exclusive]
9 No, and I do not intent to do so [Exclusive]
==========
<Q14-Q20 only for downloaders company report>
Q14 The next questions are about your MJA company report.
You have downloaded your company report of 2014. Here you could read in which degree your company meets the agreed targets from your Energy Efficiency Plan (EEP).
What were the reasons to download the report?
1 To see whether my company complies with the MJA agreements
2 To check whether the supplied data are correct
3 To gain understanding of the energy efficiency performance of my company for the last years
4 To compare the energy efficiency performance of more locations of my company
5 To compare the performance of my company with other companies in my sector
6 To be prepared for questions from RVO or authorized supervision
7 To use as an internal discussion paper
8 To see what is in it
9 To get inspired for new energy saving measures
10 Other […]

==========
Q15 What did you do with your MJA company report?

1 Nothing (yet) [Exclusive]
2 I did read it
3 I did send it to (a) colleague(s)
4 I did send it to the management / management board
5 I have discussed it with colleague(s)
6 I have discussed it with the management / management board
7 Other […]

==========

Q16 You indicated that in one way or another, recently you have thought about new energy saving measures or are planning to do so. Did the company report(s) play any role here?

1 As a source of inspiration
2 It brings me to new ideas
3 Can be used in the discussion with the management
4 Gives insight in our position concerning our energy requirement
5 Gives insight in our position concerning comparable companies
6 In an another way

Answer possibilities: (Yes sure / Yes / Yes a bit / Minimal / Not at all)

==========

Q17 What is for you/ your organization the value of the MJA company report(s) (maximal 3 answers possible)

1 It gives information to implement more energy saving measures
2 It shows our position with respect to other competing companies
3 It helps to get the management / managing board involved with energy saving
4 It is especially suitable to provide the management / managing board with information
5 Actually the report had no added value [Exclusive]
6 Other, namely: [Specify]

==========

Q18 Below we mention some possible improvements of your company report(s). To what extent do you think that these improvements apply?

1 Length of the report:
2 Clarity of the data:
3 Moment when the report can be downloaded:
4 Extent to which the information is useful:
5 The way the report can be downloaded:

Answer possibilities: (Can be strongly improved / Can be improved / May be a bit improved / Is OK / Is just fine)

A18A Can you mention more improvements?

[…]

If desired, you can explain your answers

==========

A19 If you could choose when your company report(s) is downloadable, then this time must be in:

1 January
2 February
3 March
4 April
5 May
6 June
7 July
8 August
9 September
10 October
11 November
12 December

Q19A Can you explain your preference?

[…]

==========

Q20: Can you indicate which relevant subjects should be added to your company report?

[…]

==========

<Q21-Q27 are similar to Q14-20 but now for downloaders of the MJA sector report>

==========

You have received a decision about your MJA progress statement end of June. The next questions are about your MJA progress statement.

<Q28-Q30 are similar to Q15-17 but now related to the MJA progress statement>

==========

Q31 Energy saving provides companies with the opportunity to better compete. It often leads to cost savings. In addition, a significant reduction of the use of fossil fuels should be realized to avoid an increase of the global temperatures. Therefore, the government helps consumers and companies to use less energy. The government would like to hear from you how it can do its job in a better way. Below, you can give your opinion anonymously.
In what way could your company be helped to save more energy?

[…]

Q32 How can the government encourage energy saving within your sector in a better way?

[…]

==========

To interpret your answers in a better way we will ask you for some additional information

Q33 Is the energy bill an important cost for your company?

1 Very important

2 Quite important
3 Not important, but also not unimportant
4 Lees important
5 Not important at all
==========

Q34 How many people are working at your location? (in full time equivalents)

[…]

==========
Q35 Has your company shareholders?
1 Yes
2 No

==========
Q36 Is your company a family business?
1 Yes
2 No

==========
Q37 How much time can you spend on energy related issues?
(e.g. monitoring of energy use, , planning en execution of energy saving activities, scheduling and/or discuss energy savings, meetings, etc.)

Hours per week: […]

==========

Thank you very much for your effort
Your answers help RVO.nl to improve our service to you. Of course the results will be discussed in the platform and committees of MJA3/MEE.
You can close the window now.

