Changing Behavior in the Western Cape: Climate Change Project Final Report

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Executive Summary

In late 2012, the Western Cape Government engaged ideas42 and the University of Cape Town to collaborate a multi-year initiative known as "Changing Behavior in the Western Cape". The goal of this initiative was to apply behavioral economics to policy challenges in a variety of areas, ranging from health to violence reduction to after-school programs to road safety, by designing and testing behaviorally-informed solution to policy issues in each domain.

One of the areas of focus for the initiative was climate change, where the partnership focused on the issue of energy use within government, which was a key part of the Western Cape Government's "Too Wise to Waste" program. For the Climate Change Pilot of the Changing Behavior Project ideas42 and the University of Cape Town collaborated to use behavioral economics principles to design an email-based intervention aimed at reducing electricity consumption in 4 Dorp Street, a large office building with 24 floors, where several provincial government departments are headquartered and which is occupied by a large number of civil servants.

Fieldwork and behavioral mapping carried out jointly by the ideas42-UCT teams in 2013 allowed key behavioral bottlenecks – diffusion of responsibility, moral justification, unit confusion, limited attention, identity, and social norms – to be identified. The team then used data collected using floor-level meters (which were installed for the purpose of this project) to create an e-mail campaign involving several key behaviorally informed components – including floor-level competitions, assigning responsibility, targeted information, and timely reminders – to address these bottlenecks. Several 'packages' of these interventions were then tested using a randomized control trial, for which the floors in 4 Dorp Street were randomly assigned to a control group and two treatment groups based on prior energy consumption. Randomization was intended to ensure, as far as possible, that the various sets of floors were comparable in terms of their energy use profiles.

The first or pilot phase of the experiment began in October 2015, with both treatment groups receiving a package of information and tips. We did not expect to find substantial effects from these simple treatments, which were a behaviorally modified version of standard information campaigns, in part because issues with the email system compromised our ability to reach all the intended recipients. That said, we hoped that the energy reduction, if any, resulting from these basic interventions would allow us to work out the value added, if any, by the more involved behavioral interventions which followed in Phase II of the experiment.

Phase II, or the main experiment, was announced in April, but initial teething troubles and the previously discussed problems with the email system meant that a full-fidelity version being rolled out in June 2016. In this phase, all treatment floors continued to receive information and tips. Treatment 1 floors also received an inter-floor competition, while Treatment 2 floors

received the inter-floor competition as well as being assigned a 'floor champion' (or advocate) to monitor energy consumption and lead reduction efforts.

We focus on the results from the period, starting June 10, 2016, when the full-fidelity implementation of the intervention began. While the intervention is still running and will run through the end of October, we now have data for 4 months (June, July, August and September 2016) during which the interventions were being implemented at full fidelity.

For this period, we find a large and statistically significant reduction in energy consumption of 13.5% from the combination of tips, interfloor competitions and energy advocates/champions (Treatment 2). We find no significant effect on energy consumption from Treatment 1 (tips + interfloor competition, but no advocate) for the overall period, although it is worth noting that we do find a significant reduction in energy use of 11.6% for the first two months of the full-fidelity implementation of Treatment 1; however, the attenuation of the affect over time means that there is no significant effect for Treatment 1 overall.

We also find no significant effects on energy use from the pilot 'Information and Tips' phase, when both sets of treatment floors received tips and information alone. Taken together with the much smaller point estimates for Phase I, our findings suggest that the components in Phase II add real value over and above information and tips, although faulty implementation may have reduced our Phase 1 effects.

To our knowledge, these are some of the largest reductions in energy use to have been demonstrated using behavioral nudges. It is especially noteworthy that these occurred in an office setting with no monetary incentives. Preliminary costing estimates suggest that the costs of the basic infrastructure for this project would be recovered due to reductions in energy bills in around 2 years. Our hope is that a successful intervention can be subsequently scaled up both within the Western Cape Government – but also more widely in the commercial sector and elsewhere in the world.

Background

In late 2012, the Western Cape Government engaged ideas42 and the University of Cape Town to collaborate a multi-year initiative known as "Changing Behavior in the Western Cape". The goal of this initiative was to apply behavioral economics to policy challenges in a variety of areas, ranging from health to education to road safety, by designing and testing behaviorally informed solution to policy issues in each domain.

