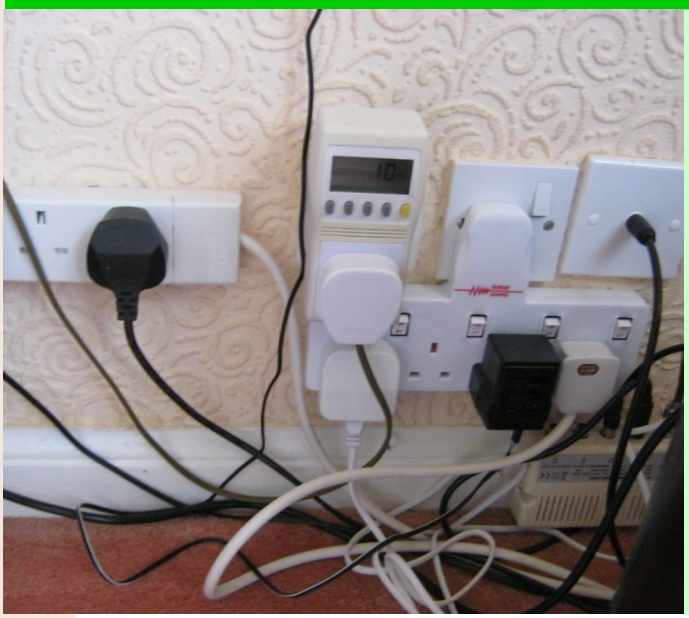
EVALOC
EVALUATING LOW CARBON COMMUNITIES

# ENERGY DISPLAY MONITORS:
## SUSTAINABLE BLACON CASE STUDY HOUSEHOLDS

COMMUNITY SUMMARY C2-EDM OCTOBER 2014



**KEY FINDINGS**

- Energy display monitors (EDMs) work as awareness-raisers and as part of household management.
- Evidence they have led to energy-saving practices and encouraged investment in more efficient appliances and efficiency measures.
- The chances of EDMs being effective are increased if they are part of a 'community conversation', where there are people around to give guidance, share experiences, and help develop new energy habits.
- Careful thought needs to be given to design (simple vs complex) so that household needs and equipment are matched with suitable types of display or control.

## 1. Energy display monitors (EDMs) in Sustainable Blacon homes

A relatively high proportion of households involved in Sustainable Blacon Ltd's activities had some experience with EDMs. Prior to the EVALOC study, Wattson displays had been tested in 50 homes, while another 50 households had tried out the AlertMe, a more 'active' system which enabled users to manage heating and some appliances remotely, as well as being to monitor their energy use online. There were also residents who had been offered an EDM by their supplier (including one who had had a smart meter installed), or who had bought one on their own initiative.

There was no 'display library' in Blacon.

Thirteen of the EVALOC case-study households had some experience of using an EDM, during the project or beforehand. The significant characteristics and responses from these households are shown in Table 1. Interviews carried out after approximately two years of the EVALOC project also picked up a rich set of detailed comments on the experience of having and using an EDM.

## 2. Building energy literacy and practical know-how in a community

An EDM is intended to make energy use more visible and easier to understand, but it may still take time for it to become familiar and for people to gain the confidence and vocabulary to talk about it. The table shows how six of the 13 householders interviewed were interested enough in an EDM to install it and look at it several times a day, while two claimed to look at it fairly regularly and two 'hardly ever'.

Ten of the homes in this small sample were owner-occupied, with two socially rented and one privately rented. Housing tenure does not seem to have influenced outcomes

As in other studies, some householders had 'domesticated' EDMS, taking them into their everyday lives, keeping them in places where they could keep an eye on household energy use and see if they had left appliances switched on by mistake. Others had adopted their EDMs for a while, during which they learned which electrical appliances drew the most and the least power, then lost interest.

