Received 22 September 2017
Revised 31 January 2018
8 March 2018
3 April 2018
7 April 2018
Accepted 10 April 2018

Competing priorities: lessons in engaging students to achieve energy savings in universities

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Abstract

Purpose – This paper aims to present findings from an EU-funded international student-led energy saving competition (SAVES) on a scale previously unseen. There are multiple accounts of short-term projects and energy saving competitions encouraging pro-environmental behaviour change amongst students in university dormitories, but the purpose of this research is to provide evidence of consistent and sustained energy savings from student-led energy savings competitions, underpinned by practical action.

Design/methodology/approach – A mixed-methods approach (pre- and post-intervention surveys, focus groups and analysis of energy meter data) was used to determine the level of energy savings and quantifiable behaviour change delivered by students across participating university dormitories.

Findings – This research has provided further insight into the potential for savings and behaviour change in university dormitories through relatively simple actions. Whilst other interventions have shown greater savings, this project provided consistent savings over two years of 7 per cent across a large number of university dormitories in five countries through simple behaviour changes.

Research limitations/implications – An energy dashboard displaying near a real-time leaderboard was added to the engagement in the second year of the project. Whilst students were optimistic about the role

This work has received funding from the European Union Intelligent Energy Europe fund under grant agreement number IEE/13/719. Note a previous version of this paper was presented at the ECEEE Summer Study Conference as a short paper reference no. 9-084-17. Open Access funding has been supported by De Montfort University.

International Journal of Sustainability in Higher Education
Vol. 19 No. 7, 2018
pp. 1220-1238
Emerald Publishing Limited
1467-6370
DOI 10.1108/IJSHE-09-2017-0157

that energy dashboards could play, the evidence is not here to quantify the impact of dashboards. Further research is required to understand the potential of dashboards to contribute to behavioural change savings and in constructing competitions between people and dormitories that are known to each other.

Social implications – SAVES provided engagement with students, enabling, empowering and motivating them to save energy – focusing specifically on the last stage of the "Awareness, Interest, Desire, Action" framework. Automated meter reading data was used in the majority of participating dormitories to run near real-time energy challenges through an energy dashboard that informed students how much energy they saved compared to a target, and encouraged peer-to-peer learning and international cooperation through a virtual twinning scheme.

Originality/value – Findings from energy saving competitions in universities are typically from small-scale and short-term interventions. SAVES was an energy-saving competition in university dormitories facilitated by the UK National Union of Students in five countries reaching over 50,000 students over two academic years (incorporating dormitories at 17 universities). As such it provides clear and important evidence of the real-world long-term potential efficiency savings of such interventions.

Keywords Students, Feedback, Energy conservation, Competitions, Behaviour change

Paper type Research paper

Introduction

It is more evident than ever that our world is unsustainable. In *Doughnut Economics*, Kate Raworth reminds us that modern life is energy intensive, resource-inefficient and unequal in its distribution of wealth (Raworth, 2017). One important area of focus is energy consumption in non-domestic and commercial buildings. These account for over 30 per cent of global energy use and 20 per cent of greenhouse gas emissions, and universities are a significant contributor to this (Andrews and Johnson, 2016; Stern *et al.*, 2016). In the UK for example, higher education institutions (HEIs) consumed 7.9 billion kWh of energy and produced 2.3 million tonnes of carbon emissions (HESA, 2014). Much work is undertaken around sustainability in universities, ranging from carbon management plans, to greening campuses and innovative travel plans. Of increasing importance and profile, in the UK, for example, the environmental performance of universities is ranked through the People and Planet's "Green League" that covers such aspects as ethical investment, energy sources, waste and recycling and carbon reduction (https://peopleandplanet.org/university-league). This league is publicly available and open to scrutiny.

Like many large and complex organisations, universities present an interesting proposition as they have a significant carbon footprint split across their direct and indirect emissions. In terms of their business operation and staff, they encompass traits of non-domestic organisations, and yet, through the provision of student accommodation and energy efficiency behaviours, they often exhibit features of residential properties. Alberts *et al.* (2016), for example, locate their research into electricity consumption in university dormitories within the domestic energy consumption literature. Of course, whilst academics, policymakers or funding bodies compartmentalise our lives into neat categories, citizens inhabit multiple conflicting worlds simultaneously. Nowhere is this more evident than in a university context where students are living and "working" (studying). Social and academic life occurs in shared spaces, accommodation is "residential" inasmuch as it is a domestic space, but typically devoid of responsibility for bills or control, thus exhibiting features of a non-domestic building. Students present a great opportunity though to lay the foundations for a more "pro-environmental" worldview. Domestic behaviour patterns practised whilst living independently for the first time have the potential to establish habits that may last a lifetime (Verplanken and Wood, 2006; Sintov *et al.*, 2016).