One of the areas of focus for the initiative was climate change, where the partnership focused on the issue of energy use within government, which was a key part of the Western Cape Government's "Too Wise to Waste" program which encourages environment-friendly behavior by government employees. Since early 2013, the Changing Behavior in the Western Cape Project has therefore been working on a pilot project to reduce energy use in Provincial government buildings. Throughout we have held the belief that small interventions, based on the principles of behavioral economics, can substantially lower energy use – saving the Western Cape Government money and in the long run slowing climate change.

Problem Statement

While there has been much work focused on creating behavioral interventions to reduce energy usage in residential households, there is only very limited evidence for the office building context. Coordinating and monitoring energy use among office floors is more challenging than residential energy consumption for two reasons. First, unlike residential consumers, occupants of office buildings typically do not have any financial incentives to reduce their energy use. Second, while residential households typically have four members, office floors can have between 50-200 individuals, making coordination much more challenging even where the will exists.

An opportunity therefore existed to apply behavioral economics to the design of a nudge - a low-cost but high-impact tweak to the existing system - to reduce energy consumption in the office context, starting with this pilot in the Western Cape.

Diagnosis Highlights

Through interviews, focus groups, and site visits to explore the office setup (conducted in 2013), we diagnosed the following six major psychological bottlenecks impeding energy efficient behavior:

1. **Diffused Responsibility**: Employees are often unsure whose responsibility it is to turn appliances and lights off at the end of the day.

2. **Moral Justification**: Employees consider public service to be their primary contribution to the environment, rather than reducing personal consumption.

3. **Unit Confusion**: It is unclear to employees how small individual behaviors translate into and affect energy efficiency.

4. **Limited Attention**: Employees sometimes simply forget to turn off devices.

5. **Identity**: While at work employees do not think about translating their energy efficient behaviors at home to the office.

6. **Social Norms**: Employees do not know how much energy their colleagues use and therefore have no reference point for how energy efficient they are.

Taking on board these insights helped us to move forwards to a design stage for our planned intervention.

Designed Solutions

We subsequently designed the following intervention components to respond to and mitigate the bottlenecks we observed. In thinking about the intervention vector, we devised an automated email system with the vision to test the effect of different isolated messages that incorporate the following intervention components:, in increasing order of ‘behavioral’ content:

Providing information – Giving easy-to-understand information regarding energy use that employees can easily translate into action. Place specific behaviors into a context that is familiar to them.

Reminders: Targeted e-mail reminders, sent out to coincide with important decisions (for example, first thing in the morning, and before the end of the work day. Additionally, reminders to turn devices *on* in the morning will avert potential tensions, such as coworkers complaining about a lack of hot water in the morning.

Social Competition: A program that compares employees' energy use with other floors, in order to pique interest and push behaviors.

Assigning Responsibility – Assigning given employees a responsibility for energy use. For example, one employee may be randomly singled out on a daily basis as the "energy champion" for the entire floor. Alternatively, one employee in each floor could be given a certain task (eg "turn off lights at the end of the day", "turn off the water heater", "unplug the printer"). Finally, individuals who are the last to leave could be identified if they fail to turn off devices. This can feed into the social competition by personalizing it.

Experimental Design

A randomized experimental design illustrated in Figure 2[1] was used to study the impact of behavioural nudges aimed at energy saving.

Prior to the start of the study, two meters per each floor were installed on the 24 floors of the 4 Dorp street building of the Western Cape Government. These meters provided half hourly energy consumption data for each floor. This data was collected for close to two years while correcting for problems such as anomalies in meter readings, meter breakdowns and tracking of floor inventories.

By the end the of the "testing period" we identified that data recorded from **1st July 2015 to October 2015 (four months)** were almost free from problems such as broken meters and sparse floor inventories. **Data for this period served as the baseline for the experiment.**

[1] Note that the timelines portrayed in Figure 2 is schematic and was envisioned prior to commencement of the study. In reality the timelines had to be adjusted substantially given several problems with the installation and testing phase, and then again once we started rolling out the interventions.