These two patterns of use – domestication or discontinued 'information-driven' use after initial interest – fit with findings from larger-scale trials such as the Energy Demand Research Project of 2007-10[1] and the more recent 'Smart Metering Early Learning Consumer Survey'[2]. In a recent community-based trial in Kingston upon Thames, up to 40% of EDM owners said that they were using their monitors at least once a day, up to two years after installation.[3]

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[1] See https://www.ofgem.gov.uk/ofgem-publications/59105/energy-demand-research-project-final-analysis.pdf (basic EDMs, with or without smart meters)

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407543/3_Smart_Metering_Early_Learning_Project_-_Consumer_survey_and_qual_research_-_Main_report_FINAL_CORRECTED.pdf (EDMs with smart meters)

[3] http://eprints.kingston.ac.uk/28626/1/Smart%20Communities%20report%20FINAL%20low%20res.pdf

| Home | Display type | How often do you look at display? | Help with installing and using? | Location | Have you learned from it? | Claimed Impact on electricity use? | Discuss energy with family and /or friends? |
|---|---|---|---|---|---|---|---|
| Households involved in Sustainable Blacon Ltd activities | | | | | | | |
| H18 | AlertMe | -* | √ | - | - | - | x |
| H19 | AlertMe | Every few days | √ | - | - | - | x |
| H20 | Wattson | Several times a day | √ | Next to TV | √ | A little (e.g. kettle) | Friends |
| H21 | Part of PV system | Several times a day | - | Window | - | - | - |
| H24 | Npower + e.on | Once a week | x | Living room | √ | x | Family |
| H25 | AlertMe | Several times a day | - | Kitchen | √ | √ (e.g. dishwasher + kettle) | Both |
| H26 | Wattson 01 | Several times a day | - | Bedroom | x (already aware) | ? (e.g. cooker) | - |
| H27 | Efergy Elite + Wattson | Several times a day (meal times) | x | Living room | √ | √ | Family |
| H28 | AlertMe + British Gas | Hardly ever | √ | - | √ | - | Both |
| H29 | Saveometer | - | - | - | - | - | - |
| H30 | Wattson 01 | Several times a day (inc. end of day) | √ | Living room | √ | √ | Both |
| Households not involved in Sustainable Blacon Ltd activities | | | | | | | |
| H32 | Plug-in energy monitor | Hardly ever | x | Kitchen | √ | √ (got rid of old fridge) | - |
| H35 | Display from Norweb | Hardly ever | - | - | √ | √ (e.g. TV + kettle) | Friends |

* - Dash means there is no information available from 2012 household survey

**Table 1.** Summary table: responses to EDMs in 13 case study households in Blacon.

Table 1 shows how those who claimed to have learned from their display, and to have saved energy, were likely to have talked about the EDM and about energy use with friends and/or family members, strongly suggesting that people 'make sense' of home energy use partly with the help of others, and also that being able to visualise electricity and gas use helps them to hold conversations about energy. Interestingly, while residents would have been given an instruction leaflet with their EDM, they did not mention it in the interviews. However, they did talk at some length about their interactions with others, whether these were unstructured or in meetings set up by Sustainable Blacon.

## 3. Lessons from the interviews

### 3.1 Visibility

The single most important requirement of an EDM is that it makes energy use more visible, to raise awareness and understanding, and on this count the EDMs seem to have been very effective. For example, one of the core volunteers, who had not previously been interested in energy or environmental issues, said that she was *'converted by seeing how much energy the kettle used [on the energy display monitor] – and how much I could save. I now sing [about it] from the rooftops.'*

Visualisation could lead to a sense of what was 'normal use', and also to some quite sophisticated diagnosis, as in this quotation from household H27:

*"When [the Wattson] was working it was brilliant because… when you put the kettle on …it just zoomed up and you realised how much electricity you were using. When you used the iron it zoomed up … and the numbers were in red, so the display was eye-catching… you knew hey-up, what have we got on that we shouldn't be having on, over what we usually use? So it was helpful. … the other [TV], when you put it on HD [high definition], it was using another twenty watts… Difference between HD and normal TV."*

As one of the residents pointed out, visualisation is more powerful than we might expect:

*"It's quite a shock when you just see it with…basics, your fridge and that, and then you just do something …when the dishwasher went on to heating the water …then [the EDM display] shot up… even though it's obvious, you know it's going to use a lot if it's heating water, it's still when you actually see the difference, you know, especially when it's on money."*

Keeping the EDM in a prominent place was of course necessary if residents were to use it as an everyday tool, and the living room, kitchen and main bedroom were all mentioned – the latter being useful for checking whether anything was unnecessarily switched on at bedtime. The household with a solar PV monitor (H21) kept it stuck to a window where it could charge itself in the sunlight and the owner appreciated the information it provided on electricity demand as well as supply. He used it to select the best times for using the solar-generated electricity:

*"It's got everything you could want on there. It shows you the daily one, it'll show you how much you produced for the month, for the year… It does a CO2 calculation and a total cost, basically what you've earned from the feed-in tariff, it pretty much covers all the bases really… it'll keep charging from the sun from [the kitchen window] and it's easy to just go and press a button and check, especially with the bigger appliances in there, you know, the cooker and the washing machine. So those are the ones that benefit the most from when it's producing at its peak. …in summer time it's usually always producing enough that it will cover the TV, fridge, even to charge mobile phones and laptops. And S's computers upstairs usually will run off the solar system. It's only the bigger appliances that tend to kick it into having to import off the grid."*

### 3.2 AlertMe experience

The AlertMe (Figure 1) could be used to control heating and appliances as well as to provide (online) energy data. At the time of the trial, though, it required a computer and a reliable Internet connection, and the time factor was seen to stand in the way of easy engagement: "...you've got to go up in the attic, switch the computer on and wait for it to come up you know, and I don't have that sort of time. So it's just it's a bit inaccessible really I would say for most people… unless they really you know love doing that sort of thing… the changes of behaviour came through going to the meetings, not through the Alert Me." (H19)

There was an appreciation of some of the features. In Household H28, although the woman respondent said that *"I'd call it a boy's toy… very clever but it bores me",* her partner became very absorbed in looking up their energy data online and showed a fairly high level of engagement. He responded that;

*"The control that you've got is fantastic but you've got to sign up on to the internet to get it…So that's the downside of it all…if I had a little unit that would talk to [the AlertMe] and give me all that information that I get through the internet without going into the internet then that would be ideal…The Alert Me system is basically a security system… because of that, we know that when we had stuff stolen it was at three thirty-eight in the morning that they took it, because it tripped the sensor."*

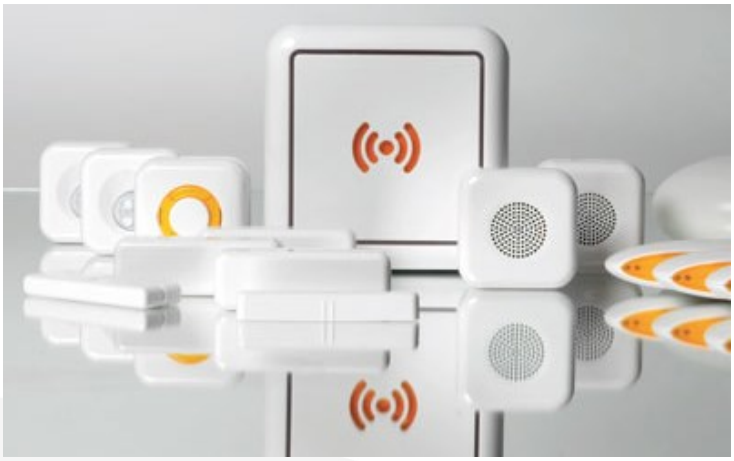

**Figure 1.** Elements of the AlertMe system. The AlertMe system is an intelligent home security and monitoring service. It enables households to control their home energy use, as well as security, via their mobile phone or broadband.. (Image: http://www.mobiletoday.co.uk/news/industry/9075/MWC--Consumers-can-manage-home-energy-use-by-mobile.aspx#.Vh522d9VhBc)

He also noted the basic energy cost of the AlertMe controls:

*"This kit uses four watts and the standby on the television that it was controlling was only using 2w…. I've got two televisions so that's 4w between them, and this is taking 4w to switch off 4w.*

In household H18, as in H19, the response to the AlertMe suggested that it was over-complex for the situation in which it was being used:

*"I think it tells you how much energy you're using but it's all on the computer and as I say I haven't been on it for a long time… But all the things on the wall you know in the gas and electric boxes and the smart plugs… I suppose it would cost them more to undo what they've done so they've just left them all in… They did show us [how to use it] but it's like it just goes in one ear and out the other… They were very good, I mean … we attended meetings and we had people come to give us talks about what you could do… some hints, energy saving factsheets, you know it was very good but …this is like a couple of years ago…. I think a lot of people did take on board what they were saying and there was a lot of useful hints but … basically all I do is override it. [One son] knows that you just put it up to twenty-six and …I'll you a demonstration. Right, OK, so there's nothing on at the moment… in a few minutes it'll fire up the boiler. .. "*