This paper focuses on the impact of an energy saving competition, peer-to-peer engagement and feedback campaign across a range of universities in five European countries over two academic years. It presents findings from a three-year EU Intelligent Energy Europe (IEE)-funded project SAVES (Students Achieving Valuable Energy-

Savings) which encompasses an inter-dormitory energy-saving competition involving dormitories in 17 European universities over two academic years: 2014-2015 and 2015-2016. At the heart of the SAVES project is an energy-saving competition called Student Switch Off (SSO). The SSO campaign was set up by the National Union of Students of the United Kingdom (NUS-UK) in 2006 and it encourages students to save energy and motivate their flatmates to do the same. Over the academic year, the SSO campaign incorporates a variety of offline and online events, peer mentoring and individual competitions to keep awareness as high as possible and distributes prizes, both at the individual and group level, to keep proactive students motivated. These include fortnightly photo competitions where students post photos on social media of themselves undertaking a variety of energy saving actions to win prizes, dormitory visits, communication skills training (to give proactive students, called SSO ambassadors, more expertise to act as peer mentors and encourage their friends to save energy) and online climate change quizzes. Prior to SAVES starting in 2012-2013, SSO was delivered at 54 UK universities, and it reached 130,000 students, engaged 25,000 through Facebook fan pages, pledge schemes and events, and delivered average energy savings of 6 per cent per participating dormitory.

Unlike previous SSO competitions where the energy-savings were presented every two to three months after manual energy data analysis had been completed, in the 2015-2016 academic year, in the majority of participating dormitories, SAVES was able to provide daily updates based on automated data collection via a Web-based dashboard presented as a "live" leaderboard of dormitories competing to achieve the most savings across the competition period. Notably, the project was able to test the use of automated meter data to run near real-time energy challenges, inform students about how much energy they are using, raise awareness of how students can save energy and encourage peer-to-peer learning and international cooperation through a virtual twinning scheme. SAVES had two aims: one was to generate an average of 8 per cent of electricity savings in participating university dormitories, and two, to encourage energy saving behaviours in students at a key moment of change in their lives so that when students move out of dormitories into private accommodation, there is potential for these energy saving behaviours to come habitual. To do this, the project focused on the following behaviours:

- switching off lights and appliances when not in use;
- putting lids on pans when cooking;
- putting jumpers on instead of turning up the heating;
- not overfilling the kettle; and
- opening windows before using air conditioning (relevant in the Mediterranean EU countries).

The structure of the paper is as follows. First the relevant literature is explored for key themes and context alongside reflections on energy and behaviour change in organisations. Then the methodology is introduced prior to discussing the findings and concluding remarks.

Literature review

A range of literature studies exists on behaviour change interventions aimed at encouraging university students to save energy when living in dormitories and on the relative impact of different types of interventions (Bekker *et al.*, 2010; Erlene Parece *et al.*, 2012; Karp *et al.*, 2016; Konis *et al.*, 2016; Sintov *et al.*, 2016). Such studies have often focussed on interventions in one geographic location (typically a number of dormitories/flats in one university) or over

a relatively short timescale (a week/month). There have been several studies focusing on universities and in particular dormitories, which have consistently shown relatively high savings. From the classic study in Oberlin in 2007 (Peterson *et al.*, 2007), which saw 30 per cent savings, to more recent campaigns in British Columbia (Senbel *et al.*, 2014) – 16 per cent savings, London (Alberts *et al.*, 2016) – 20 per cent savings and a more modest 6.4 per cent saving in California (Sintov *et al.*, 2016), healthy savings are possible; yet, the majority of these studies focus on single universities, and were conducted over a relatively short period of time.

Studies show a range of factors influencing these results. The benefits of peer-to-peer engagement were observed by Senbel *et al.* (2014) in their research in six universities in British Columbia. Whilst it was found that the competition generated savings, people were motivated by the actions of people known to them, rather than strangers. Alongside this, Alberts *et al.* (2016) also note the benefits of competition with a calculated energy saving of 20 per cent, although they framed their study as "residential". Asensio and Delmas (2015) who studied behaviours in a residential context found benefits in using non-price incentives to tackle the attitude-behaviour gap, especially at the appliance level. This degree of granularity was not achievable in dormitories in the SAVES project, but the incentive approach is relevant. All of these studies typically use a form of energy feedback using "dashboards" to present energy consumption data to students.

Beyond universities, a recent review of the literature and evaluation of an energy savings intervention in a commercial office space by Mulville *et al.* (2014) achieved healthy savings of 18 per cent over the intervention period. Comparative feedback pushed the savings to 28 per cent. Elsewhere though, after conducting their research into providing individual energy feedback to university employees, Murtagh *et al.* (2013) offered a sobering reflection for behaviour change noting that whilst the potential for significant savings is high, motivation is low. On a more positive note, a recent review of over 20 energy and behaviour change interventions from around the world, showed a range of potential savings from 4.5 per cent to 50 per cent (Staddon *et al.*, 2016). Using the "behaviour change" wheel as a framework to analyse successful behaviour change initiatives, the authors note that the most successful initiatives had a combination of technological automation *and* "enablement" – that is opportunities for building users to move beyond education and training to more participatory approaches. The authors observe that enablement appears to be linked to a change in the relationships of the relevant actors and a shift in levels of employee control and responsibility. The organisational context is relevant here. Many of the university studies (Alberts *et al.*, 2016) situate their observations in the residential context rather than a wider organisational context. Depending on the nature of the dormitory students may have limited control over their behaviours, and also be exposed a wider set of behaviour influences. Bull *et al.* (2015) have observed, for example, that organisational energy behaviours are subject to a much wider set of influences than residential energy consumption.