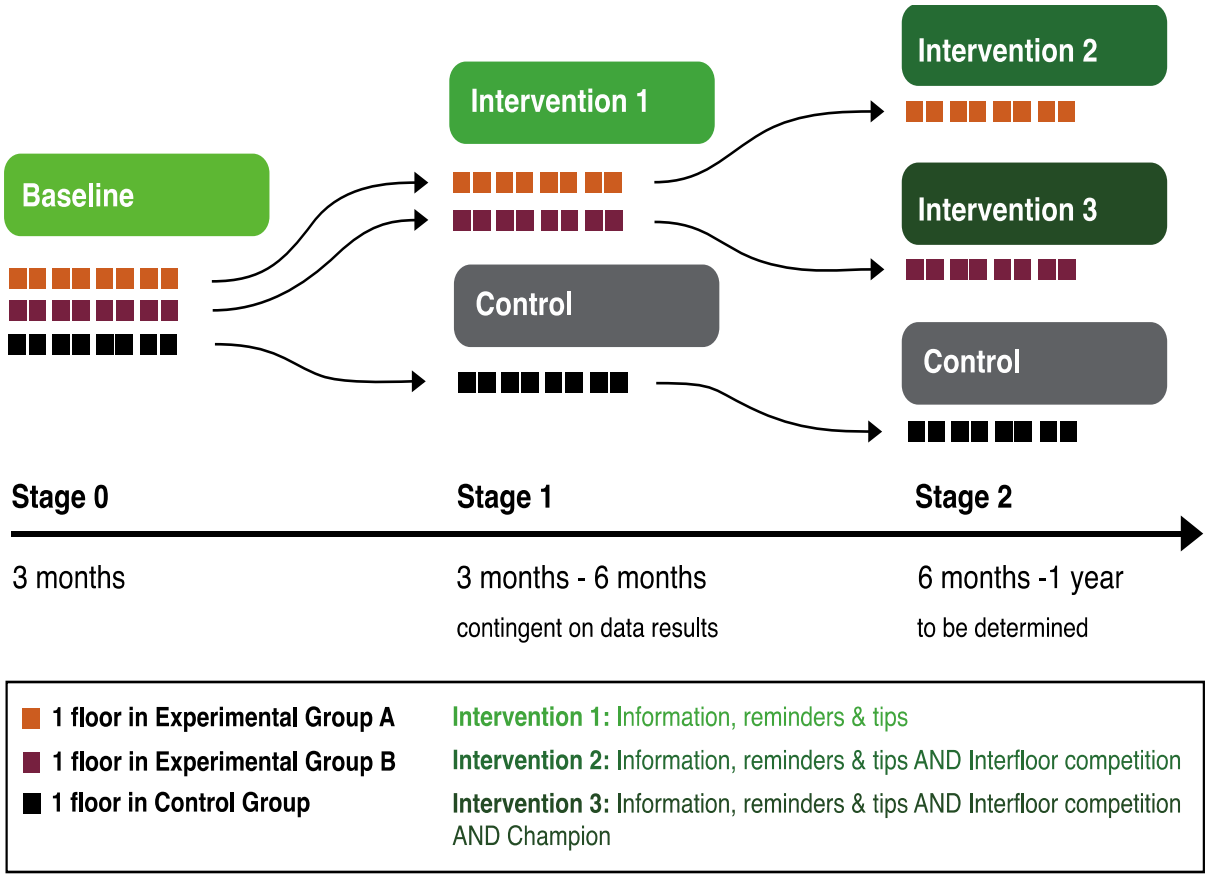


Figure 1: Experimental design

The baseline data was used to calculate the average per capita consumption for each floor. Based on the calculated average per capita consumption values, the floors were then randomly assigned into controls and treatment groups as shown in Table 1. In total Treatment 1, 2 and the Control group were allocated seven floors each. Floor numbers 8, 9, and 24 were dropped from the experiment due to ongoing renovations at the time.

Table 1: Random allocation of floors to treatments

Floor Number	Assignment
1	Treatment 2
2	Treatment 2
3	Treatment 1
4	Treatment 2
5	Control
6	Control
7	Treatment 1
10	Treatment1
11	Control
12	Control
13	Treatment 2
14	Treatment 1
15	Treatment 1

16	Treatment 2
17	Control
18	Treatment 1
19	Treatment 2
20	Control
21	Treatment 2
22	Treatment 1
23	Control

Roll-out of Phase I

The Roll-out of Phase I commenced with the sending out of an introductory email about the study on 19th October 2015. However, the actual routine sending of emails to members of floors allocated to treatment groups in the form of *energy reduction tips* started on 21st October 2015. In this case members of floors assigned to Treatment 1 and Treatment 2 received the same tips while the Control group received no emails throughout Phase I. The schedule for the tips email were as follows:

- General Tips: First Monday of the month (1X per month)
- Reminders to turn off light: Every Friday (4X per month)
- Kitchen Tips: Every 3rd Wednesday of the month (1X per month)

These emails schedules were followed until the end of Phase I on 31st March, 2016.
However, we subsequently discovered that a cap on all 2Wise2Waste emails meant that only some of all our messages would have reached floor occupants. While we did not expect large effects from the information and tips treatment, this nevertheless means that the effects we might have seen were likely further attenuated by these intervention difficulties.

Roll-out of Phase II

The roll-out of Phase II formally started on 4 April, 2016 with an announcement email introducing the interfloor competitions to those in Treatment 1 and introducing both interfloor competitions and floor advocates to those in Treatment 2. In this phase, floors allocated to Treatment 1 were to receive emails giving them feedback about an inter-floor competitions. Floors assigned to Treatment 2 were to receive the inter-floor competition feedback, but also received weekly emails that assigned a specific person on that floor as an "*energy savings advocate*".

Initial operational hiccups meant that the intervention implementation was patchy for April and May 2016, with only a monthly (as opposed to a weekly) feedback email being sent in May (the "Partial Implementation Period", and with only some of the advocate emails getting through due to the aforementioned issue with email caps.

However, from 10 June 2016 the interfloor competition messages successfully started going out on a weekly basis (for both Treatment 1 and 2 floors). Thus far we have accumulated data for June. July, August and September 2016, all which is included in this analysis. We refer to the period from 10 June 2016 as the "Full Fidelity Period" and will focus on the results from

this phase, though as can be seen in the detailed results, we also detect effects in the "Partial Implementation Period" despite the faulty implementation.

We intend to continue the intervention until the end of October 2016 – exactly a year after the conclusion of the baseline data collection - which will take us to the beginning of summer when one would normally expect energy consumption to start decreasing.

Data and trends

Given that we have two meters, twenty-one floors, half hourly data and 461 days from July 2015 to 4th October, 2016, the expected number of observations was 929,376[2]. However, due to meter issues such as meters breaking down[3] and some missing data points in meter recording, our sample size was reduced to 881,355 observations. Out of this, the baseline data recorded 218,616 observations, Phase I recorded 308,952 observations while Phase II recorded 353,787 observations. *Table 3* presents simple averages (in kWh/30min) for meters in the Treatment and Control groups for Phase I and Phase II, capturing the different implementation shortfalls as periods on their own e.g. Period 3: Announcement period (4 April to 9 May 2016); Period 4: After monthly interfloor manual calculations was sent out (10 May -11 June 2016) and Period 5: commencement of weekly interfloor competition winners (12 June- 4thOctober, 2016).

Table 2: Meter Average Energy readings (kWh/30min) for the different periods by groups

	Treatment 1	Treatment 2	Control
Baseline	2.590503	2.746928	2.472423
Phase1 Information and Tips	2.353272	2.387042	2.213113
Period 3: Announcement of Phase 2	2.411395	2.553864	2.107978
Period 4: Partial Implementation	2.620585	2.515202	2.572571
Period 5: Full Fidelity Period	2.373018	2.298384	2.432428

[2] 2X2X24X461X21= 929376 where 2- two meters, 2- two 30 mins in one hour, 461= total number of days (30*5+31*9+29+3), 21- number of floors

[3] For instance in June/July,2016 meters 4 and 6 broke down; a similar problem was recorded for meter 18 in April 2016.

