

Scheme to Reduce Energy Consumption in Households A Pilot Project December 2008

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Summary

With the twin issues of peak oil and climate change at play we need to reduce our energy consumption by 20% across all activity before 2020. This report proposes and assesses a local door-to-door method (Local Scheme) to persuade householders to reduce their energy consumption. Over a period of 6 months, advice on energy saving was offered to participants and energy consumption was monitored. Two surveys examined how participants rated their own progress.

In surveys householders said they reduced energy consumption in response to the Local Scheme and the national Power-of-One promotion. Participants indicated they approved of the local scheme. In 2008, energy consumed as electricity, gas, heating oil and car fuel was 12.1, 16.6, 57.7, and 37.9 kWh/d respectively. Energy data were difficult to collect so insufficient data were available to show a difference between 2007 and 2008. However, data suggest energy saving of about 5 kWh/d at a cost of approximately 3 cent per kWh when saving energy by this method. Suggestions are made for an improved scheme.

Introduction

With peak oil occurring at about this time and the limited opportunities for renewable generation (Trainer, 2007) we need to reduce the amount of energy we use. Adding to this the impact of fossil fuel on our climate and we have a very cogent argument for cutting back on energy consumption.

A number of initiatives currently in hand are likely to bring about initial reductions in energy consumption. These include the Green Motor and Vehicle Registration Tax Rates (DOEHLG, 2008), the Greener Homes Scheme and PO1 from DCENR (2007). Several groups (EPA, SEI and Carlow County Council) carry out measurement of energy consumption, in local business. All these activities have the potential to make a contribution to the 20% reduction anticipated in the Programme for Government (2007).

The object in this project was to propose a door-to-door method to persuade householders to reduce their energy consumption and to assess its effectiveness. This report deals with a domestic pilot trial in housing estates only and is on a larger scale than similar work undertaken under Power-of-One-Street.

Method

Experimental design.

The method involved selecting 4 housing estates at random in Carlow Town where a total of 230 houses were visited. Of these only 79 agreed to participate in a short survey on PO1. These became the working group. Four households were eliminated by random selection leaving 25 households in each of three housing estates; X, Y and Z this last made up from two smaller estates. These householders were then asked to take part in the scheme, which lasted six months between January and July 2008.

Surveys

On the first visit householders were asked to complete a small, five-question survey, concerning the national PO1 campaign. A second survey was conducted at the end of the

scheme concerning the local scheme and this had questions similar to the earlier survey. Responses from the two surveys were compared and reported below.

Energy conservation data

A small card showing the arguments for reducing energy consumption and giving an outline of the scheme, was handed to each participant. A few days later an A4 card was given describing their role in the scheme. A label for this card was provided each month with two to four suggestions to reduce energy consumption. Meter readings were sought on two occasions for the survey period and for the previous year, 2007. The latter are available from ESB and Bord Gais by phone or post. Some heating oil bills, relating to 2007, were obtained and these gave outline information. Records of petrol/diesel purchase were sought. Mileage on cars was recorded on two occasions and details of each vehicle (manufacturer, model, engine size, age) were gathered. An Internet site (SEI, 2008) was consulted for vehicle efficiency.

At the end of the project, letters were sent to householders, giving the overall result of the trial along with their own energy consumption. Values for electricity and gas were restricted to April/May but not for heating oil or for cars.

The cost of the scheme was calculated using time and out of pocket expenses recorded and a moderate overhead cost.

Results and Discussion

This is a new scheme, and it was undertaken using voluntary labour and no funding. It is likely that this approach would offer greater returns if it were funded and had input from suitably qualified advisors.

The quantity of data obtained was less than anticipated and this reduced the possibility of significant results. Analysis of the surveys did not show any difference between estates. However the combined data did yield significant values but not significant differences. These are given in detail in the text below and in Table 1:

- *QA. Have you reduced energy consumption on account of the scheme?* A significant number of participants felt they had reduced energy consumption due to the influence of both PO1 and the Local Scheme. Seven participants who said they had saved energy in the local scheme had not given the same answer in relation to PO1. This suggests that the local scheme was effective in persuading people who were not already interested in energy conservation to become involved.
- *QB. Did you persist (will you persist) with the economies?* Many participants indicated persistence with the economies they had achieved. This was significant in relation to the local scheme but not concerning PO1. Differences between PO1 and the local scheme were not significant.
- In QC (PO1) householders were asked whether the potential savings would influence them whereas in relation to the local scheme householders were asked whether they would recommend the scheme to a friend. The result in the former case was insignificant while the latter was significant. This indicates the local scheme was popular with participants.