A5 Monitoring data and dedicated reports

Description of monitoring data used for this paper

Name	Description
NIC	National Industrial Classification. ID-code of companies. Usually, a 'company' is a physical confined production site. In some cases, there are exceptions, i.e. in the case of gas producing companies who own several production sites, but report on an aggregated company level.
Sector name	Sector name as used in LTA3. In total, 40 sectors have joined LTA3 or LEE, 22 participate in this pilot. The sectors are not fully similar to the sectors as defined by National Statistics. Usually the LTA3 sectors are more detailed than that of National Statistics (i.e. tapestry form a separate sector in LTA), but sometimes less detailed, i.e. chemistry and pharmacy form separate sectors in National Statistics, but form one sector in LTA.
Company name	Company name as registered on entering LTA .
Total primary energy usage [TJ]	Energy use 2014. Net consumption as defined by AgentschapNL (2012)
Number of employees (KvK)	Number of employees, as registered by Chamber of Commerce.
Name of Contact person	Name of Contact person
Contact person e-mail	E-mail address of contact person
Sector number	Number of the sector
EG	Energy Group: 1 if value 1-100 TJ, 2 if value 100-250 3 if value 250-650 4 if value bigger than 650
WG	WG (worker group) : 1 if value 1-150 2 if value 150-400 3 if value bigger than 400
Category	Identification number for sector, EG and WG. Eg. 102.11 would indicate a company that belongs to sector 102 with energy usage of 1-100 and worker number of 1-150
Sample group	Number of the sample group (1,2, 3) +4 for reports send by mail
SBI-code	SBI-code as registered in the e-mjv. Missing SBI-codes have been complemented using SBI-code list SBI-coding 2014/ V-0144
Download date	Date of download of dedicated report. Based on 6e download bedr.rapp 27-10-2015. Some companies have more than one download, possibly for downloading in a different format (pdf, excel etc). The date signifies the date of the first download.
Download yes/no	Signifies if a company has downloaded at least one dedicated report (1) or not (0). Based on column 'download number'>0.
Energy costs gas [euro/m3]	Price for natural gas (Based on 2014_MJA_Financieel). Only partially registered.

Energy cost electricity [euro/kWh]	Price for natural gas (Based on 2014_MJA_Financieel). Only partially registered.
Ambition EEP 2009-2012 (%)	Ambition for Energy efficiency plan 2009-2012. Ambition is defined by the summation of expected savings by 'certain' and 'conditional' projects in the categories process efficiency, supply chain efficiency and renewable energy, divided by energy use in 2011. Values are missing for companies that did not make an EEP for 2009-2012, usually because they joined LTA3 later. Sample group 4 misses many values as a large sector joined after 209-2012.
Realization EEP 2009-2012 (%)	Realization of ambition 2009-2012. Realization is the sum of realized savings of implemented projects in the categories process efficiency, supply chain efficiency and renewable energy, based on the formulas in AgentschapNL (2012). A value >100% is possible by addition of these three categories
Result 2014 (%)	Saving percentage due to projects that have been implemented in 2014. The result is based on addition of savings by new process efficiency projects and the improvement or deterioration of savings by supply chain and renewable energy projects. Source is 2014 results in e-mjv.
Result 2014 [TJ]	Savings in TJ due to projects that have been implemented in 2014. The result is based on addition of savings by new process efficiency projects and the improvement or deterioration of savings by supply chain and renewable energy projects. Source is 2014 results in e-mjv. A negative result is possible when savings by supply chain efficiency or renewable energy is lower than last year.
Planned saving 2014 [TJ]	Expected savings in TJ of certain and conditional projects planned in 2014.
Planned saving 2014 [%]	Expected saving (TJ) of certain and conditional projects planned in 2014, divided by energy use 2014.
Number of planned measures 2014	Number of planned certain and conditional projects in 2014.
Number of realized measures 2014	Number of realized projects in 2014. These consist of new process efficiency projects, but also existing supply chain efficiency and renewable energy projects that are reported each year.

Appendix B (Data and Analysis)

B1 The download data

The site registers downloaded reports. Information that is registered is:

- NIC-code of downloaded report [NIC]
- Company name [BEDR_NM]
- User ID and name of the person downloading the report [INSTAN_ID; INSTAN_NM]
- Sector code and name [SECTOR_CD; SECTOR_NM_KORT; SECTOR_NM]
- Date and time of download [JAAR; DATUM]

B2 Non response analysis fieldwork

The invitation to complete the survey was sent to 505 companies. 167 respondents returned a completed survey, corresponding to a response of 33% percent, which is about the same for all treatments.

The response to the survey does differ significantly for energy costs (costs natural gas, Costs electricity), number of planned and realized measures and saving in 2014, number of realized measures 2015, and size (Table B1). The download response does differ significantly in the total energy usage, the number of planned and realized measures in 2014 and in 2015, and size. These variables are to a large extent determined by the industries the companies operate in. For this reason industry dummies are included in all our analyses.