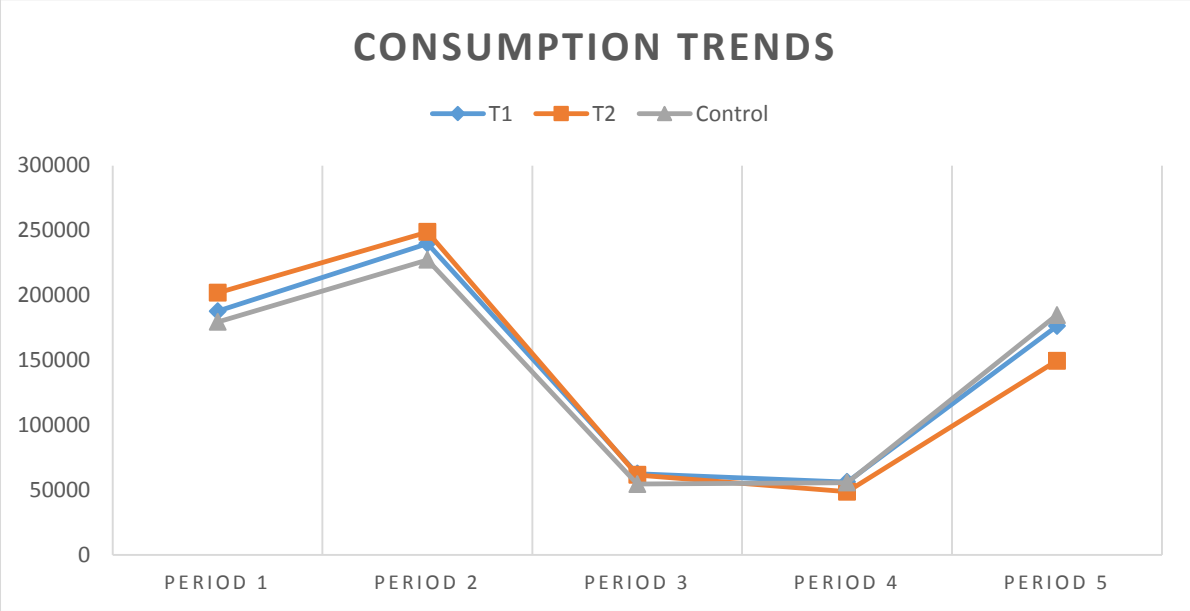


Figure 2: Energy consumption trends from 1 July, 2015 to 4th October, 2016

Figure 2 shows the trends of total energy consumption for Treatment 1, 2 and Control floors for each phase of the project, from the start of baseline data (1st July 2015) to the current position of Phase II roll out (4th October, 2016). At the start of the Baseline period (Period 1) Control floors were recording slightly lower energy consumption readings than Treatment floors.

By the end of Phase I (when the Announcement for Phase II was sent out e.g. Period 3) the difference between the Treatment group and Control groups started dwindling closing the gap by the commencement of Period 4. It was only when the monthly interfloor competition winners were sent out in Period 4 that we started observing a decline in consumption for Treatment 2 floors. Interestingly by the end of July 2016 (Period 5) both Treatment 1 and 2 that started with higher energy consumption values compared to control floors are now consuming considerably less than the Control floors as shown in the *Figure 2*.

Results

Phase I:

In the following section the impact of the "Information and Tips" intervention rolled out to Treatment 1 & 2 floors are analysed. The Phase I intervention was rolled out in isolation between 21 October 2015 and 3 April 2016. In *Table 4*, the average treatment effect (ATE) for phase I is estimated. The results indicate that the average reduction in energy use due to Tips of 0.0594 kWh/30mins was not statistically significant.

Table 3: Estimation results for phase I

VARIABLES	PHASE1
Treatment(tips)	0.109
	(0.374)
Time variable	-0.0858
	(0.0990)
Treatment x time variable (tips effect)	**-0.0594**
	(0.177)
headcount	0.00666
	(0.00455)
floornumber	-0.0639*
	(0.0334)
August 2015	-0.172***
	(0.0338)
Sept 2015	-0.195***
	(0.0516)
Oct, 2015	-0.295***
	(0.0665)
Nov 2015	-0.292***
	(0.0719)
Dec 2015	-0.597***
	(0.107)
Jan 2016	-0.401***
	(0.138)
Feb 2016	-0.127
	(0.113)
March 2016	-0.267***
	(0.0944)
Constant	3.167***
	(0.639)
Observations	531,490
Number of Meters	42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

During Phase II, as noted previously, we were faced with several crucial implementation problems. In terms of the evaluation of the impact of the two treatments (*interfloor competitions* and *interfloor competition with floor advocates*) we therefore expect the initial behavioural responses of our intervention to be very "noisy" in the first weeks/months of the roll-out. Notwithstanding this, we first present the analysis of Phase II using the entire data available (See *Table 4*) before dis-entangling the unique occurrences during this period (*Table 5*).