The importance of longer-term studies that can evaluate the post-intervention impacts are duly noted by both Sintov *et al.* (2016) and Peterson *et al.* (2007). The SAVES project contributes to this need for a "broader scale, longer-term study" inasmuch as the interventions are over a much longer period of time (several years) instead of months, even though it is acknowledged that the changes observed are within an "intervention period", albeit a longer one. It also fits with Konis *et al.*'s (2016, p. 216) recommendation that "persistent engagement may be needed to maximise the potential of occupant participation".

The SAVES project focused on students as a distinct group of consumers, many of whom were living away from home for the first time and adopting new energy-usage behaviours.

Theoretical underpinnings for the SSO intervention originally came from the habit discontinuity hypothesis of Verplanken and Wood (2006) who suggest that when individuals undergo significant change in their lives (e.g. having a baby, moving home), they may be more amenable to adopting new, pro-environmental behaviours. This is because the habit cues that previously prompted certain behaviours have been altered and individuals are more likely to consciously consider the actions they undertake (Wood and Neal, 2009). This also backs up observations from Peterson *et al.* (2007) who discovered that "freshmen" – those new to university – were more open than students who had been there longer. For the majority of students moving to university, this is the first time they have experienced independent living – a significant lifestyle change, during which they have the potential to adopt new pro-environmental behaviours.

Methodology

As stated in the introduction, the contribution of this paper is the scale of data gathered to be able to generate findings with regards to the effectiveness of these types of interventions. An ambitious and large-scale mixed-methods approach was used to evaluate the level of electricity saved and the impact on behaviour. This took the form of three extensive surveys, electricity meter readings and focus groups. This section outlines the participants, and the mixed-method approach to data analysis undertaken, namely, surveys, quantitative analysis of electricity meter readings and focus groups.

Participants

The sampling frame for the calculation of energy savings consisted of dormitory buildings used as student accommodation in five different European countries: Cyprus, Greece, Lithuania, Sweden and the UK (see Table I for a list of the participating universities). Participating dormitories were selected based on the availability of good quality electricity metering data, the ability to communicate directly with their students and support of their participating institutions. The sampling frame for the evaluation of swings (changes) in stated behaviours consisted of students living in the participating dormitory buildings. A

Table I.
List of the dormitory providers in the SAVES project

Dormitory provider	Country
Queen Mary, University of London	U
University of Worcester	UK
The University of Northampton	UK
Cranfield University	UK
University of Warwick* (2015-2016 only)	UK
University of the West of England* (2014-2015 only)	UK
University of Bath	UK
De Montfort University	UK
University of Cyprus	Cyprus
Technical University of Crete	Greece
University of Athens	Greece
Vilnius Co-operative College	Lithuania
Vilnius Gediminas Technical University	Lithuania
Vilnius College of Technology and Design	Lithuania
Vilnius University	Lithuania
Klaipeda State College	Lithuania
SGS (Gothenburg)	Sweden
SSSB (Stockholm)	Sweden

control institution (control group) was identified in Sweden (in Linkoping) incorporating 13 separately metered areas in five dormitories housing 2,401 students. This control group had accessible baseline and contemporary electricity data that was readily available at the time that the SAVES project started. The dormitories in Linkoping were also chosen, as there were no other behavioural or infrastructural interventions taking place – unlike many potential UK universities that have other related activities that could interfere with a control. Residents of the control group also took part in the pre- and post-competition questionnaire surveys outlined below. In the intervention group, this amounted to 17 different universities, housing 24,976 students over the academic year, 2014-2015 and 30,349 students in, 2015/2016 (55,325 students in total over two years). The sample of control group students was 2,401 each year.

Calculating energy savings and behaviours

Electricity data. Baseline electricity data (kilowatt hour usage) were collected for each of the participating dormitory buildings for the, 2013-2014 academic years in the majority of cases; in universities where SSO was run in years prior to 2013-2014, the baseline was formed from the year prior to the campaign starting. The baseline electricity data were collected through historical meter readings that varied between monthly manual meter readings and 15-min automated meter readings. In the vast majority of cases, the spatial scale of the electricity data was at the dormitory level. The electricity data for the years that SSO ran were collected with the help of automated meters in the majority of cases. Where dormitories were electrically heated or cooled, degree-day correction was performed to ensure fair comparison. Similarly, where necessary, the data were adjusted to factor in occupancy number or infrastructural changes. The intervention was conducted in the, 2014-2015 and 2015-2016 academic years and the baseline (2013-2014 in most cases) was kept the same for both intervention years so the post-intervention data were always compared against pre-intervention data – rather than the baseline being brought forward to a year in which the intervention took place. In a small number of cases where data for a month were missing or erroneous, it was extrapolated/interpolated based on the average of the data available for other months. A consistent approach to data collection and analysis was taken across the dormitories where possible; however, owing to variances in the availability of historical data across the different dormitory providers, specific assumptions were made where either obtaining the data had been a challenge, or where there were a specific set of circumstances worthy of note. These assumptions were categorized as follows (please see Laskari *et al.*, 2016 for a fuller explanation of the process):

- missing data;
- occupancy;
- degree days;
- infrastructure; and
- other.