From this extract, it sounds as though the AlertMe was being used in a roundabout way as a thermostat, to reach very high indoor temperatures. But the respondent went on to say that '*I don't really look at it any more, I can just feel if it's cold I'll put… some extra clothes on',* suggesting that the AlertMe had dropped into the background but also, perhaps, that a 'high tech' approach to comfort was being abandoned in favour of a more traditional one. One of the respondents from household H28 offered a similar account of (a) using the thermometer on an EDM to read the room temperature and (b) reverting to a fuel-free way of keeping warm. She had used both an AlertMe and an EDM supplied by British Gas:

*"We used to argue … and he would tell me it was warm and I would say 'No, it's not'. So now we use it to stop arguments because I can say to him now 'Look, it's at 20' or 'It's gone down to 1'9 and then he has to concede that it is cold because it's gone down to 19 … if it stays at 20 and I'm cold I go and get a jumper now, whereas before I had that I would have just turned the heat up… So we keep it at a constant 20 now and we can gauge now."*

## 3.3 Wattson experience

The basic reaction to the Wattson (Figure 2) was favourable: it showed electricity use well and clearly, provided it was within reach of the radio signal. The design was appreciated: *'It had either changed colour of flashed, it had different modes so if it was in pink or purple …There was a lot of activity so you looked and thought what the hell's on now….It did make you think I will admit'* (H26). The 'drama' of real-time electricity data had been effective:

*"People are a bit shocked when they see it… [laughs] that was a great party piece that, ticks away a couple of hundred pound a year, sits there quite happily and you just say, well, 'Hang on, I'll put the kettle on', and it goes up to three thousand something pounds a year and you have to remind them that's if you're boiling the kettle 24 hours a day for the whole year, as opposed to what it's going to cost you… but it is such a dramatic difference that it makes them realise that … perhaps I shouldn't be boiling a full kettle when I only want one cup."*

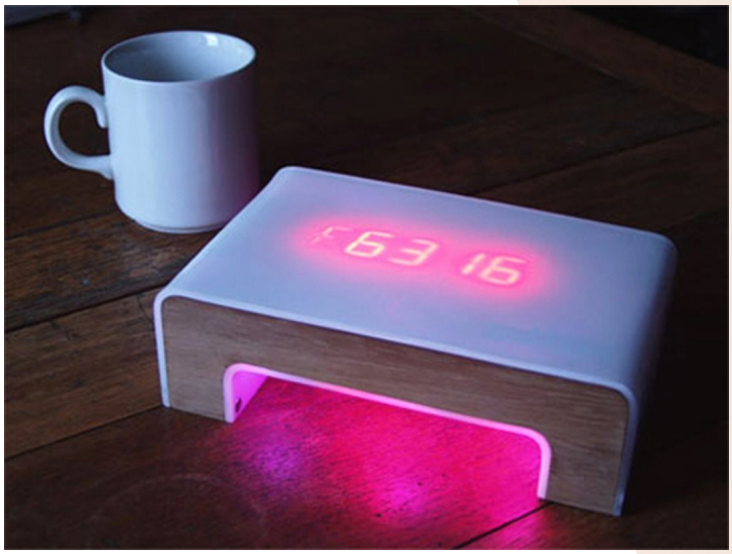

**Figure 2.** The Wattson energy monitor. (Image: http://www.amazon.co.uk/Wattson-01-Personal-Energy-Monitor/dp/B00154KHW6)

Several users mentioned that the need to acknowledge the difference between real-time data extrapolated over a year and actual consumption data. This had been a thought-provoking exercise:

*"… if you put the kettle on you do not have it running twenty-four hours a day, three hundred and sixty-five days a year. I would like to know how much each unit is using for that period of time it is actually on. For instance, say the fridge or the freezer - they're permanently switched on but the motor isn't working all the time, how much does it cost me when it does click in?... Particularly the washing machine and the dryer, because they are two that I feel we could potentially alter the usage of… And effectively, would it be worth it? You know, if I put the washing machine… on a lower temperature or a shorter cycle, if that's going to save me 20p a year it's hardly worth the effort, but if it's going to cost me £2 every time I load the washing machine that's a huge difference… Common sense says the longer the programme the higher the temperature, obviously the more it's going to cost you. I don't know what is the difference between a 40o wash and a 60o degree wash in terms of cost."* (H20)

H26 did not use their Wattson any longer by the time of the interview, but had found it useful:

*"Nothing came as a surprise on the Wattson - it just sort of reinforces what you already know… I think a lot of thought had gone into the way it was set up so and quite a number of people, from the queries that were asked at the meetings, derived a fair bit of information from. I think most women were not aware of how much it costs to use a tumble dryer and I think most of them had found out… And standby things is another thing that people don't realise. You know, they just leave the telly and everything on standby and then wonder why the bill's so big 'when we haven't used anything'."*