The results from the estimation in *Table 4* shows that Treatment 1 floors (who received only the *interfloor competition* feedback) on average reduced consumption by 3.5% during Phase II, although the impact of this feedback was insignificant. Treatment 2 floors (who received both interfloor competition emails, as well as, assigning floor advocates) consumed about 0.264 kWh less energy per every 30 minutes than meters on Control floors (significant at the 10% level). Compared to Baseline average consumption levels of 2.591KWh/30min (for

Treatment 1) and 2.747 KWh/30min (for Treatment 2) this constitutes reductions of 3.5% and 9.6% respectively for the whole of Phase II.

Table 4: Estimation results for Phase II

VARIABLES	PHASE2
Treatment1	2.986***
	(0.726)
Treatment2	2.334***
	(0.583)
Timevariable	-0.608***
	(0.0888)
Treatment 1* timevariable	**-0.0893**
	(0.151)
Treatment 2* timevariable	**-0.264***
	(0.154)
Announcement	-0.163*
	(0.0915)
Monthly Intervention	0.118*
	(0.0595)
Head Count	0.0101**
	(0.0042)
August 2015	-0.189***
	(0.0371)
Sept 2015	-0.232
	(0.0543)
Oct, 2015	-0.331***
	(0.0646)
April 2016	0.431***
	(0.109)
May 2016	0.297***
	(0.0990)
June 2016	0.434***
	(0.0850)
July 2016	0.399***
	(0.0704)
August 2016	0.323***
	(0.0583)
September	0.292***
	(0.0676)
Constant	0.776*
	(0.465)
Floor dummies	Yes
Observations	577,620
Number of meterid	42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Estimation results for the re-grouped periods in Phase II

VARIABLES	Period 3	Period 4	Period5
Treatment1	2.883***	2.851***	2.834***
	(0.542)	(0.518)	(0.708)
Treatment2	2.462***	2.517***	2.319***
	(0.468)	(0.516)	(0.626)
Timevariable	-0.656***	-0.0174	-0.589**
	(0.0798)	(0.104)	(0.0986)
Treatment 1* timevariable	0.188	-0.0964	-0.180
	(0.180)	(0.152)	(0.159)
Treatment2* timevariable	**0.0236**	**-0.453****	**-0.345***
	(0.178)	(0.201)	(0.178)
headcount	0.0096**	0.0114***	0.0131**
	(0.00465)	(0.00426)	(0.00542)
August 2015	-0.189***	-0.189***	-0.187***
	(0.0373)	(0.0371)	(0.0383)
Sept 2015	-0.227***	-0.237***	-0.291***
	(0.0564)	(0.0542)	(0.0460)
Oct, 2015	-0.327***	-0.337***	-0.392***
	(0.0657)	(0.0638)	(0.0510)
April 2016	0.132**		
	(0.0536)		
May 2016	-	-0.122*	
		(0.0671)	
June 2016		-	0.431***
			(0.0846)
July 2016			0.395***
			(0.0701)
August 2016			-0.304***
			(0.0578)
September 2016			0.284***
			(0.0679)
Constant	0.774*	0.623	0.618
	(0.457)	(0.467)	(0.480)
Floor dummies	Yes	Yes	Yes
Observations	294,620	281,111	423,357
Number of Meters	42	42	40

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In *Table 5* we control for each event that impacted on the roll-out of Phase 2 interventions. Period 3 captures the period post the initial announcement at the start (4 April 2016) of Phase II, which we expected could have impacted behaviour.

Period 4 (Partial Implementation) captures the period after May 10th, when the first feedback was sent to *Treatment 1 & 2* floors involved in the interfloor competitions. Although we had

initially indicated that we would give *weekly* feedback on the interfloor competitions, we had to calculate the results for this month manually and hence this feedback announcing the overall winners for the month of April was in the form of *monthly* feedback.

Period 5 (Full Fidelity Period) captures the period (12 June and after) where after feedback about the interfloor competitions was sent out weekly (without any interruptions. **Considering that the interfloor competitions were only functioning properly from Period 5 onwards – this is the period of evaluation that we are most interested in.**

Using the Average treatments effects (ATE) obtained from these regression results, the percentage reduction is summarized in *Table 7* for Phase I and Phase II as a whole, and also for the respective periods within phase II.