For the majority of dormitories, eight months' worth of data were compared (October-May), in a few dormitories nine months' worth of data were used (October-June), depending on the period of occupancy of the dormitories which were usually empty or occupied by different tenants over the summer period. In, 2015-2016, the latest leaderboard of the SSO competition on each campus was fed back to students through an online energy dashboard (https://switchoff.nus.org.uk/) developed by De Montfort University (DMU). There was variation in the amount of feedback received by students between the different universities, but there

were consistent approaches within participating dormitories of each university (for example, University of Warwick students living in dormitories were exposed to roughly the same amount of energy data feedback as each other, but that level of feedback would have been different from students at the University of Worcester). In some cases, the dashboard was updated daily and appeared on a plasma screen in the reception of a dormitory; in other cases, the dashboard was updated monthly (because we were only able to obtain monthly readings), and the dashboard only communicated via email or social media. In all cases the metric used to judge the performance of each building was percentage reduction, and the equation used to calculate the percentage reduction was as follows:

$$\frac{kWh\ consumption\ during\ baseline\ period - kWh\ consumption\ during\ intervention\ period}{kWh\ consumption\ during\ baseline\ period} \times 100$$

This calculation was performed on an ongoing basis as the competition progressed so the time period of data included in the calculation gradually increased – e.g. by the end of October 2015, the calculation compared the October 2015 electricity data against the baseline data from October 2013 for each participating building (with the baseline data amended as necessary to factor in changes in infrastructure, degree days).

Survey 1 and 2: pre- and post-intervention. The baseline (pre) and follow-up (post) surveys used for the evaluation of stated behavioural changes were circulated online and were incentivised with one €100 cash prize and three €25 cash prizes (distributed via a raffle) as project-wide incentives for both the baseline and follow-up surveys. Behaviour change, as defined by the per cent stated behaviour swing from pre-to post survey, and energy savings were studied for both academic years that the SSO campaign was run – 2014-2015 and 2015-2016. All students in the participating dormitories, including the control group, were encouraged to complete the survey at the start of the academic year (pre-intervention) and closer to the end of the academic year (post-intervention). Only students who responded to the baseline survey could participate in the follow-up survey to be eligible for the pre-/post-comparison evaluation. The survey was translated to the different country languages and circulated in all the participating dormitories. Questionnaires were designed and circulated with the help of Survey Monkey software. In the case of Sweden, both a Swedish and English version of the survey were circulated due to the high number of international English-speaking students. In all countries except for the UK, 60 per cent or more of respondents lived in a dormitory of the same university in both years. In the UK, this percentage was only 7 per cent because the vast majority of students move out into the private-rented sector each year.

The questionnaire surveys covered the following topics: demographics, psychological, social and behavioural aspects, incentives and barriers for energy saving. The baseline and follow-up questionnaires were not entirely identical but the questions aimed for the pre/post-comparison were the same across the baseline and the follow-up survey. The follow-up survey did not include demographic questions, as these were answered in the baseline survey and were available for each respondent after the matching. In addition, a few SSO-specific questions were added in the follow-up survey aiming to determine the aspects of the campaign that were more impactful. The following variables are discussed in this paper:

(1) *Energy awareness*: Increase of awareness on the impact of lifestyle and habits on energy consumption since the start of the academic year was evaluated on a five-point scale, with scores ranging from 1 “a great deal” to 5 “not at all”. This

question allowed for a direct, yet subjective, self-evaluation of the respondents as regards to their energy awareness and whether this had increased in the past academic year. This question was only asked in the follow-up survey.

"How much has your awareness of what you can do to reduce the impact of your lifestyle and habits on energy consumption increased since the start of this academic year?"

- A great deal
- A fair amount
- A little
- Not very much
- Not at all

(2) *Influential sources of information*: A list of sources of information that might have helped increase the energy awareness of students was provided. Respondents could select as many sources as they thought relevant. Only the respondents that answered 1 = A great deal, 2 = A fair amount and 3 = A little in the previous question (see above) could answer this question. Those who answered 4 = Not very much and 5 = Not at all were excluded from this question as it was not relevant to them. This helped identify in a direct way the sources of information that respondents were exposed to in the evaluation period and may have resulted in an increase of their energy awareness. This question was only asked in the follow-up survey.

"What have been the main sources, if any, of information that have made you more aware of what you can do to reduce your energy consumption? [Select all that apply]"

- Friends living in halls of residence at my university
- Family
- University-wide campaigns
- The Student Switch Off campaign
- Feedback and information about my hall's energy consumption
- An article I read or a documentary I watched
- A course I took at university
- Other (please specify)

(3) *Behaviour swings*: The frequency that each of the six target behaviours was undertaken was measured on a five-point scale with scores ranging from 1 "Never" to 5 "Always". The higher the score, the more frequent the behaviour was undertaken. This question was asked in both the baseline and follow-up survey in order to allow for pre/post-comparison.

"Please consider each of the actions below, and indicate how often you take them".

- Never
- Rarely
- Sometimes
- Often
- Always

Analysis

Analysis was performed at the project level, country level and at dormitory level. Throughout, 2014-2015 and 2015-2016, electricity consumption data were collected for each of the participating dormitories and compared to the baseline data to find out how much electricity was saved.

Descriptive statistics were used to describe the basic attributes of the survey data at the project and country/group level. A chi-square test was used to determine any significant differences between countries and between the treatment and control group. A paired-sample *t*-test was used as a pre-intervention to post-intervention comparison test to determine significant changes between the baseline and follow-up survey.