Table 1. Outline survey result

	PO1		Local Scheme		
	Mean ¹ (%)	C.I. 95%		Mean ² (%)	C.I. 95%
QA	55	5.7	QA	50	21
QB	49	50	QB	53	12
QC	52	91	QC	61	52
Population	100		Population	100	

Notes: 1. Households out of 25 per housing group.

Participation pattern

We initially adopted a business-like approach to householders. Our visits were short and to the point with an efficient exchange of paper and answers to any questions raised. Calls were made on weekdays in the evening and sometimes on Saturday morning. Householders were often absent at these times (Fig. 1). We managed to contact only half to one third of householders on each outing.

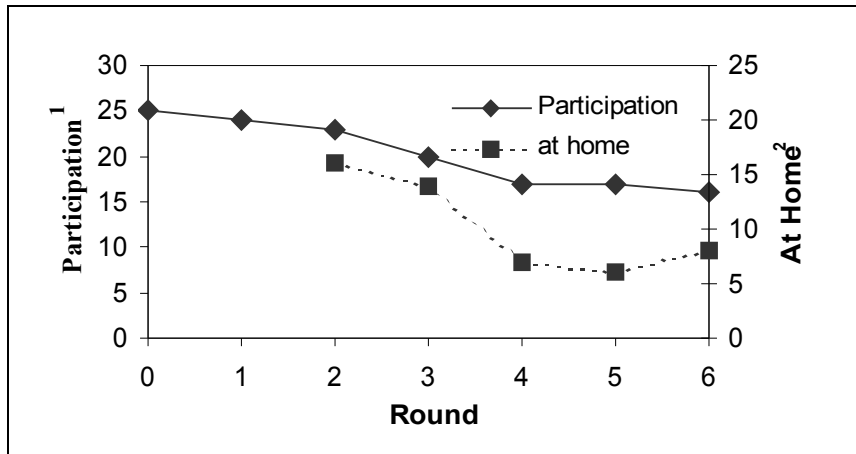


Fig.1 Decline in participation in the local scheme over time and the proportion of active participants at home in Estate X when surveyors called. Notes: 1. Total participants at Estate X involved in a given round, 2. Participants at home when surveyors called.

The business-like manner seemed appropriate given the number of houses involved. However, the number of participants dropped from Round 1 to Round 4 (Fig. 1). In the fourth round a different approach was adopted whereby a surveyor engaged each householder in a friendly chat about the local scheme or any other subject that occurred. This took time but only one participant withdrew from the scheme in the remaining two months and this was at Estate X (Fig 1).

Energy use record

Electricity was the easiest to record with data available in every house, sometimes in an outdoor box. Back readings were available to participants by phone or letter. The procedure for back readings was explained verbally and in writing in some cases many times. Some claimed this facility was difficult to use while others seemed to feel a request for further information at the end of the scheme carried no further benefit for them so why bother. The restriction that only householders could obtain this information was a constraint to the project team. Back readings were obtained for only eight households out of a total of forty-four. In an effort to overcome the lack of meter readings for 2007, data were requested from ESB. They appeared willing to assist but in the end provided no useful information. Several months after our first request, ESB indicated that MPRN numbers, in place of the addresses we sent, would have made it easier for them to retrieve the data. Energy data are given in Table 2.

The experience with piped gas was similar to electricity but the number of households was less. A request for meter data from Bord Gais was unsuccessful. The only information available for heating oil was on bills, each covering periods of 2 to 12 months. There was no continuity between oil bills and intermediate bills may have been absent. No participant had a meter on an oil tank. Oil sale records to participants did not appear to be available from

merchants. Participant approval was required for this and popular comment suggested that merchants were not inclined to maintain past records.