The main problem seems to have been the demand for batteries, mentioned by B31 and B09:

It was eating batteries …I think it was four at a time and sometimes they only lasted a fortnight and by the time the next meeting come I'd already bought another four and another four and I said you know should it be chewing batteries like this? 'No, it shouldn't be', but …there was a fault I think with it and when it chewed the last lot that's probably when we put the thing away. (B09)

H27 switched to an Efergy Elite at the end of their trail period with the Wattson, and seemed to have adopted an EDM into their household routine.

### 3.4 Other types of display

The interviews reflect the fact that various forms of EDM had been on the market for several years, and also that some energy suppliers had been offering them to their customers. (Since 2013, British Gas and E.ON have been offering displays in conjunction with smart meters, as part of the Foundation Stage of smart meter rollout.) The Sustainable Blacon interviews included households who at some point had had EDMs from Npower, E.on, Norweb and British Gas, as well as two who had bought an EDM on their own initiative. Most of these displays were of the type that shows overall electricity use, but household H32 had bought a cost-plug-type display some years prior to the interview – that is, one that is plugged into one appliance at a time and shows instantaneous demand and consumption over given periods of time. This plug had been able to translate something that was barely significant at the time of purchase (a high-consuming fridge-freezer) into something requiring action:

*"... when we went away on holiday. I said, We're using loads of electricity when we're not here … what's the only things we've got [on]? And one was a fridge-freezer in there and the other one was a little freezer in the garage and I worked it out that this fridge-freezer was using, they told me when I bought it that it was quite heavy on electric… and it was using over a thousand kilowatts a year … [They got rid of it] and we noticed a big difference then over the next few years…We've just got this little A+ fridge now and a freezer in the garage…"*