The follow-up survey was sent out to students that completed the baseline survey. In total, 6,907 students gave their consent to receive the follow-up survey by providing their email in the baseline survey. The total number of responses for the follow-up survey was 1,541. From those 1,541 respondents, 1,358 were matched to respondents of the baseline survey and were considered for the pre-/post-comparison test. The response target for the baseline survey was 15 per cent of students living in dormitories, while the target for the follow-up survey (matched survey responses) was 15 per cent of the baseline 15 per cent. This target was met in both years. All countries apart from Greece and Cyprus had a large number of respondents (Table II). The end result though, of both the metered energy data and the survey, has been a far-reaching Europe-wide data set which is explored in the following results section.

Survey 3: Retention of behaviours. A third questionnaire survey was conducted with students who lived in participating dormitories in 2014/2015 but moved into private accommodation in 2015/2016. The aim of this survey was to help identify whether the energy saving actions established during their time in dormitories had been carried forward. The survey was sent to all students who responded to the follow-up survey the previous academic year (613 students). A question asking the respondents if they lived in private accommodation or in dormitories was used to screen out the students that still lived in dormitories. The survey had two €25 cash prizes (distributed via a raffle) that were used as project-wide incentives for participation. Overall, 98 valid responses were collected and included representation from all five participating countries. The following variables are discussed in this paper: increase of energy awareness when living in dorms and increase of awareness on how to save energy as a result of the SSO campaign was measured via one question.

Responses were given on a four-point scale with scores ranging from 1 "Yes, a lot" to 4 "No change at all" and the higher the score the smaller the increase of energy awareness.

> "When you lived in halls last year, did your awareness of how to save energy increase as a result of information/posters/messages from the Student Switch Off campaign?"

Table II.
Number of matched student responses (pre- and post-intervention surveys)

	Cyprus	Greece	Lithuania	Sweden	UK	Control Group	Total
Students living in dormitories	208	1,142	7,171	3,171	13,279	2,406	27,377
Matched survey responses	14	17	38	222	155	167	613
2015-16							
Students living in dormitories	208	1,142	7,171	3,171	17,705	2,406	31,803
Matched survey responses	15	18	134	185	266	127	745

- Yes, a lot
- Yes, a fair amount
- Yes, a little
- No change at all

(1) *Actions taken to save energy when living in dorms*: The level of influence of SSO in taking action for energy saving was measured via one question. Responses were given on a four-point scale with scores ranging from 1 "Yes, a lot" to 4 "No, not at all". The higher the score, the smaller the level of influence:

"Did you take actions to save energy as a result of the SSO campaign last academic year?"

- Yes, a lot
- Yes, a fair amount
- Yes, a little
- No, not at all:

(2) *Retention of behaviours in private accommodation*: The level of retention of behaviours in private accommodation was measured via one question. Responses were given on a four-point scale with scores ranging from 1 "Yes, a lot" to 4 "No, not at all". The higher the score, the smaller the level of retention of behaviours. This question was only answered by those responding with "Yes, a lot", "Yes, a fair amount" and "Yes, a little" to the previous question on level of influence of SSO:

"You mentioned that you took actions to save energy as a result of the campaign last year, are you still taking those energy saving actions now?"

- Yes, a lot
- Yes, a fair amount
- Yes, a little
- No, not at all

(3) *Reasons for retaining behaviours*: The reasons for retaining the behaviours adopted as an effect of SSO in private accommodation was measured through one question. A list of five options was provided along with an open-text option:

"Why do you continue to take those energy-saving actions now? [Select all that apply]"

- To save money
- Because my flatmates encourage me
- To save time
- To take personal action on climate change
- Because I have got into the habit of saving energy
- Other (please specify)

Focus groups

Three focus groups were held in each country with the exception of Cyprus due to them having a low number of students in dormitories. Further, 53 students attended in total across the five countries. The purpose of the focus groups was to provide input into the

design of the energy dashboard due to be introduced after the first year of the project (Figure 1).

The dashboard (https://switchoff.nus.org.uk) functioned as a responsive, single-page Web application accessed via a Web browser. It was designed to be viewable on a variety of displays (i.e. desktop, laptop, tablet, phone). The application included both an administration section, where participating university staff could configure and publish their dormitory competition, and the publicly accessible section of the application that allowed students (and any interested parties) to view published leader board competitions for each university. The energy dashboard displayed the consumption data from dormitories and was either manually or automatically imported into the system depending on the sophistication of the energy management system. Another notable feature was the ability to embed individual competitions as an iframe on another website. The competitions for participating universities were embedded in the SSO website to increase their visibility.

Students were presented with an initial design brief for key features of the dashboard and asked to rank these in order of priority. Two further focus groups per country were conducted in May/June 2015 as a means for students to feedback their experiences from participating in SSO and support any update to the energy dashboard. The student focus groups addressed the experiences and additional requirements of students via two approaches: a qualitative, in the form of a discussion, and a quantitative approach in the form of a questionnaire survey. These templates enabled the coding and analysis of the Likert scale questions and were cross-checked against the audio recording of the discussion. The design of the focus group structure, templates and discussion guides were prepared centrally and then distributed to local research teams. The recruitment of focus participants was done locally and invites sent out via email. A €20 incentive was offered to each of the participants to secure participation. Only students that had heard of or participated actively in SSO were eligible to take part.