Purchase records for petrol and diesel in 2007 and 2008 were sought but no records were obtained. Car mileage was recorded at different times. Details of manufacturer, model and engine size were noted in the expectation that engine efficiency could be obtained on the Internet. The web-site used (SEI, 2008) required brake horsepower for each car and this information is not generally known to car owners. This task was undertaken at the end of the scheme when it seemed inappropriate to approach householders for further information. Only miles travelled are shown in the results below with no reference to data from cars for 2007.

Table 2. Energy consumption in the local scheme.

		Energy Type			
		Electricity	Gas	Heating ³	Cars ⁴
2007	No of Values	7	2	5	
	Mean (kWh/d)	11.4	25.1	62.7	
	CI 95%	3.6	9.1		
2008	No of Values	26	13	4	13
	Mean (kWh/d)	12.1	16.6	57.5	37.9
	CI 95%	1.9	7.0		15.34
Difference¹	No of Values	4	2		
	Mean (kWh/d)	0.9	-8.1		
	CI 95%	3.8 ²	13.5		

- Notes: 1. Difference between comparable values
 2. The true difference lies between -3 and +4 kWh/d or -26 and +41%
 3. Heating oil data refer to various periods so differences are not meaningful
 4. Only 2008 data was available for cars. The units for Mean and CI 95% for cars are miles/day.

The 2008 data in Table 2 can be compared to the national average data for electricity, gas, heating and cars which is 16.4, 41, 41 and 33 kWh/d respectively. The local data are below average for electricity and gas, which suggests that the participants were economical before this scheme took place and the possibility of further savings under these two headings, was diminished.

The effort to quantify energy used by participants was only partly successful. The difference in Table 2 between energy consumption before and after the Local Scheme was not significant for either electricity or gas. The result shows the trend only i.e. what the result might be if more data were available. It seems that approximately 1000 homes are required to provide significant differences. Controlling variation by, for example, reading all meters on the same day would reduce this number.

The cost of running the scheme was estimated. Taking labour at €10/h, overheads at €180 and out-of-pocket expenses at €180 a total cost of €960 was calculated for the scheme of this size. The mean savings in electricity and gas (Table 2) accumulated to 30,000 kWh/y. Dividing the cost of the scheme by the energy saved indicated a possible cost of €0.03 for each kWh saved. This is less than the cost of gas and very much less than the cost of electricity.

Conclusion

Participation rates in this scheme were less than planned and the drop out rate was greater than expected. There were several weaknesses, which if corrected, could yield a better result in a future scheme. The principal findings in the Local Scheme are as follows.

- Householders felt they reduced their energy use by PO1 and by the Local Scheme. They appeared to respond to the local scheme better than to PO1 but there was insufficient data to confirm this.
- The participation rate in the local scheme was poor with significant losses as the scheme progressed. Changing from a business like approach to a more friendly style maintained participation rate.
- Savings in electricity and gas are suggested by the data but no comparisons between 2007 and 2008 are possible for gas or cars.
- Meter data suggest that saving of energy by this method is possible at a cost of 3 cent for every kWh saved. This would be a good deal if it could be achieved in practice.

How we might have done better

There was evidence that some participants did not understand the scheme several months after we started. This suggests that an alternative approach using greater publicity, both at the start and during the scheme, might offer a better result.

Saving energy can be viewed as a technical issue but in this context the behaviour of the participant is the key. We started from a technical standpoint and tended to emphasise the mechanics of the scheme. A more fun approach with greater involvement by participants in running the scheme might find greater acceptability with householders.

We expected that monitoring energy usage could have indicated the success or otherwise of this approach. We were only partially successful. If we had started in September instead of January and recorded meter data every month we might have gathered sufficient data to establish differences without seeking values from the previous year. However, in this scheme, resistance by participants, Bord Gais and ESB prevented the assembly of the comparative data needed for this part of the project.

Very little data was available for heating oil and vehicle fuel. In any future scheme thought might be given to how these fuels could be monitored. Possibilities could involve filling heating oil tanks every month – a fuel merchant might fill all the tanks on the same day at a discount. In the case of cars the SEI web site could be used but it would be wise to gather all the data, required for this purpose, from householders at the start of the scheme.

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