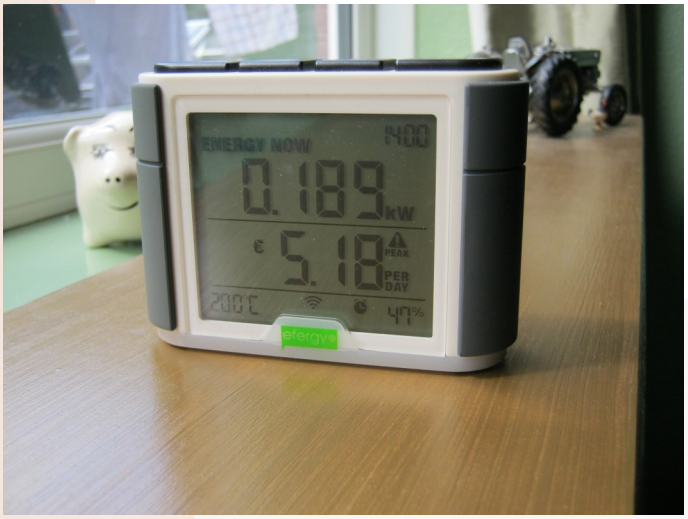


**Figure 3.** The Efergy Elite energy monitor.

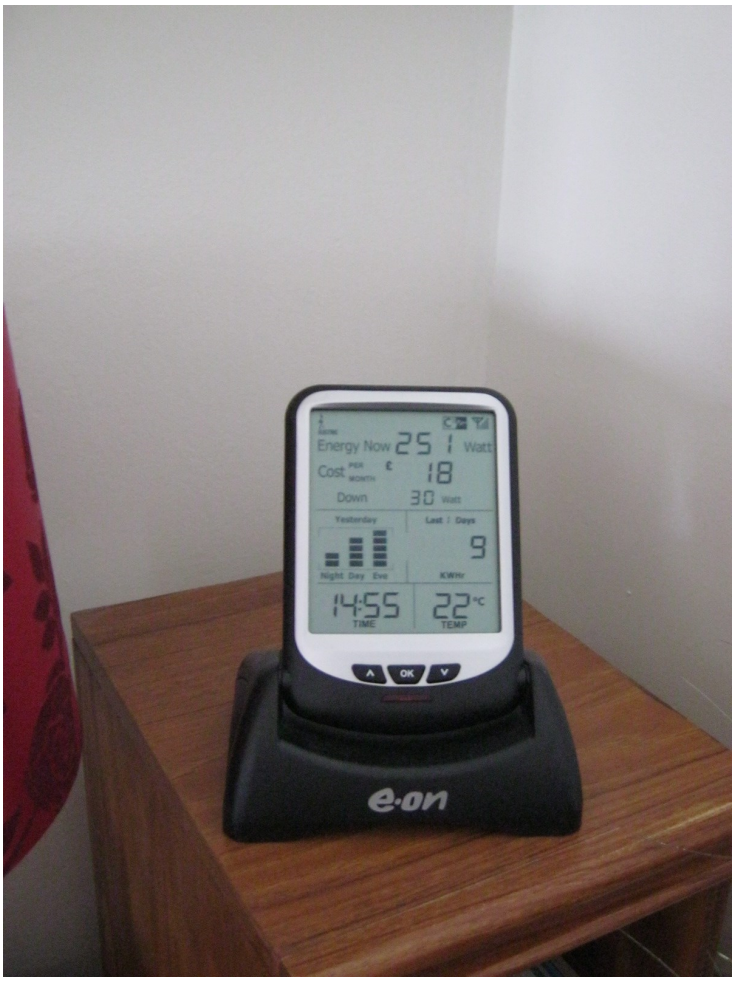


**Figure 4.** Energy display monitor provided by E-on to some households.

## 4. Impacts on energy use

The EVALOC project did not have 'before and after' consumption data for these 13 households, and in any case the EDM is only one of many factors influencing energy use in each, so we cannot measure any precise impact it may have had. But the interview responses indicate that there was a useful impact in most instances, and that this could either be direct (respondents using less energy themselves) or indirect (passing on useful messages to others). For example household H20, who had found the cost information on their EDM particularly useful, noted that;

*"Gas we just ignore, but using electricity - we're more conscious of that because we had the Wattson meter…. it's not plugged in at the present minute but with that you could see the electricity being used. … I never used to worry about not filling the kettle up, I used to fill it right up and put it on whereas now I tend to guess about two mugs of water and put it on."*

Seven of the 13 households interviewed thought they had made some reduction in their energy use as a result of using one or more EDMs, even if they no longer checked them. But one (H35), who had been given an EDM by Norweb (Scottish Power), claimed that;

*"I did [change] for a while but then I went back to me old ways. The kettle was one thing, I did sort of try and …just boil enough for what you want but it's stupid… I'd rather just … if I'm in I'll fill the kettle in the morning and make myself a drink and each time I want it I'd*

*just use what was in the kettle. .. you know people say well you shouldn't do that, it uses more electric. Well, it can't use that much electricity surely?"*

It may be relevant that H35 was in the 'control' group of households with no Sustainable Blacon interventions.

Household H27 was the only one to put a figure on their perceived energy savings (10%), *'which I think for us two was good.'* They did not specify whether this applied to electricity, gas, or both, though it seems likely that both were involved; a new central heating boiler had been a significant factor. They also mentioned a reduction in their standby usage. The EDM seemed to have played a role in keeping them informed and thinking about usage over time, as well as in real time, and there was also the impact of being part of a study and liaising with researchers:

*"The most useful part was [Wattson] gave you a weekly amount of units that you'd used. What they do they set it to a certain, to so much money per unit and the amount of units and you can see on your computer how much you're using … on a weekly basis and you can see through the weeks how much it's either gone down or gone up or anything and it was always sticking around the £5,6,7pounds a week on usage … I liked to see on the computer … the 30 day downloads. They had all different kinds, they had graphs, they had charts, all sorts of things you could look at and then of course you could transfer all that data over to the University to… pick it up every month."*

Research elsewhere shows, on average, durable savings of a few percent for basic displays on their own, which can rise to ~10% or more if these are combined with other forms of feedback and advice. A strong lesson from feedback trials is that 'more is more': if people hear the same sort of thing from several trusted sources, they are better able to interpret and use the information to guide their actions than if they only hear it from one source.