Figure 1.
Image of the energy dashboard

Results

Sample characteristics

Respondents were a mix of under-graduate and post-graduate students studying a range of subjects but in both years architecture/engineering/technology received the highest proportion of respondents (36 per cent in Year 1 and 33 per cent in Year 2). Respondent characteristics were similar over the two academic years. More than 55 per cent were female students and nearly 80 per cent of the respondents were between the age of 17 and 24 years. The majority of respondents in all countries were native to the country they study, although in the UK and Sweden, a significant number of international, non-EU citizens, were encountered (full demographic information is available in Laskari *et al.*, 2016).

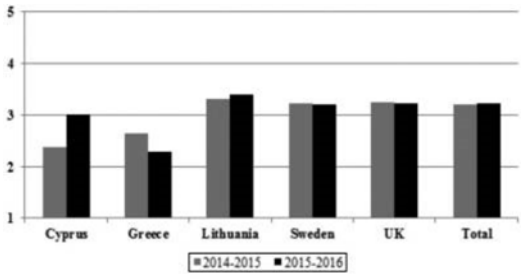
Increase of energy awareness

Overall, students felt that their energy awareness had increased by a little at the end of the academic year compared to the beginning of the academic year in both years that the study was performed (Figure 2). The biggest increase of energy awareness was found in Cyprus and Greece in both years. In Greece and Cyprus, the biggest change between the two years is also found. This is attributed to the fact that the sample size for those two countries was small and therefore more sensitive to change.

The three sources of information that helped the most in the increase of students' energy awareness were: the SSO campaign, their family and an article they had read or a documentary they watched (Figure 3). SSO was in the top three most influential sources of information in all five countries in both academic years that the study was performed. Disappointingly, the least influential sources of information were: feedback and information on their dormitory's energy consumption, university courses and friends living in their dormitory. These sources of information were the least important sources in both academic years. It is unclear though whether respondents group their positive feedback around "the Student Switch Off campaign" which saw a very positive response (40 per cent in the second year), i.e. it encompassed the general aspects of the campaign including peer-to-peer engagement and the core element of the competition.

Behaviour swings

Out of the six targeted energy saving actions, a statistically significant increase is observed in the frequency that students state they have performed the less well-known energy saving actions, namely, putting a lid on pans when cooking and boiling only the right amount of water in both years (see Table III and IV). The percentage change in the frequency that each



Note: 1 = A great deal, 3 = A little, 5 = Not at all

Figure 2.
Increase of energy awareness (2014-2016)

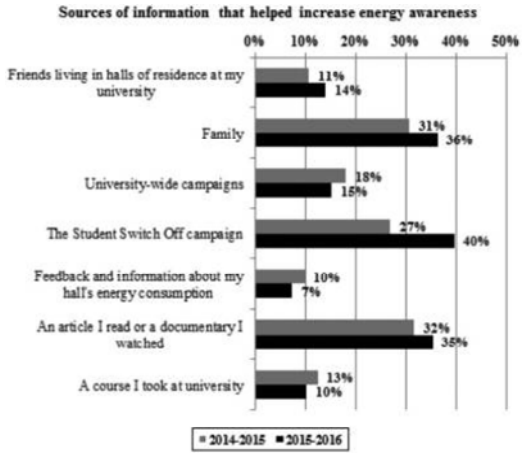


Figure 3.
Influential sources of information (2014-2016)

Action	Cyprus (%)	Greece (%)	Sweden (%)	UK (%)	Total (%)	Control group (%)
Switch off lights in empty rooms	6*	3	−1	0	0	−3*
Avoid leaving electronic equipment on stand-by	11	0	4	3	4**	−1
Put a lid on pans when cooking	−2	18*	6*	1	3**	2
Boil the kettle only with the amount of water you intend to use	2	8	5**	2	4*	5*
Put an extra layer on before deciding to turn on the heating	−2	−2	6**	−2	1	1
Open windows before deciding to use a cooling device or system	9	0	−1	1	1	−1

Table III.
Targeted behaviour swings across the EU countries (2014/2015)

Notes: A positive percentage change indicates an increase in the frequency that an expressed behaviour is performed at the end of the academic year compared to the beginning of the academic year. A negative percentage change indicates a decrease in the frequency that a stated behaviour is performed at the end of the academic year. *statistically significant, $p < 0.05$ **somewhat statistically significant, $0.5 < p < 07$

of the six target energy saving behaviours was undertaken between the beginning and the end of each academic year for each behaviour targeted by SSO is presented in Table III and Table IV. In the first year of the project, a significant increase was observed in the frequency that electronic appliances are turned off as well. In Cyprus, a significant increase was found in switching off lights the first year [$t(13) = -2.280$, $p < 0.05$] and in putting a lid on pans the second year of the campaign [$t(12) = -2.501$, $p < 0.05$]. In Greece a significant positive change was found in putting a lid on pans the first year [$t(12) = -2.889$, $p < 0.05$] and in boiling only the right amount of water in the kettle [$t(7) = -2.376$, $p < 0.05$] the second year. In Lithuania, no significant positive change was noted. In Sweden, a significant positive change was found in putting a lid on pans [$t(85) = -2.184$, $p < 0.05$], while a somewhat significant positive change was found in boiling only the right amount of water [$t(85) = -1.787$, $p = 0.077$] and putting an extra layer on instead of the heating [$t(85) = -1.805$, $p = 0.075$] in the first year of the campaign. In the second year, a significant positive change was