	Download response = 0					Download response = 1					
Variable	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**p**
Total primary energy usage	319	1355525	2419001	1332882	2160952	186	1716825	292.45	2834928	2887707	0.0357
Costs natural gas	319	6149216	8336677	0	14888	186	5945161	4321554	0	4738	0.5627
Costs electricity	319	8394796	2636627	0	28531	186	8769194	2199.81	0	10258	0.5967
Ambition EEP 2009-2012 (%)	251	.1403745	.1935761	-.153	1721	157	.203121	.8610848	-.026	10.78	0.1854
Realization EEP 2009-2012 (%)	260	.0866	.3256891	-2256	1496	161	.1427267	.4046808	-1356	3086	0.4493
Result 2014 (%)	265	.0479509	.1671191	-.972	1349	163	-.0511288	.9314431	-10791	.952	0.7599
Result 2014 [TJ]	309	1129515	4813423	-78	567.8	182	9265385	1057014	-795.6	781.4	0.9187
Planned saving 2014 [TJ]	319	5198746	2624046	0	411.3	186	8737097	4264303	0	551.8	0.1058
Planned saving 2014 [%]	319	.0398433	.1007408	0	.836	186	.0350484	.0906494	0	.948	0.2408
Number of planned measures 2014	319	1793103	2359475	0	21	186	2069892	2249434	0	13	0.0440
Number of realized measures 2014	319	3454545	3489919	0	25	186	4693548	7442585	0	90	0.0198
Ambition EEP 2009-2012 (#)	251	1403745	1935761	-15.3	172.1	157	203121	8610848	-2.6	1078	0.1854
Realization EEP 2009-2012 (#)	260	8.66	3256891	-225.6	149.6	161	1427267	4046808	-135.6	308.6	0.4493
Number of realized measures 2015	265	4795094	1671191	-97.2	134.9	163	-5112883	9314431	-1079.1	95.2	0.0145
Number of realized measures 2015 (additional)	309	1129515	4813423	-78	567.8	182	9265385	1057014	-795.6	781.4	0.0565
Result 2015 [TJ]	319	5198746	2624046	0	411.3	186	8737097	4264303	0	551.8	0.0049
Result 2015	319	3984326	1007408	0	83.6	186	3504839	9064939	0	94.8	0.1489
Size	278	1145504	175504	0	1395	171	133924	1507847	0	1000	0.0029

Table B1: No-response analysis download

	Survey response= 0					Survey response = 1					
Variable	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**	**p**
Total primary energy usage	338	1398272	2332446	1332882	2160952	167	1671414	3120727	3724979	2887707	0.9274
Costs natural gas	338	6919822	8485152	0	14888	167	4362275	2782866	0	3531	0.0047
Costs electricity	338	7796923	2530.22	0	28531	167	1002186	2383517	0	10258	0.0081
Ambition EEP 2009-2012 (%)	278	.1383345	.1834212	-.153	1721	130	.2205154	.9462272	0	10.78	0.1070
Realization EEP 2009-2012 (%)	284	.1003415	.3663283	-2256	3086	137	.124073	.3425601	-.875	2729	0.3886
Result 2014 (%)	290	.0222345	.3116037	-4265	1349	138	-.0150362	.9387134	-10791	.952	0.2824
Result 2014 [TJ]	330	784697	6401374	-795.6	567.8	161	1606832	9290037	-486.7	781.4	0.1619
Planned saving 2014 [TJ]	338	4741716	2515698	0	411.3	167	1006467	452834	0	551.8	0.0279
Planned saving 2014 [%]	338	.0324822	.0803245	0	.836	167	.0494012	.1237922	0	.948	0.0170
Number of planned measures 2014	338	1739645	2103472	0	14	167	2209581	2688289	0	21	0.0352
Number of realized measures 2014	338	3476331	3369575	0	20	167	4790419	7870053	0	90	0.0361
Ambition EEP 2009-2012 (#)	278	1383345	1834212	-15.3	172.1	130	2205154	9462272	0	1078	0.1070
Realization EEP 2009-2012 (#)	284	1003415	3663283	-225.6	308.6	137	124073	3425601	-87.5	272.9	0.3886
Number of realized measures 2015	338	3139053	3024364	0	18	167	4437126	6978923	0	76	0.0227
Number of realized measures 2015 (additional)	338	1177515	1723764	0	11	167	1532934	2656623	0	24	0.1506
Result 2015 [TJ]	338	3928751	1520786	-15476	2400367	167	5815527	1795185	-945137	1644266	0.0443
Result 2015	338	1198225	.6575716	1	7	167	1347305	140536	1	15	0.5234
Size	282	1156525	1690401	0	1395	167	1325269	1623918	1	1000	0.0445

Table B2: No-response analysis survey

B3 Robustness check

	Download
Treatment T1	1.547
	(4.86)**
Treatment T2	2.024
	(6.25)**
Size	-0.000
	(0.51)
Electricity usage	0.000
	(0.46)
Gas usage	0.001
	(2.30)*
Realization EEP 2009-2012 (#)	0.007
	(2.00)*
Result 2015 TJ	-0.000
	(0.02)
	(0.64)
Sector Dummies	Yes
Constant	-1.910
	(2.89)**
N	364

Heteroskedasticity-consistent estimator of variance; sector dummies incl.; + $p<0.1$; * $p<0.05$; ** $p<0.01$

Table B3. Logistic Regression Results for Probability to Download.