## 5. EDMs and social learning

Sustainable Blacon offered an unusually high level of support for EDM adoption, incorporating energy visibility into the overall programme of activity, and organising meetings and workshops in which EDMs could be introduced and explained. Household H26, asked why they had adopted a Wattson, commented that;

*"It was part of Sustainable Blacon… it was one of the provisions I agreed to, this. We agreed to Sustainable Blacon having access to the accounts and everything so this is, as I understood it, the second part…I used to send our meter readings through to the college … the same day every month."*

The couple in household H27 also talked about how the social nature of Sustainable Blacon's activities made it possible to have conversations that might otherwise seem to intrude on people's privacy and imply criticism of their way of life:

*"We… don't go out preaching to people or anything like that… every now and then I go out for a meal with some ex-Guiders and if one of the ladies asks me … what you're doing then I can explain to her… Otherwise you become really boring to people – 'Oh, don't talk to her, is she going to start on about saving electricity?'. But if … they want the information I will give it to them."*

*"Well, people are very private about their incomings and outgoings, they don't want anybody to know, do they, even now…"*

*"I also belong to a carers' group… and I'm getting the eco people to come and give them a talk sometime … so we'll be getting somebody hopefully to go and talk to them about saving energy, so… I belong to a knitting group and … if I've mentioned that I've been to a meeting or something, they've asked me what I've been talking about."*

A similar point was made by H28, who commented that, while they wouldn't wish to tell friends what to do with their heating, they have shown them their display:

*"I think we probably have shown people, said look at this, that one particularly look, this is really good…You can do the kettle display as well and show them how much the electric uses for the kettle, that's quite good on the [EDM] out there."*

'Energy visibility' in itself thus seems to have had a spin-off effect, encouraging people to talk about what they were seeing and what it might mean for themselves and for others. Seven of the 13 case-study respondents had used their EDMs as talking points with others. This is significant in terms of community engagement, as so much useful knowledge spreads by word of mouth. The couple living in household H25 showed how their AlertMe became part of conversations within and beyond their family, even after their own interest had flagged:

*"I used it at first - it was quite a novelty to see….[our son] looking at everything, he'd say to me, 'What have you just turned on? It's shot up'. So it's quite good but you've got to keep it plugged in…You could either show the money you were using or the energy …you just had to connect it into the Alert Me through the computer … yes I probably did do that then… Probably used it for about three or four months…and then stopped. I didn't see the point because we knew what everything was using more or less by then… but we'd still get it out if somebody came … we'd say 'Look at this, look when you switch your kettle on what happens' …So it was quite good to show other people as well…"*

H27 had a nice illustration of how their EDMs (Wattson and then Efergy) communicated to their grandchildren:

*"The grandchildren, they loved it. What was C's favourite thing? We watched a film on the television and it was Las Vegas, and he's sat here and he said 'Well they're not very energy conscious, are they? Look at all those lights they've got on there.'"*

Household H20, who had used their Wattson display to talk with at least five friends, showed how it had acted as a catalyst for supplier-switching and the purchase of more efficient appliances, as well as prompting a change in behaviour:

*"The Wattson meter yes, and ...just talking about the price … had it gone up, had it gone down? and whether he'd changed his supplier recently, because we were thinking that it was about time we changed ours . …He was one of the first ones when he came to visit that we showed him the meter… And then he was oh, didn't realise it cost that much …One of the things they have both done, like us, is they've stopped filling the kettle to the brim when they only want one cup.*

*Other things within the house needs a lot more money than they've got at the moment… But they are in the pipeline, like there is a panel within their double glazing that's gone, that needs replacing, and they're going to. They're aiming to get an A-rated washing machine next."*

## 6. Summary

The main lessons from the EDMs in the Blacon case study households seem to be that:

- They have 'worked' as awareness-raisers and as part of household management, and there is evidence that they led to energy-saving practices and encouraged investment in more efficient appliances and efficiency measures.
- The chances of EDMs being effective are increased if they are part of a 'community conversation', where there are people around to give guidance, share experiences, and help develop new energy habits. The 'social' nature of EDM use by several of the SB households interviewed points to the importance of introducing new gadgets and technologies in a social way, e.g. with a trained installer or knowledgeable friend, and/or through special-interest groups or community meetings.
- Any display/control system that requires new batteries frequently, or uses substantial amounts of electricity, is of questionable value.
- There are uses for both simple and complex EDM designs, and careful thought needs to be given to 'horses for courses', so that household needs and equipment are matched with suitable types of display or control. EDMs and control systems can be too clever and too complex for purpose, as well as too simplistic.

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**The EVALOC project seeks to assess, explain and communicate the changes in energy use due to community activities within six selected case study projects under the Department of Energy and Climate Change's (DECC) Low Carbon Communities Challenge (LCCC) initiative, a government-supported initiative to transform the way communities use and produce energy, and build new ways of supporting more sustainable living.**

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