Action	Cyprus (%)	Greece (%)	Lithuania (%)	Sweden (%)	UK (%)	Total (%)	Control group (%)
Switch off lights in empty rooms	−2	0	−4	0	0	−1	−4*
Avoid leaving electronic equipment on stand-by	6	7	−2	−3	−1	−2	−4
Put a lid on pans when cooking	16*	9	0	5*	3	4*	0
Boil the kettle only with the amount of water you intend to use	14	17*	−8*	3	6*	3**	1
Put an extra layer on before deciding to turn on the heating	−4	−15*	−3	−1	1	0	−3
Open windows before deciding to use a cooling device or system	−2	6	1	−1	0	0	−2

Notes: *Statistically significant, $p < 0.05$; **somewhat statistically significant, $0.5 < p < 07$

Table IV. Targeted behaviours' swings across the EU countries (2015/2016)

observed in putting lids on pans [$t(141) = -2.290$, $p < 0.05$]. In the UK, a significant positive change was found in only the second year of the campaign for boiling the right amount of water [$t(206) = -2.181$, $p < 0.05$]. In the control group, smaller or equal change, compared to the treatment group, was noted in all targeted behaviours in both years.

Retention of behaviours

On retention of behaviours, 68 per cent of the respondents no longer living in dormitories said that when living in dormitories their awareness on how to save energy had increased as a result of information/posters/messages students received from the SSO campaign. Further, 70 per cent of those respondents stated that they had taken action to save energy as a result of the SSO campaign the previous academic year. From the 70 per cent of respondents who took action to save energy as a result of the SSO campaign past academic year, almost all of them (99 per cent of them) continued to take those actions in their current life when living outside of dormitories. The majority of respondents (74 per cent of respondents) continued to take energy saving actions in their current lives to save money. A large number of respondents also continued to take the energy saving actions because they had gotten into the habit of saving energy (56 per cent of respondents) and to take personal action on climate change (48 per cent of respondents). Encouragement from flatmates and saving time were not popular reasons for taking energy saving actions (3 per cent and 6 per cent of respondents, respectively).

Energy savings

An important measure of the project's success was quantifiable energy saving. In the academic year, 2014/2015 1.5 million kWh of electricity were saved (5.26 per cent) in dormitories across the 17 participating universities, while in 2015/2016, there was a saving of 2.5 million kWh (8.76 per cent) (see Table V). The reason for this increase was most likely a combination of the improvements made by delivery partners between the two years of the project in light of lessons learned (feedback surveys, focus groups and trial and error) and the addition of an energy dashboard (details of which are outlined in the following section) – it is, however, impossible to disaggregate the exact impact of different changes on overall savings between the two years. In some cases, such as in Cyprus in Year 2, the high energy savings were most likely achieved because the SSO campaign was so well integrated into the life of students living in the dormitories. It is also worth mentioning that there were only

Table V.
Energy savings per country, 2014-2015 and 2015-2016

	Energy usage and savings per country					
	UK	Greece	Cyprus	Sweden	Lithuania	TOTAL
(2014-2015)						
Baseline usage (kWh)	19,349,583	2,070,276	233,210	3,110,500	4,220,787	28,984,356
2014-15 usage (kWh)	18,334,297	2,016,552	217,067	2,735,296	4,157,609	27,460,821
kWh saving	1,015,286	53,725	16,142	375,203	63,179	1,523,535
% saving	5.25	2.60	6.92	12.06	1.50	5.26
CO2 saving (kg)	545,696	38,682	11,816	6,378	15,678	618,251
(2015-2016)						
Baseline usage (kWh)	20,340,014	1,660,781	244,154	2,706,120	4,152,605	29,103,674
2015-2016 usage (kWh)	18,650,358	1,645,797	143,443	2,376,600	3,739,449	26,555,647
kWh saving	1,689,656	14,984	100,711	329,520	413,156	2,548,027
% saving	8.31	0.90	41.25	12.18	9.95	8.76
CO2 saving (kg)	908,156	10,789	73,720	5,602	109,176	1,107,443

208 students living in the dormitories in Cyprus, and that a high proportion (70 per cent) were returning students who had engaged with the campaign in the previous academic year.

Energy data were also compared against the control group set up in Linkoping, Sweden. In both academic years, there was a significantly higher saving in the treatment group in Sweden compared to the control group. In, 2014/2015, there was a 12.06 per cent saving in the treatment group compared to 2.81 per cent in the control group, whereas in 2015/2016, these figures were 12.18 per cent and 1.99 per cent, respectively (see Table VI).