Table 6: Baseline and Endline consumption (in kWh/30min) and percentage reductions for each of the estimation periods

	Baseline	**Phase1**	**Phase2**	**Period3**	**Period4**	**Period 5**
Control	2.4724	2.2131	2.3924	2.1079	2.5726	2.4324
TIPS	2.6712	2.4724				
ATE		(-0.0551)				
% Reduction		**2.06%**				
Treatment 1	2.5905		2.428	2.4114	2.6206	2.3730
ATE			(-0.0893)	0.188	(-0.0964)	-0.180
% Reduction			**3.5%**		**3.7**	**6.95%**
Treatment 2	2.7469		2.3965	2.5539	2.5152	2.2983
ATE			(-0.264)	0.0236	(-0.453)	(-0.345)
% Reduction			**9.6%***		**16.5****	**13.5%*[4]**

When Phase II is dis-entangled into periods 3, 4 and 5 we observe a non-significant 3.7% reduction for Treatment 1 floors (tips + interfloor competition *with monthly feedback*) and a 16.5% reduction for Treament 2 floors (tips + interfloor competition *with monthly feedback* + advocates) for period 4. In period 5 when our weekly interfloor competition feedback was up and running, we observed a non-significant 6.95% reduction on average energy consumption amongst Treatment 1 floors, while for Treatment 2 floors a 13.5% reduction in consumption was observed. Paranthetically, we should note that using only data until the end of July (i.e. the first half of the full fidelity period) does show a significant reduction in electricity consumption of 11.6% for even Treatment 1 floors. Thus, it is possible that Treatment 1 – the interfloor competition alone – has a smaller but still substantial effect, but one that wears off more quickly than when the competition is combined with the floor advocate/champion.

These results are much better than what we anticipated in setting out with this research, especially considering that these reductions are not incentivised by monetary savings for the floor occupants in the same way that it would be for residential consumers.

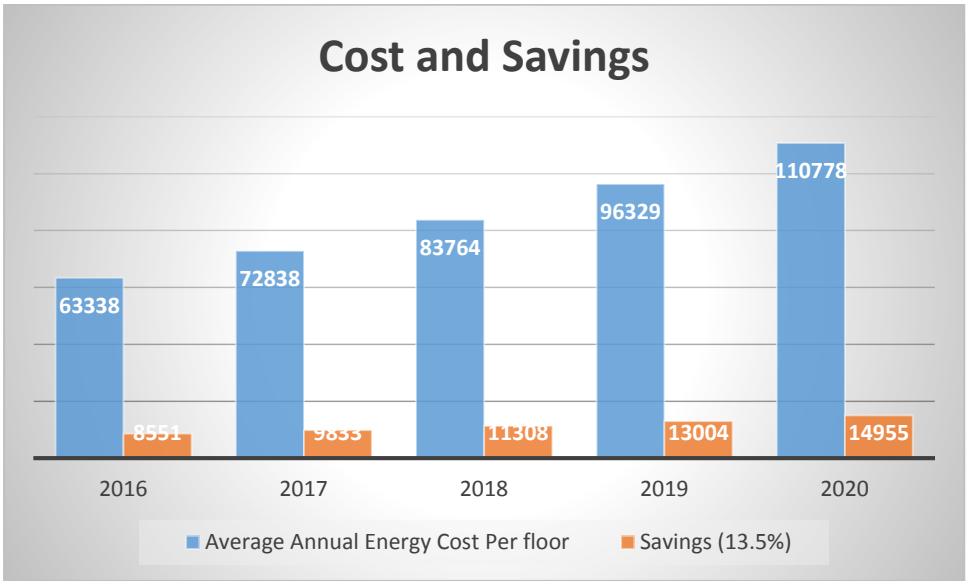
[4] Baseline average used for period 5 treatment2 percentage reduction is 2.548376

The current pilot is expected to conclude by the end of October 2016. This means that we would be able add one more month worth of data to the existing analysis and further buttress our understanding of the sustainability of these results.

The Business Case

In so far as assessing the overall cost effectiveness of this intervention and the potential for scaling it up in other buildings it is important to understand what the value of savings achieved due to the combined tips, interfloor competition and advocate treatments are and how it compares to the costs of installing energy meters and associated consultancy fees.