Energy dashboard use

One of the key features of Year 2 of the SAVES project and the student engagement was the energy dashboard designed by DMU in conjunction with feedback from nine focus groups across five countries. At the end of the project, two further focus groups were held in the University of Bath (UK) and the University of Cyprus (Cyprus) to offer a review of the dashboard. In total, 12 participants attended the focus group in the UK, but it was found that there was limited use of the dashboard. This lack of engagement was attributed to the local ambassadors and residence coordinators not promoting this aspect of the competition. When shown the energy dashboard, although the focus group was positive about its appearance and functionality, for example, one student said "If I had known about [the

Table VI.
Energy saving comparison between control group and SSO treatment group, 2014-2015 and 2015-2016

	Swedish control group and treatment group energy saving comparison	
	Control group	Treatment group in Sweden
(2014-2015)		
Baseline usage (kWh)	3,332,010	3,110,500
2014-2015 usage (kWh)	3,238,440	2,735,296
kWh saving	93,570	375,203
% saving	2.8	12.1
(2015-2016)		
Baseline usage (kWh)	3,332,010	2,706,120
2015-16 usage (kWh)	3,292,000	2,377,000
kWh saving	39,010	330,120
% change	1.2	12.2

dashboard] I definitely would have looked at it". The most noticeable "negative" comment was around the international aspect of competition whereby students could see their halls in comparison to the other EU ones. No one saw any great benefit in having their dormitory compared to a dormitory from another country – responses included "What is the point in comparing consumption with a country you don't know?" and "It'd be better if we [were] being compared with universities near us". The value they placed in the league table was being compared to their peers locally, and perhaps nationally. Constructive comments were made regarding the need for consumption data, energy saving tips and email alerts to look at the dashboard. In summary then, students liked the idea of the dashboard but would have liked it to be easier to access (via email alerts for example), and would like more relevant information from it both in terms of who they were being compared to, how much energy they were consuming and what they could do about it.

At the University of Cyprus, the focus group had five attendees. They all agreed that the dashboard was a very useful tool. The dashboard informed them of their energy consumption and they liked its appearance and its colour scheme. In common with wider research on dashboards, one student said that:

> Initially I was very excited by the dashboard and I was accessing it, at least once a week. As the time passed this excitement started fading away and I stopped accessing it so frequently. Now that the competition is over, I don't use it at all.

Most students particularly liked the ranking and the percentage change. Almost all of the students accessed the dashboard from a PC or laptop, through the local university SSO Facebook fanpage. Across the two focus groups the common feedback for the future of the dashboard was that they preferred comparisons to be with dormitories near them, they wanted increased social media functionality, regular alerts and discussion forums coupled with greater interactivity.

Conclusion

This Europe-wide project has shed further light on the role and potential of student-led campaigns, underpinned by practical action, and competitions with neighbouring dormitories, to achieve sustained energy reductions. The literature presents a mixed picture of the scale and impact of savings from student-focused energy-saving engagement activities, notably because most studies are small-scale and short-term. This research provides further insight into the potential for savings and behaviour change in university dormitories through relatively simple actions that individuals have control over. It is tempting to overcomplicate the interventions and overlook the benefits of energy efficiency interventions like those outlined here which can be sustained. Our research leads us to have more faith in these initiatives if, and it is an important if, they are appropriately supported and resourced, thereby moving beyond "mere feedback" to "enablement". This aligns with the findings of Wisecup *et al.* (2017) who note the importance of an "active intervention strategy".

So whilst other interventions have shown greater savings, this project over two academic years across five countries provides clear evidence of consistent savings of 7 per cent across a large number of universities through simple behaviour changes. The fact that 99 per cent of those who had taken action to save energy as a result of SAVES stated that they were still carrying forward those actions six months later when living outside of dormitories is very positive – and adds weight to the argument that this is a fruitful time to engage with students to encourage pro-environmental behaviour change.

This paper then makes two clear contributions. Firstly, it contributes to the literature by providing supportive long-term evidence of the potential of behaviour change through student engagement projects, in particular it demonstrates the importance of collective "holistic" campaigns that include a wide range of interventions focusing on very specific achievable behaviours that students have control over. Alongside the need to further understand the potential of habit-discontinuity theory for students, our findings echo those of Staddon *et al.* (2016) on the importance of "enablement alongside technical interventions such as feedback displays". In SAVES, students are not just the recipients of information but are also involved in communities and peer-to-peer support. Second, our research makes a theoretical contribution to the literature by applying non-residential behaviour change insights into the behaviour of students. In the context of students in dormitories, we argue that a lack of agency and control over many aspects of energy, and the lack of being responsible for the bill itself, aligns more to organisational and non-domestic studies than residential. Student accommodation is also heterogeneous. With different ownership structures, cultures and levels of control in terms of energy, behaviours and bills forces akin to a workplace culture may arguably influence the student. More research is needed to understand the variations between different universities, countries and even with different dormitories in the same university.

Of course there are limitations to this work. Further research is required to understand the potential of dashboards to contribute to these savings and in constructing competitions between people and dormitories that are known to each other. This echoes the findings of Senbel *et al.* (2014) who found people engage better with those whom they know. The literature does seem to show that after an initial impact the role of dashboards is limited. The data are not here to substantiate or contradict that view. That said, students are optimistic about the role the dashboards can play, particularly in contributing to the competitive element of the programme and further long-term research is required here. Whilst the information-deficit model of behaviour change has been rightly critiqued, the provision of useful information about the potential efficiency and impact of incentives on simple behaviours has a role to play. Future research is of course needed and a follow-up study (SAVES 2) has recently been funded by the EU *H, 2020* fund to explore the longer-term impacts of such interventions as students move out of dormitories into private rented accommodation.

Competing priorities will continue to be a theme for students in their future lives and careers, as it is for all of us at whatever stage we find ourselves. Difficult choices remain as convenience, comfort and careers threaten to erode our commitment to more energy efficient life choices that may require sacrifice to live more lightly on this earth. The students studied as part of the SAVES project though do provide some hope that long-term energy efficiency is possible given the right conditions.

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