In *Table 5* below, we first reflect on the average annual energy (kWh) consumed per floor in 4 Dorp Street. We have used the data obtained from the meters over the last year to surmize these consumption values. The average consumption per floor (6606 kWh) multiplied by an average cost of 0,7987 c/kWh for Small Power Users such as 4 Dorp Street amounts to R5271/month. The costing for 21 floors (involved in our evaluation) is then about R110 842 per month and R1 330 090 annually[5].



[5] As a cross check this corresponds well to the energy costing for 4 Dorp Street (as 0,45% of the Annual Energy Consumption value - Combined Consumption for Wale and Keerom St - reported in the Report provided by Public Works for 2014/5)

Table 5: Costs and Savings

	Rands	Savings (13.5%)
Average Annual Energy Cost Per floor (R's 2016)	R63 338	R 8551
Average Annual Energy Cost Per floor (R's 2017)	R72 838	R 9833
Average Annual Energy Cost Per floor (R's 2018)	R83 764	R 11308
Average Annual Energy Cost Per floor (R's 2019)	R96 329	R 13004
Average Annual Energy Cost Per floor (R's 2020)	R110 778	R 14955
Total over 5 years	R427 047	R 57651
Average installation cost per floor (2 meters)	R21 210	
Average additional costs (consulting fees etc)	R35 933	
Total Costs of installation per floor	R57 143	
Years to recoup installation costs		<2(1/2)
Years to recoup total costs		<5
Annual Savings after costs recouped (R's 2020)		R14955
Annual Savings for 21 floors (R's 2020)		R314055

If the 13.5% savings we are currently achieving (over period 4-5) through a combination of tips, interfloor competition and assignment of floor advocates is sustainable, total savings over a 5 year period (assuming energy prices rises at 15% per year) would be R57 651 per floor. If we deduct the cost of R21 210 for two meters per floor, those costs would be recouped within two-and-a=half years of rolling out the behavioural interventions. Given the additional costs of consultancies etc, the total costs would amount to R57 143 per floor. In line with the projected savings described above these full costs would therefore be covered in less than 5 years, where after annual savings across 21 floors would amount R314,055 (using 2020 consumption figures and prices).

Conclusions

The aim of this project has been the reduction of energy consumption in Western Cape Government buildings by installing energy meters on each floor and thereafter using emails as behavioural nudges to incentivise energy savings.

In this pilot project we specifically used the building of 4 Dorp Street in a randomized control trial. Our energy savings intervention was designed to roll-out over two phases and involved 21 floors (each with two energy meters installed on far-ends of the building). During Phase I

emails with energy savings tips were rolled out to occupants of Treatment 1 and 2 floors (a total of 14 floors), while the 7 Control floors received no messaging. Phase II involved the roll-out of additional interfloor competitions with feedback for those on Treatment 1 floors, while those on Treatment 2 floors received feedback on interfloor competitions, but also received weekly emails assigning one person per floor as the "*energy savings advocate*".

The project was delayed in starting (by more than a year) due to technical and implementation hurdles so that it was not possible to start getting good baseline data until July 2015, causing a huge delay in the implementation of the program. The roll-out of Phase II was also very "noisy" with various issues related to programming hamstringing the effective roll-out of the interfloor competition feedback.

Nevertheless, after 13 months of closely monitoring meter recordings in the 4 Dorp Street building and workers' attitudes towards energy savings emails, we can draw the following conclusions based on our estimation results and percentage reduction estimates:

- In Phase 1 when both Treatment 1 and Treatment 2 floors received the same intervention (Tips), there was no significant reduction in electricity consumption.

- During the four months of Phase II after the implementation issues were resolved and we started receiving good data capturing both the weekly interfloor competition floor the study recorded no significant results for Treatment 1 and about a 13.5% reduction for Treatment 2.

Other studies using behavioral nudges (with residential households) have typically resulted in only 1-7% (max) reductions. The results presented here are therefore particularly encouraging given that the occupants of these floors are employees and therefore NOT incentivized by real monetary savings. The standard assumption is that it is harder to achieve reductions in such a setting – making the results of this experiment a reason to re-evaluate the conventional wisdom. Finally, preliminary costings suggest that the basic infrastructure for scaling up this intervention would be covered within a 2.5-year period and that total costs (including consultancy fees) would be covered within a 5-year period.